ISBN 978-602-19877-3-5

PROCEEDING

THE INTERNATIONAL CONFERENCE ON MATHEMATICS, SCIENCE, EDUCATION AND TECHNOLOGY

ICOMSET 2015

Education, Mathematics, Science and Technology for Human and Natural Resources

October 22, 2015

Inna Muara Hotel and Convention Center
Padang, Indonesia

Published by :
Faculty of Mathematics and Science
State University of Padang
Padang, Indonesia

Address:
Faculty of Mathematics and Science
State University of Padang
Jl. Dr. Hamka Air Tawar Padang - Sumbar

The International Conference on Mathematics, Science, Education and Technology

(ICOMSET 2015)

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State University of Padang
Padang, Indonesia

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Message

from the

Rector of State University of Padang

Ladies and Gentlemen,

It give me great happiness to extend my sincere and warm welcome to the participants of the International Conference on Mathematics, Science, Education and Technology (ICOMSET 2015). On behalf of Universitas Negeri Padang, let me welcome all of you to the conference in Padang, West Sumatra Province, Indonesia.

We believe that from this scientific meeting, all participants will have time to discuss and exchange ideas, findings, creating new networking as well as strengthen the existing collaboration in the respective fields of expertise. In the century in which the information is spreading in a tremendous speed and globalization ia a trend. Universitas Negeri Padang must prepare for the hard competition that lay a head. One way to succeed is by initiating and developing collaborative work with many partners from all over the world. Through the collaboration in this conference we can improve the quality of our researches as well as teaching and learning process in mathematics, science and technology.

I would like to express my sincere appreciation to FMIPA UNP and organizing committee who have organized this event. This is a great opportunity for us to be involved in an international community. I would also like to extend my appreciation and gratitude to keynote speakers and participants of this conference for their contribution to this event.

Finally, I wish all participants get a lot of benefits at the conference. I also wish all participants can enjoy the atmosphere of the city of Padang, West Sumatra.

Thank you very much

Prof. Dr. Phil. Yanuar Kiram
Rector

Message

from the

Dean of Faculty of Mathematics and Science
State University of Padang

Rector of State University of Padang
Vice-Dean of Faculty, Mathematics and Science
Head of Department in Faculty of Mathematics and Science
Distinguished Keynote Speakers
Organizers of this conference
Dear participants
Ladies and gentlemen

I am delighted and honored to have this opportunity to welcome you to ICOMSET 2015 - the International Conference on Mathematics, Science, Education and Technology, which is hosted by Faculty of Mathematics and Science, State University of Padang.

As the Dean of Faculty of Mathematics and Science, I wish to extend a warm welcome to colleagues from the various countries and provinces. We are especially honored this year by the presence of the eminent speaker, who has graciously accepted our invitation to be here as the Keynote Speaker. To all speakers and participants, I am greatly honored and pleased to welcome you to Padang. We are indeed honored to have you here with us.

The ICOMSET organization committee and also the scientific committee have done a great work preparing our first international conference and I would like to thank them for their energy, competence and professionalism during the organization process. For sure, the success I anticipate to this conference will certainly be the result of the effective collaboration between all those committees involved.

This conference is certainly a special occasion for those who work in education, mathematics, science, technology, and other related fields. It will be an occasion to meet, to listen, to discuss, to share information and to plan for the future. Indeed, a conference is an opportunity to provide an international platform for researchers, academicians as well as industrial professionals from all over the world to present their research results. This conference also provides opportunities for the delegates to exchange new ideas and application experiences, to establish research relations and to find partners for future collaboration. Hopefully, this conference will contribute for Human and Natural Resources.

I would like to take this opportunity to express my gratitude to all delegates and sponsors for their full support, cooperation and contribution to the ICOMSET 2015. I

also wish to express my gratitude to the Organizing Committee and the Scientific Committee for their diligence. The various sponsors are also thanked for their kind support.

In closing, I realize that you are fully dedicated to the sessions that will follow, but I do hope you will also take time to enjoy fascinating Padang, with its tropical setting, friendly people and multi-cultural cuisine.

I wish the participants a very fruitful and productive meeting and with that. Finally, we respectfully request the Rector of State University of Padang to open the ICOMSET 2015 officially.

Thank you,

Faculty of Mathematics and Science
Prof. Dr. Lufri, M.S.

Message

from the

Chairman of Organizing Committee

Firstly, I would like to say welcome to Padang Indonesia. It is an honor for us to host this conference. We are very happy and proud because the participants of this conference come from many countries and many provinces in Indonesia.

Ladies and gentlemen, This conference facilitates researchers to present ideas and latest research findings that allows for discussion among fellow researchers. Events like this are very important for open collaborative research and create a wider network in conducting research.

In this conference, there are about 120 papers that will be discussed from various aspects of mathematics, science, technology, education and other related topics.

For all of us here, I would like to convey my sincere appreciation and gratitude for your participation in this conference.

Thank you very much

Drs. Hendra Syarifuddin, M.Si, Ph.D
Chairman

Socially Response-able Mathematics, Science and Technology Education: Quality, Engagement, and Sustainability

Bill Atweh

ABSTRACT

In this talk I will outline an approach to the teaching of mathematics, science and technology education based on social responsibility (or Response-ability). I will argue that the primary role MSTE the development of active citizenship. I will present basic components of the Social Response-able Education approach toward developing school knowledge in meaningful way and towards achieving this primary goal. I will illustrate this approach through a project involving schools in Western Australia.

NEW PATHS FOR HALF-METALLIC AND FERROMAGNETIC IN OXIDES

Andrivo Rusydi
National University of Singapore

ABSTRACT

The search for high performance soft-magnet with high resistivity has been intense recently, driven by the strong demand in energy sector, such as energy generation, electrical motor, transformer and other energy efficient devices. Apart from hard-magnets, soft-magnets also play an important role in many engineering applications. Here, we introduce new paths to generate room temperature soft magnets with high resistivity by manipulating electronic structure of a materials. We will give example of well-known as non-magnetic materials such as TiO_2, ZnO, and even magnetic Fe_3O_4.

The Design of Solid Catalysts: Some Examples from Universiti Teknologi Malaysia

Hadi Nur

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ABSTRACT

The design and synthesis of particulate materials for new catalyst systems with novel properties remain a big challenge today. Here an attempt has been made to synthesize metal oxide particulate materials for several heterogeneous catalytic and photocatalyticsystems, which contain examples from our recent research projects in this area. The particulate metal oxidecatalysts have been designed for single centre catalyst, phase-boundary catalyst, bifunctional catalyst, photocatalyst and chiral catalyst. In our current research, the synthesis of well-aligned titanium dioxide catalyst with very high length to the diameter ratio was also demonstrated for the first time by sol-gel method under magnetic field with surfactant as structure aligning agent.

Keywords: *Particulate materials; Heterogeneous catalytic system;Synthesis of titanium dioxide under magnetic field; Liquid-gas boundary catalyst; Bifunctional catalyst; Photocatalyst.*

A Millimeter-Wave GBSAR for Landslide Monitoring

Ir. Dr. Chan Yee-Kit[1], Ir. Dr. Koo Voon-Chet[2]

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ABSTRACT

Every year, over one million people are exposed to weather-related landslide hazards around the World. Due to the recent climate change, it is likely that the decrease of permafrost areas, changes in precipitation patterns and increase of extreme weather events will influence the weather-related mass movement activities. This paper reports the recent development of a ground-based synthetic aperture radar (GBSAR) for continuous monitoring of landslide-prone areas in Malaysia. It is an ultra-wideband system operating at K-band with spatial resolution of 0.5 m in range and 2.9 mrad in cross range. The system is mounted on a rail which travels along a linear guide to achieve SAR imaging. The GBSAR has been installed at a test site to provide timelyinformation for landslide monitoring and early warning system. The paper discusses the design, development and field experiments using the new GBSAR system.

Keywords : *Synthetic Aperture Radar, Interferometry, Landslides, Millimeter-wave, Environmental Monitoring*

NOVEL BACTERIAL CELLULOSE WITH WELL ORIENTED FIBRILS ALIGMENT: SYNTHESIS AND CHARACTERIZATION

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ABSTRACT

Bacterial cellulose (BC) having oriented fibrils alignment can be synthesized by *Acetobacter xylinum (A. xylinum)* at the liquid/oxygen-permeable substrate interface in a static cultivation process. We discovered that BC gel produced on ridges polydimethylsiloxane (R-PDMS) shows uni-axially oriented fibrils alignment along the ridge direction of substrate. The degree of orientation of BC gels increases with the decrease in the ridge size of the PDMS substrate. An optimum ridge size of 4.5 μm was observed where the BC gels show the highest birefringence (Δn), the highest fracture stress (σ), highest swelling degree (*q*), the lowest elastic modulus (*E*), and the thickest BC fibril. We also found that culturing a tubular BC (BC-TS) gel in oxygen-permeable silicone tubes with inner diameter <8 mm yields the BC-TS gel of the desired length, inner diameter, and thickness with uni-axially oriented fibrils along the longitudinal axis of the silicone tube. Thus, BC with a uni-axially oriented fibril structure and excellent mechanical properties holds promise for use as a micro vessel or soft tissue material in medical and pharmaceutical applications

Index Terms— BC, *A. xylinum*, static cultivation, liquid/oxygen-permeable substrate interface, oriented fibrils

ETNOMATHEMATICS (MATHEMATICAL CONCEPTS IN MINANGKABAU TRADITIONAL GAME)

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ABSTRACT

The aim of the study is to explore mathematical concepts that can be developed by playing a minangkabau traditional game. The game that is observed in this study is a stick game (main lidi or cimene). This game is played by children in age of 5 until 14 years old. The primary concern of this paper is algebra concepts. It can develop number senses, basic counting principle such as addition and multiplication, placing value, and basic symbols. The side findings are it can develop children's character and children Scientifics culture. Furthermore, this paper will provide a new insight in "cimene" game to Minangkabau society and it also give the opportunity to save the traditional games from extinction.

Index terms – etnomathematics, mathematical concepts, minangkabau traditional game, character, scientifics culture.

1. INTRODUCTION

Mathematics is human activity[1]. It has two meanings. First, people have to experience to construct mathematics idea. They are required to involve actively in constructing mathematics concepts. Second, mathematics exists in human activity. Everyday activities involve mathematics. There is mathematics in transactions in the market, in constructing a building, in tailoring clothes, in bathing, games and many others human activity. This activity has repeated so many times and some activity has become cultures.

This reality encourages the researcher to understand and learn about mathematics concepts that can be developed in a game. The game that is chosen is a Minangkabau traditional games that is played since years ago. However, the culture changes have led to the era where children do not play the game as many as it is played a few years ago. It is a games that utilized sticks as the main tool.

According to Glorin; Ascher [2] Etnomathematics is the study of mathematical practices of specific cultural group and the course of dealing with environmental problems and activities. It means that etnomathematics is the study that related to mathematics concept, mathematical activities and mathematics behavior that is used, done and exist in one culture. Cultures is a setrt of norms, beliefs, and values that are common to a group of people who belong to same ethnicity[2].

This study is aim to explore the mathematical concepts that is recited in sticks games. It also aims to provide a new insight in "cimene" game to Minangkabau society and to guarantee the continuity of this traditional game.

2. STICK (LIDI/CIMENE) GAME

Sticks game (play lidi/cimene) is a game that used sticks as the main objects. It uses hundreds of sticks which have two or three different lengths. The length represents the different value of each stick. The shortest sticks represent the smallest value and the longestone represents the highest value. The value of the stick is given by players before they begin to play as an agreement. In other word, there arepossibilities that the sticks will be valued differently in different game.

Sticks game is played by children of age 5 until 14 years old. It can be played by two, three, four and many players. This game also can be played by group. The complete description of the game will be described as follows:

a. There are at least two player
b. There arehundreds of shortest sticks, tens of middle sticks and 1-5 the longest sticks.
c. The player determines the value of each different length of sticks. The shortest can be valued1, 2,3,.., 10,…,100, the middle length can be valued, 5, 10, 50, 100, 500, and the longest can be valued 10, 100, 1000,…. However, the shortest always get the smallest value and the longest always get the highest value.
d. The player holds all of sticks in the hand with a certain height and let it go.
e. The player collect the sticks one by one without touching other than stick that he/she wants to collect. In collecting the stick, eventhough the player does not touch a stick and the stick is

ISBN 978-602-19877-3-5

moving or shaken, it is considered that he/she failed.

f. The player counts their sticks and their score.
g. The scores are accumulated in each turn
h. The player that gets the highest score will be announced as the winner of the game.

The primary concern is to observe the mathematical concepts that can be developed by children throughout playing the game.

3. MATHEMATICAL CONCEPT

3.1 Numbers senses

Numbers trigger young children's interest. The everyday activities became the best media for learning processes.Children in early age has introduced to numbers by people around them. A age four, most of children can count until ten. However, they do not introduce any sign of each numbers. In several cases, when children talk about numbers the made several mistakes such as they cannot determine the value of each number, they get confuse to choose which one is greater between 6 and 7, and irregularity in counting (1, 2, 3, 6, 7, 5).

In order to help young children to understand numbers in a sense, adult tends to use fingers as real objects that represent numbers. In this situation sticks in sticks games can be used as real objects in introducing the numbers sense to young children.

In playing a game, young children can see the number of sticks that they obtained (we focused in sticks that valued as 1). They count the sticks by themselves. They know how many sticks that represent a number. In the end, children can reach a sense what numbers really is, what they represents.

3.2 Addition

As the rule of the game said that players can determine the value of each different length of sticks, it creates an opportunity to children to learn about addition. It happens when player count their sticks. For example, when the player decided to value the shortest sticks as 1, the middle sticks as 5 and the longest sticks as 10, then the can learn addition of 1, 5, and 10.

1+1+1+1+….+1+5+5+…+5+10+10
5+5+…+5+1+1+1….+1+10+10

There are many combination that can done by the children. Moreover, the difficulties of the addition processes are increase when the player valued with others numbers.

This informal situation will sharpen children addition ability. Since children experiences by themselves the addition activities, it will help them to understand the concept of addition.

3.3 Multiplication

Multiplication is one of basics concepts of algebra that need to be learn by students. It is a bridge to learn others concepts such as division, multi-digit multiplication, fractions, and ratios. It is really important to students in understand multiplication concept such that they can overcome any difficulty in the next lesson.

Mathematics concepts are related one to another. According[3]the instruction of multiplication starts when children have mastered the basic additions and subtraction skills.

Introducing multiplication to students begins by introducing the idea of add so many times[4]. This condition can be supported when the student play this games. In sticks game, add the value of the sticks as many as the number of sticks that they have. For example, if a player gets eight of shortest sticks (valued by 5), three of middle sticks (valued by 10) and one of the longest sticks (valued by 50), it can be count as follows:
First method

$$5 + 5 + 5 + 5 + 5 + 5 + 5 + 5 = 40$$
$$10 + 10 + 10 = 30$$
$$50$$
$$40 + 30 + 50 = 120$$

or he can count as (second method)

$$8 \times 5 = 40, 3 \times 10 = 30, 1 \times 50 = 50$$
$$40 + 30 + 50 = 120$$

or he does the processes of counting in his mind (third method)

5, 10, 15, 20, 25, 30, 35, 40, 50, 60, 70, and 120.

Whatever the method of counting that is used, it happens during the games. This situation gives players togain new experiences in counting. By assimilating the knowledge that they have with the new knowledge, they come to new conclusion.

The sticks played its role as real object that representing a number (a group of objects 1) and the children will count the number of object 1). They count the number by adding so many times until they get their result. It leads to multiplication concept that is used by other players.

In conclusion, sticks game can be used to introduce children to multiplication concepts. It can happen naturally without intervention of unnecessary effort that lead to force children to understand the concept as the teacher believe what it really is.

ISBN 978-602-19877-3-5

3.4 Placing value

There are three different kinds of sticks based on length. Every stick represents different values. Learning from the fact that the valued of one sticks can be replaced by some sticks, it provide a new insight of the game. The player can learn about placing value where the value of one stick is equal to several sticks. Let's takes an example of this case. We assume that the shortest stick is valued as 1, the middle length of stick is valued as 10, and the longest stick is valued by 100. From this three sticks children/player can learn that 1 of middle lengths sticks is equal to 10 of shortest sticks and 1 of longest sticks is equal to 10 middle length sticks or 100 shortest sticks. It will provide a new knowledge to player that each number has their own place in number system.

Since players are free to decide the value of each stick, they have the opportunity to learn different value of numbers to others.

3.5 Basic symbols

Among the mathematics concepts that can be developed by playing sticks games is the basic understanding of symbols. Symbol are used to communicated an idea. In several occasion, we create our own symbols and give definition what the meaning of the symbols. For example, in English the symbols for area is A. However we used L as the symbols of Area. There are many cases that we define a symbol to communicate an idea. Another example is letter x that is used differently in different cases. It represents different meaning. Since it is used to communicate an idea, we define the meaning of x before we use it such that our audiences understand the topic.

Therefore, I argue that symbols are created by people but people get confuse with the symbols themselves. It is really important to look back to the nature of symbol. Symbols are created to help people communicate their idea. Symbols are a set of unrecognized figure that need to be remember. Symbols should be understood by the users.

Based on this believe, sticks games can be used to introduce the basic understanding of symbols. Players make the rule. They valued the sticks and sticks itself become symbols to the player. If the players decided the valued of shortest stick is 5, the shortest stick become the symbols of 5. As the game played so many times and the sticks become symbols for many numbers. Through the experiences, children will come to a sense that one sticks can represent many numbers and its depend on the first definition that the give to the stick. It comes to the sense that one symbols can have different meaning, it depends on the context the symbol that is used.

4. SCIENTIFIC CULTURE

4.1 Careful observation

Winning is the goal of playing games. In order to win in sticks game, player must collect the higher score. Higher score will be achieved when the player can collect amount of sticks. Every player will try to collect the longest sticks as much as possible since it has higher value.

As game is played, the difficulties of collecting sticks increase consistently. Player needs to be careful to collect the sticks.

Figure 1.

Figure 2.

Figure 1 shows that a player try to collect the sticks, he try to collect the easiest part first. As in the picture 4.1.2, player comes to face difficult situations. He should observe the position of the stick such that others sticks do not shaken when he execute the plan.

The player should consider the position of stick. He also makes prediction what will happen to sticks around it. It required a careful observation and thorough investigation. When he fails to analyze the situation, the player loses his opportunity to get extra score.

4.2 Decision making

Every player encounters different problems in every turn that they have.It creates an opportunity to develop students problem solving. The first step to solve the problem is to do an observation. The second step is analyzing the structure of stake of sticks. The third step they need to decide which stick that will be taken, how to do it, and what method that will be used.

ISBN 978-602-19877-3-5

When children do this activity so many times and experience it by themselves, it will develop their problem solving ability. They learn what should be done before taking a decision. They learn to evaluate their work. They learn from mistakes. Finally, they learn to overcome their disappointment.

5. CHARACTER BUILDING

The stake of sticks is very unstable. Players should focus on the sticks. Every player that take turn can deceive other players since it is possible that the sticks only shake a little such other player could not see it. Therefore, every player should honest to themselves and other players. They must admit every mistake that they do during the games.

There are consequences for players that lie to others. It is often that the player who cheats will be disqualified. Other punishments for cheated player are losing one or two his turn, all sticks that he gets are not counted or forcing to quit the games. These punishments teach young children that dishonest are wrong act. They also learn that there are consequences for wrong acts.

6. CONCLUSION

This paper provides a new insight that traditional game is not just a game. It is full of mathematical concepts, lesson and values. These games can be used to develop several mathematical concepts, scientific culture, and children character. It will be challenging to develop a learning instruction that utilize this game.

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ISBN 978-602-19877-3-5

THE INTEGRATION OF SPIRITUAL AND SOCIAL COMPETENCIES ON CURRICULUM 2013 IN MATH SUBJECT IN STATE JUNIOR HIGH SCHOOL OF MEDAN

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ABSTRACT

The purpose of this research is to find integration model of spiritual and social competencies contained in the lesson planning, implementation of learning, and assessment of learning, especially in mathematics in the first grade of junior high school (VII SMP) which is able to integrate spiritual and social competencies while inserting the competence of knowledge and skills in it. In the field, the researchers found some things that hinder the integration of the two competencies, namely the teachers still do not fully understand how the planning that is integrated with core competence (KI) 1 and core competence (KI) 2, the learning model used in the learning process does not yet support the process of forming the character of the students. Similarly, in giving exercise, the teacher does not insert spiritual and social values in essay test and just sticking with multiple choice questions.

The Integration of spiritual and social value in learning is very dependent on the learning model that corresponds to the characteristics of learning materials. It can be applied if teachers choose the *PAIKEM* learning (active learning, innovative, creative, effective and fun) such as problem-based learning, project-based learning, inquiry learning and discovery learning). The assessment of spiritual and social competencies should be carried out through the observation, inter-students assessment, self-assessment and teacher's journal. Therefore, teachers need to make a rubric of attitude assessment expressed qualitatively..

***Index term*:** Competence, Spritual and Social, curriculum 2013

1. INTRODUCTION

Curriculum is a set of plans and arrangements regarding the objectives, content and learning materials and methods used as guidelines for the organization of learning activities to achieve certain educational purpose (Depdiknas, 2006: 449). Curriculum regulates how the implementation of learning in the classroom, and therefore the curriculum is a reference for teachers in determining the learning materials and the appropriate methods that can be applied to achieve educational goals. In order to enhance the quality of education in Indonesia for the better, the government has made several changes of curriculum in accordance with the reality of the situation existing education. As with phenomena which recently befell the world of education in Indonesia, where many cases occurred unscrupulous performed by students ranging from elementary to high school level, has forced the government especially Dekdikbud (Department of Education and Culture) to establish a curriculum that emphasizes the cultivation of spiritual and social values on the learners, that is Curriculum 2013.

According to Nuh M. (2012), Minister of Education and Culture, the implementation of Curriculum 2013 aims to correct the behavior and character of the learners so that cases such as fights, sexual harassment, bullying, violence, among adolescents can be minimized. Curriculum 2013, which emphasizes on education that integrates spiritual and social competencies and of course without losing the cognitive and psychomotor competencies is a perfect solution to resolve the crisis of morals and character education. On the Curriculum 2013, the perpetrators of good education is the principal, teachers, and students have to integrate the spiritual and social competence in all subjects in school. In other words, in each of the learning process, students not only will have the competencies of knowledge (cognitive) and skills (psychomotor), but also spiritual and social competence. However, it was later raised concerns in the minds of educators will be their inability to apply the spiritual and social competence in specific subjects such as Mathematics, Science and others.

Polemic pros and cons of the implementation of the curriculum 2013 that occurred in the community has inspired researchers to conduct research regarding the application of curriculum 2013 in mathematics at some junior high school in the city of Medan, to know the deficiencies of curriculum 2013 that occur in the field whether it is derived from human resources as teachers, as well as learning devices. Furthermore, from the results of the investigation, researchers will design the integration pattern of spiritual and social competence in process of lesson planning, the implementation of learning, and assessment of learning and also develop Math textbook, for the first

ISBN 978-602-19877-3-5

grade of Junior High School which integrate spiritual and social competence with knowledge and skills in it. The implementation of curriculum 2013 in the city of Medan is started simultaneously in the academic year 2014, so the results of this study are expected to be a good evaluation for teachers, principals and government in the development of curriculum 2013.

2. REVIEW OF LITERATURE

2.1 Curriculum 2013

Curriculum is the heart of education where the materials, processes, content and learning objectives determined by it. According to Nasution (1995), the curriculum is a number of subjects at school or lectures in university that must be taken to achieve a level. The same thing also expressed by UNESCO (2004: 13), which states that "Curriculum is what is learned and what is taught (context); how it is delivered (teaching-learning methods); how it is assessed (exams, for example); and the resources used (eg, books used to deliver and support teaching and learning) ". Studies in several countries in Asia, Europe and the USA (David L.Grossman, Wing On Lee and Kerry J. Kennedy, eds., 2008) suggests that the policy on the school curriculum is closely linked to the interests of national education policy and situation as well as context that supports it. Therefore, a curriculum change in a country can be caused by the need of education situation is happening.

Curriculum should give attention to the whole sphere that is not only focused on the cognitive, psychomotor or affective only. Competence curriculum that is able to integrate spiritual, social, cultural and cognitive competence in line with the character and competence of psychomotor course will produce a civil and dignified man. This is in accordance with the formulation of the human quality of Indonesia in the National Education Goals set forth in Law No. 20 of 2003 on National Education System:

National education serves to develop the ability and character *development as well as the civilization of dignity in the context of the intellectual life of the nation, aimed at developing students' potentials in order to become a man of faith and fear of God Almighty, noble, healthy, knowledgeable, capable, creative, independent and become citizens of a democratic and responsible.*

Curriculum 2013 is a new curriculum proposed by the Ministry of Education and Culture of the Republic of Indonesia to replace the Education Unit Level Curriculum (Curriculum 2006). Curriculum 2013 is a curriculum that promotes understanding, skills and character education. Students regulate on the material, active in discussions and presentations as well as having good manners discipline.

2.2 Core Competence and Basic Competence

2.2.1 Core Competence (KI)

Core Competence cannot be equated with Competency Standards (SK). If SK in the KTSP (Education Unit Level Curriculum) is taught to students, the core competency is not to be taught, but to be formed through learning process. Every subject must be submitted to the core competencies that have been formulated. In other words, all the subjects that are taught and learned in the classroom should contribute to the formation of core competence.

The core competence serves as organizing element of basic competence. As an organizing element, core Competence is a binder for the vertical and horizontal organization of basic competency. Vertical organization of Basic Competence is the link between the the Basic Competence content of class or level of education to a level above that meet the principles of learning in which there is a continuous accumulation of the content learned. Horizontal organization is the link between the Basic Competence content of the subject with the Basic Competence content of different subjects in the weekly meetings and the same class so that a process of mutually reinforcing can happen.

According to the Ministry of Education and Culture (2013), designed core competencies in four inter-related groups, namely:

a. Core Competence 1 (related to the spiritual attitude)
   In this religious competence, students can be judged on the following charges: a) Obedience worship, b) Conduct of gratitude, c) Pray before and after the activity, d) Tolerance in worship.
b. Core Competence 2 (related to social attitude)
   In this social competence, the attitudes which can be observed : a) Honest, b) Discipline, c) Responsibility, d) polite, e) Caring, f) Confident, and the other attitudes according to its competence in learning, for example: cooperation, thoroughness, perseverance, and others.
c. Core Competence 3 (related to knowledge)
   Knowledge competence is divided into several basic competencies that depend on the subjects and the learning material at a certain level.
d. Core Competence 4 (related to skill).
   The forms of skill Competence are result of students' works, students' performance, project, portfolio, and others.

The four groups are the reference of basic competencies and should be developed in every learning activity integratively. Competences that relates to religious and social attitudes are developed indirectly (indirect teaching) when students learn about knowledge (core competence 3) and skill (core competence 4).

2.2.2. Basic Competence (KD)

In supporting core competencies, learning - outcomes of a subject are explained into basic competencies. The achievement of core competence

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is obtained through learning basic competence conveyed through subjects. The formulation is developed by taking into account the characteristics of learners, initial capabilities, as well as the characteristics of a subject. As a supporter of the achievement of core competencies, basic competencies are grouped into four according to the formula that supports core competencies, namely:

a. Basic competence group of spiritual Attitude (supporting core competence-1) or group 1
b. Basic competence group of social attitudes (supporting core competence-2) or group 2
c. Basic competence group of knowledge (supporting core competence-3) or group 3
d. Basic competence group of skills (supporting core competence-4) or group 4.

The description of basic competence is to ensure that the achievements of the learning does not stop until the knowledge alone, but must continue to skills, and comes down to attitude. Through the core competence, each subject is emphasized not only to contain the knowledge, but also includes content that is useful to the process of skill formation. It also contains a message about the importance of understanding these subjects as part of the formation of attitudes. The ongoing process is to ensure that knowledge continues to skill and empties to attitude so that there is a close relationship between basic competence of knowledge, skills, and attitudes.

2.3 Lesson Plan of Curriculum 2013

Lesson Plan is a work plan that describes procedures, organizing, learning activities to achieve the basic competencies that have been established which have been outlined in the syllabus. Lesson plan most scope covers the basic competencies that comprise one) indicator or several indicators for one session or more. A teacher must pay attention to the steps the preparation of lesson plan. in Curriculum 2013 is divided into three major steps, preliminary activities, core activities and closing activities. Before preparing lesson plans, there are some things you should know:

a. Lesson plan is derived from the syllabus for directing the activities of learners in order to achieve basic competency. Every teacher in the educational unit Lesson Plan obliged to prepare a complete and systematic.
b. Lesson plan are prepared for every basic competence which can be implemented in one meeting or more.
c. The teacher designed a fragment of the Lesson Plan for each meeting tailored to scheduling in the education unit.

Components of lesson plan in Curriculum 2013 consists of: 1) Identification of Subjects, 2) Basic Competence, 3) Achievement Indicators Competence, 4) The learning objectives, 5) Teaching materials, 6) Allocation of time, 7) Method of learning, 8) learning activities, 9) assessment of learning outcomes, 10) learning resources

2.4 The Implementation of Learning in Curriculum 2013

Learning is an effort to create a climate and services on the ability, potential, interests, talents, and needs of diverse learners to enable the optimal interaction between teachers and students, and between students and students. The Ministry of Education and Culture (2013) stated that there are several steps that can be implemented in learning through the curriculum in 2013 in general, namely:

2.4.1. Learning Model in Curriculum 2013

The learning model can be defined as a conceptual framework that describes a systematic procedure in organizing learning experiences to achieve specific learning objectives, and serves as a guideline for the designers of learning and teachers in planning and implementing learning activities. According Kemdikbud, there are several models of learning that are relevant to the curriculum in 2013, among others:

a. Discovery Learning Model

Discovery learning is one of learning model developed and implemented in curriculum 2013. Discovery learning refers to various instructional design models that engages students in learning through discovery. Teachers as main implementers of learning is certainly obliged to understand and apply this learning model. Discovery learning model has some learning steps, namely: preparation, implementation, and assessment. In main activities, the implementation of discovery learning include stimulation, statement (problem identification), data collection, data processing, verification (evidence) and drawing conclusions (generalizations).

b. Problem-based Learning Model

Problem-based learning is a teaching method in which students learn about a subject through the experience of solving a real problem. It is a format that simultaneously develops both problem solving strategies and disciplinary knowledge bases and skills by placing students in the active role of problem-solvers confronted with an ill-structured situation that simulates the kind of problems they are likely to face as future managers in complex organizations. Learning steps in problem-based learning consist of basic concepts, problems definition, independent learning, and knowledge exchange.

c. Project-based Learning Model

Project-based learning is a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and

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respond to an engaging and complex question, problem, or challenge. Teacher assigns students to carry out exploration, appraisal, interpretation, synthesis, and finding information to produce various forms of learning outcomes. This learning model has six learning steps, namely: 1) the determination of the question, 2) drawing up project plans, 3) scheduling, 4) monitoring, 5) testing results, and 6) Experience-evaluation. Assessment system conducted on the project –based learning is the project assessment. Every project (task) will be assessed based on students' ability in finishing it within a predetermined time.

2.4.2 Assessment in Curriculum 2013

a. Characteristics of Assessment

Assessment in Curriculum 2013 has the following characteristics: 1. Completed study, 2. Authentic, 3. Continuous 4. Using valuation techniques varied, 5. Based on the reference of criterion. According to the Ministry of Education and Culture (2013), the assessment of Spiritual and Social competency is done through:

b. Observation

It is an assessment technique conducted continuously using the senses, either directly or indirectly by using observation format that contains a number of behavior indicators observed. This is done during lessons and outside learning

c. Self-Assessment

It is an assessment technique conducted by asking learners to express their own weakness and superiority in the achievement of competence.

d. Peer Assessment

It is an assessment technique done by asking learners to assess each other related to attitudes and daily behavior of the learners.

e. Journal of Teacher's Notes

It is a teacher's record inside and outside the classroom which contains information on the results of observations about the strengths and weaknesses of students related to their attitudes and behavior.

f. Knowledge

Knowledge aspect can be assessed in several ways, namely: a) written test, b) Oral test, c) Assignment

g. Skills

Aspects of skills can be assessed in several ways, namely: a) Performance, b) Project, c) Portfolio.

3. RESEARCH METHODS

3. 1 Research Approach

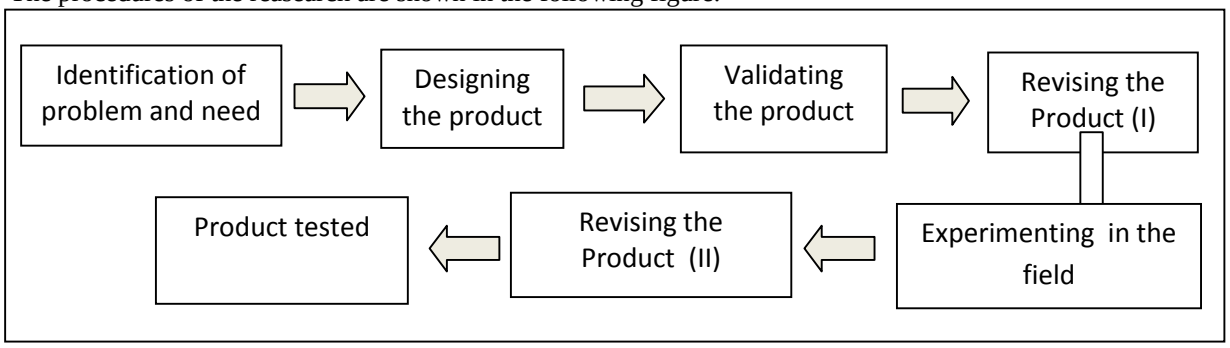
This study is developmental research that aims to develop educational products and test the effectiveness of the product. This research was conducted for 2 years where the first year, researchers conducted an investigation of the problems that occur in the field related to the implementation of the curriculum 2013 mainly related to how the teacher pours spiritual and social competence in mathematics in the first year of junior high school. The results of these investigations became the basis for researcher to design a integration model of spiritual and social competencies in mathematics in the planning process, the learning process and assessment. In addition, in the second year of this research, the researcher will develop the mathematics textbook which supports the integration of spiritual and social competencies into knowledge and skill competencies.

3. 2 Research Location

The research was conducted at several schools of Junior High School in the city of Medan that use the curriculum 2013, namely SMPN 1, SMPN 34 and SMPN 38 Medan.

3. 3 Research Procedures

The procedures of the reasearch are shown in the following figure:



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4. RESULTS AND DISCUSSION

4.1 Integration of Spiritual and Social Values on Curriculum 2013 Mathematics of Junior High School.

As already described in the literature review in the third section, Law Number 20 year 2003 about National Education System, learning activities, beside to make students are able in competing that had targeted, not only that but also the student taught so that the students know, realize, care, and internalize to do the behavior realizely or not, the student will do it with happily in their daily life and their social life.

To grow up the spiritual values and social are integrated in learning process such us introduce values gotten realizely about the important values life, and internalize values into the behavior of students daily through a learning process , moreover when learn in the class and outside of the class, especially in mathematics. regarding with the aim of national education to improve the quality of education is directed to improve the quality of Indonesian human sources development through heart, mind, taste and exercise so that have a competitive edge to facing of global challenges. The relevancy of education to produce graduated according with indonesian need potential.

4.2 The Integration of Spiritual and Social Values in Planning of Mathematics Learning

Learning materials, learning activities, indicators of achievement competencies, appraisal, allocation of time, and learning resources are defined in the syllabus is basically intended to facilitate students master KI (core competence) or KD (basic competence). So that these components also facilitates learning can help students develop character, the minimum necessary to adapt the components of learning activities, indicators of achievement of competencies, and assessment techniques from the syllabus. Addition or modification of learning activities, indicators of achievement and assessment techniques in the syllabus must pay attention to compliance with the Core Competence and Basic Competence relating to knowledge and skills.

As in the syllabus, in order that Lesson Plan may provide guidance to teachers in creating learning that has spiritual and social values, it is necessary to adapt to some of its components. Lesson Plan format that combines the knowledge and skills competencies with the spiritual and social competence can be found in the appendix. A blend of spiritual and social values needs to be facilitated and developed since the learning process is designed by Lesson Plan. It was, among others, can be done by making changes to the Lesson Plan following three components.

a. Addition or modify the learning activities in the Lesson Plan, as well as adding valuable words of spiritual and social formation of values in each learning activity so nuanced learning activities designed to develop spiritual and social competence
b. Addition or modify the indicators of achievement of competencies in the Lesson Plan primarily on basic competencies indicators related knowledge and skills, thereby ensuring indicators related to the achievement of spiritual and social competence.
c. Addition or modify the Lesson Plan assessment techniques on well with observations, self-assessment, peer assessment and journals consistently to develop and / or measuring the development of spiritual and social competence of students.

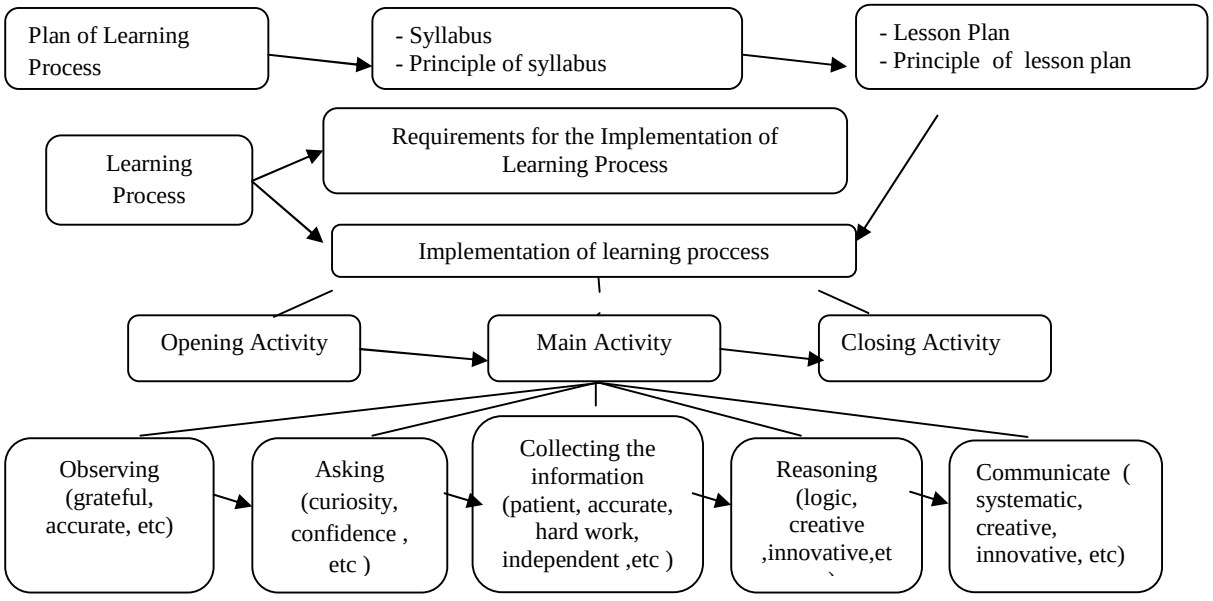

Figure 4.1 the Flow of Planning and Learning Process according to Standard Process**.**

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The integration of alternative spiritual and social competence that can be implanted and developed to students and progress on the word bold.

4.2.1. Opening activity

In opening activity, teacher:

a. prepare students psychologically and physically to follow the learning process;
b. ask questions to remaind the student about the lesson before continue the next lesson.
c. explain the purpose of learning or basic competenciesthat will be achieved;

In the opening activities, kinds of activities that can be done and the values of spiritual and social that can be implanted and developed include the following.

a. Teacher entered the classroom on time (discipline);
b. When the teacher entered the classroom, says greeting to the students (politely);
c. Pray before starting the lesson and pray for other students who are ill in order to get well (religiousness, careness);
d. Ensuring that every students come on time (discipline);
e. Give warn to students who come late politely (discipline, polite and careness)
f. Linking the material / competencies that will be learn with spiritual values and appropriate social.
g. convey the scope of material and the description explanation of activities according to the syllabus.

4.2.2. Main Activity

Main activity is learning process to achieve basic competence that will be done interactively, inspiratif, interesting, challenging, to motivate the students to take an active action, and giving enough chance and space for initiative, creativity, and antonomously based on their talent, max, physical progress and pshycologic's students. This Main activity use according with students's characteristics and the subject that can collect the information of observation process, asking, and communicating.

a. Observing

In observing activity, the teacher asks the students independently to see and hear visual medial, audio and audiovisual about the topic / material's theme they will learn by applying the principles of nature with praise of creation, grateful for the perfection of his creators (religious, grateful, self-contained, logical thinking, creative, curious);

b. Asking

Asking activity, the teacher facilitates the interaction between students and teachers, environment, and other learning resources politely and orderly (curious, cooperation, mutual respect);

c. Gathering information

In collecting information, the teacher:

1) facilitating students by giving assignments, discussions, and others to come up with new ideas both orally and in writing (creative, confident, critical, respectful, polite);
2) Provide an opportunity to think, analyze, solve problems and act without fear (creative, confident, critical);
3) facilitating learners in problem-based learning, project, search, discovery (cooperation, mutual respect, responsibility);

d. Reasoning

In reasoning activity, the teacher facilitates the students analyze the patterns of mathematics closely related to everyday problems (conscientious, creative, hard working, confident).

e. communicating

In communicating activity, teacher:

1) facilitate the students present written or oral with responsibility and confidence in learning outcomes, what they have learned, skills or materials that still need to be improved, or strategicies or new concepts were found based on what is learned. (responsibility, confidence, co-operation).
2) facilitate the presentation of the results of the students responded with courtesy and respect include give the question and answer session to confirm, denial and reason, give additional information, or complete the information or other responses. (courtesy, respect, critical thinking).

4.2.3. Closing Activity

Things that need to be taken to ensure that the integration of spiritual values and social can be more intensive is as follows:

a. beside the conclusions relating knowledge aspects, students should be facilitated to obtain a valuable moral lesson, learned from the knowledge and skill or through a learning process in the past.
b. Assessment not only measures the student achievement the knowledge and skills but also on the development of student character.
c. Feedback related to the product or process should involve both competence and character and begin with the positive aspects pointed by students to grow up self-reliance.
d. The students' works are displayed to develop the mutual respect with other people's work and confidence.
e. Follow-up the activities remedial learning, enrichment programs, counseling services and provide good assignments individualy and group assignment given in order not only related to the development of intellectual ability but also personality ability.
f. Pray at the end of the lesson.

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4.3 The Integration of Spiritual and Social Values in Mathematics Learning Process

Spiritual and social values are integrated in learning process is the introduction of values, facilitating obtaine the awareness the importance of values, in sense of appreciation to a value that is the truth of faith and awareness of the value embodied in the attitudes and behavior of values into the daily students through a learning process,moreover inside and outside the classroom. Spiritual Competence and social development not through special learning but implicitly integrated in the learning activities at all learning materials and be sustainable in the sense that the educational process of cultural values and national character is an activity that is the process is quite long, starting from the beginning students entry until completion of an educational unit.

Learning Process activities has activities that support the character value through active learning that has been discussed by teachers through various activities such as problem-based learning (problem-based learning), project-based learning (project-based learning), investigation (inquiry learning), and invention (discovery learning). Each learning activity contains the noble values to be imparted to students sincerely and continuously without any boredom. The daily behavior of teachers and education personnels in the school and outside the school in the form of "exemplary" by must be done by giving directly example to the students.

A learning activities, either explicitly or implicitly formed of six components. The components are:

4.3.1. Goals

Learning activities instill character values when the purposes of such activities are not only focused on knowledge but also attitudes. Therefore, it should be added goal orientation in learning activities to the achievement of an attitude or a certain value, for example in mathematics, primary values developed are logical, critical, hard work, curiosity, independence, self-confidence, while the main character of the principal developed in subjects mathematics include religious, honest, intelligent, strong, caring, and democratic.

4.3.2. Input

Input is defined as material / reference as a starting point the implementation of learning activities by students. Input may be either oral or written text, graphs, diagrams, drawings, models, Charta, real objects, films and so on. Input that introduce the values are not only present material/ knowledge, but also describe outlines the values that are associated with the material / knowledge.

4.3.3. Activity

Learning activity is what had done by the students (together with and / or without teacher) with input to achieve learning objectives. Learning activities that can help students to internalize the values is active learning activities that encourage autonomous learning and learner-centered. Learning which facilitates autonomous learning and student-centered learning will automatically help students to gain a lot of value.

4.3.4. Setting

learning setting related when and where the project is implemented, how long, whether individually, pairs, or groups. Each setting has implications for the values of education. Time setting of short task completion, for example, will make students accustomed to work quickly and appreciate the time well. Meanwhile, working in group can make the students gain ability to cooperate, mutual respect, and others.

4.3.5. Teacher's Role

Teacher's role who facilitate internalized values by students include the teacher as a facilitator, motivator, participants, and giving feedback. Like a quotation of Ki Hajar Dewantara, the teachers who effectively and efficiently develop the value of spiritual and social students are those who ing ngarsa sung tuladha (in front, the teacher serves as role models / give an example), ing middle Mangun intention (in the midst of students, teachers build initiative and cooperate with them), tut wuri Handayani (behind, the teacher gives spirit and encouragement for students).

4.3.6. *Student's* Role

The active participation of students in learning are as participants of discussion, experimentation actors, presenters of discussion and experiment results, project implementers, etc. Therefore, a teacher facilitates students to know, care, and internalize the spiritual and social values. In facilitating students to know, care, and have character, the students should be given an active role in learning.

4.4 The Integration of Spiritual and Social Values in Assessment of Mathematics Learning

To measure the results of learning, teacher can perform test and non-test instruments to the students. Assessment techniques to determine the mastery of mathematical concepts is usually done by the test instrument. The test instrument is used to measure aspects of knowledge or skill. Non-test instrument is used to reveal aspects of attitudes, including spiritual and social values. Non-test instrument includes the observation sheet used by teachers (observer) or questionnaire for students. Beads of statement on the observation sheet or questionnaire are prepared based on indicators of the character values revealed.

Assessment techniques that can be used to determine the spritual and social development are observation, inter-students assessment and self-

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assessment. The instrument composition is fisrtly preceded by arranging the test specification. The socres are stated qualitatively, for example:

a. BT (Belum Terlihat): Unseen yet (if the students have not demonstrated early signs of character stated in the indicator).
b. MT (Mulai Terlihat): Start visible (when students begin to show the character that is stated in the indicator but not consistently).
c. MB (Mulai Berkembang): Start to Develop (when students are already showing some characters stated in indicators and begin consistently).
d. MK (Membudaya): Civilized (if the students continuously perform character stated in the indicator consistently).

The integration of spiritual and social competence into the knowledge and skills competence is to shape students' spiritual and social values in math subject which consist of the following characters such as religious, honest, intelligent, firm, care, and democratic, logical reasoning, critical, creative and innovative, hard working, curiosity, independence and confidence.

Those values are described in the indicators. For example, the indicator to form the team working and independence characters as follows:

a. The character of team working has indicators: disscusing to the teacher or a friend about the subject matter, trying to find sources to learn about the concept/ issue learned / found, attempting to find a more challenging problem, and active to seek information.
b. The character of independence has indicators: accomplising the students' own assignment, having confidence to solve problems, and possesing confidence of their abilities.

4.5 Model of Spiritual and Social Competence Integration into Knowledge and Skill Competencies in Mathematics of Junior High School.

In the Learning Proccess, students are expected actively to develop their own potentials, doing the process of internalization, socializing with the others and comprehending the good values into their personality in social interaction, improving the community more prosperous and also developing national life to be dignitary. Therefore, learning which has religious and social values should be implemented integratedly, through good planning, appropriate methods and models of learning and correct assessments combining attitude elements.

Below is described model of of the spiritual and social competencies integration into the knowledge and skills competencies:

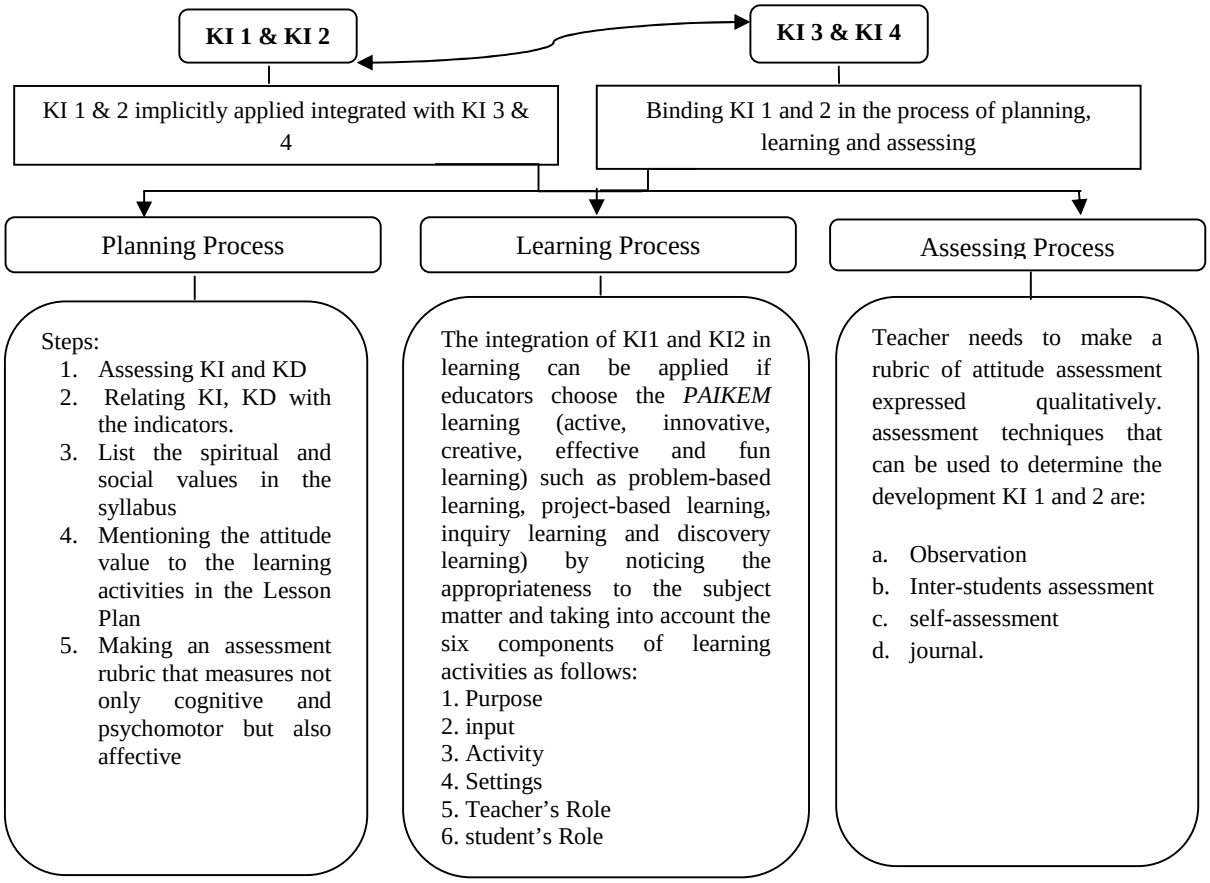

Figure 5.2. Integration Pattern of Spiritual and Social Competencies into Knowledge and Skill Competencies in planning, learning and assessing processes

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Note:
KI 1 : spritual competence
KI 2 : social competence
KI 3 : knowledge competence
KI 4 : skill competence

The implementation of mathematics instruction that builds students' personalities is done by observing and adjusting to the students' environmentts. The implementation needs to be applied gradually with full of patience and diligence. If the implementation aims to produce students with the comprehensive and humanitarian capabilities, it requires teachers to change their teaching habit. The teacher is demanded to have creativity, open mind, hardworking , diligence, patience and sincere to give great benefit to the students as much as possible. Remember, the good vehicles used, depend on the driver, the good curricullum applied, depend on the teacher.

5. CONCLUSIONS AND SUGGESTIONS

5.1 Conclusions

After analyzing the data, the conclusions can be drawn are as follows:

a. The Integration of spiritual and social competence in mathematics at state Junior High School 1, 34, and 38 Medan in terms of planning, the learning process until the assessing process is not done optimally. This is due to a lack of students understanding in applying curriculum 2013.
b. In learning activity, most teachers have not been using a varied learning model in accordance with the characteristics of the material and learners, whereas, the variation in teaching methods is needed in order to establish and improve the students' interest in learning mathematics. The integration of KI 1 and 2 in learning can be applied if teachers choose the *PAIKEM* learning (active learning, innovative, creative, effective and fun) such as problem-based learning, project-based learning, inquiry learning and discovery learning).
c. The assessment of spiritual and social competencies should be carried out through the observation, inter-students assessment, self-assessment and teacher's journal. Learners' progress can be known by teachers and parents, and even by the students themselves. The assessment of spiritual and social values in mathematics learning carried out integratedly with the teaching and learning activities. However, teachers often provide assessment portion only on the cognitive domain. Therefore, teachers need to make a rubric of attitude assessment expressed qualitatively..

5.2 Suggestions

In relation to conclusions previously stated, suggestions are stated as the following:

a. Teachers are expected to improve their ability to use a variety of appropriate learning models to support the integration of spiritual and social competencies into knowledge and skill competencies in mathematics learning.
b. The school is expected to ensure that the entire process of planning, learning activity and assessment process teachers do, can integrate well both spiritual and social competencies into knowledge and skill competencies, so that the purpose of the implementation of the curriculum 2013 can be achieved.
c. The government should provide training or workshop that is more optimal for teachers to strengthen their role in the implementation of curriculum 2013, and the government is also expected to make improvements to the deficiencies and obstacles that occur in the field.

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Statistical Analysis of the Relationship between Pedagogic Competence and Professional Competence in the Competency Test Results of Senior High School Teachers in West Sumatera Province

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ABSTRACT

Professionalism of teachers is often attributed to one factor that is quite important, namely the competence of teachers. Competent teachers can be evidenced by the acquisition of professional teacher certificate following an adequate allowance according to the standard of Indonesia. The problem arises then is that the teachers were regarded as competent teachers only whether they held the certificate or not. Meanwhile, this seems to be academic unaccountable in the long terms. So that,it was required for the professional teachers to improve their pedagogic competence as well as professional one. This study aims to determine the relationship between pedagogic competence and professional competence of high school teachers in West Sumatera. The method used in this research is a quantitative approach. Data was obtained from Teacher Competency Test (UKG) of Senior High School during 2012-2014. The data analysis began with data description that displays the data, the value of descriptive statistics and its graphical representation. Then, the paired t-test, correlation analysis and regression analysis are used to analyze the data. The unpaired t- test performed to test whether there is an increase in both teachers' pedagogic and professional competence year-by-year. Correlation analysis and regression analysis were used to examine the existence of the relationship between pedagogic competence and professional competence. Based on the results of paired t test, it was concluded that there is increase in both pedagogic competence and professional competence from 2012 to 2013, while there is the opposite results for the rest. The results of correlation analysis showed the pesent of positive correlation between both competences. However, as the correlation coeficients indicates, the relationship between these two competences is not as high as the one in 2013 UKG. For 2014 UKG, there is no relationship between the competences. Acording to the regression analysis, it is found that for 2012 UKG and 2013 UKG, the professional competence affects the pedagogic competence, whereas the latest one showed the opposite results.

Index Terms— Pedagogic, Professional, Teacher Competency Test

1. INTRODUCTION

The teachers have a position as professionals, according to Law No. 20 year of 2003 on National Education System stated that the teacher is "..... professional in charge of planning and implementing the learning process, assessing the results of learning, coaching and training, and conducting research and community services, especially for educators at the college,[1]. Law on Teachers and Lecturers (UUGD) also said that professional is any work or activity conducted by a person and is a source of income of life that requires expertise, skills, or skills that meet standard quality or certain norms and requires education profession. As professionals, teachers are required to constantly develop themselves coincide with the emergence of science and technology as well as the circumstance that the teacher's compulsary to have academic qualifications, competence, teaching certificate, physically and mentally healthy, and have the ability to achieve national education goals. Regarding the competence, a teacher must have pedagogic competence, personal competence, social competence, [2] and professional competence that acquired through professional education.

The fact that the most of teachers held the professional teacher certificate leads to convincing assumption that they are competent teachers. The problem arises then is that the teachers were regarded as competent teachers only whether they held the certificate or not. Meanwhile, this seems to be academically unaccountable in the long term.

Education and Culture Minister Mohammad Nuh said that the result of Teacher Competency Test was far below the required standard. There are valid indicators of poor portrait he elaborated. Firstly, the average results of Teacher Competency Test (UKG) followed by 460,000 in 2012 is 44,50 of the 70

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targeted standards. Secondly, based on the results of the mapping of access and education quality in 2013 and 2014, Indonesia ranked 40 of 40 countries in mapping Learning Curve-Pearson. Thirdly, based on Mapping Trends in International Mathematics and Science Studies in 2011, Indonesia ranked 40 out of 42 countries in mapping TIMSS science literacy. Finally, mapping PISA 2012, Indonesia ranked 64 of 65 countries. With this circumtance, it may be agreed that the teachers were placed at strategic positions that need focused attention are not only on welfare, but also improving the quality of professional. One way that is done now is to analyze the results of UKG already implemented.

This state of affair happened because of the difference among teacher mastery the required competence. To determine the condition of the mastery of the teacher competence, it is important to map the teacher competence UKG. It is intended to determine mastery map teacher in pedagogical competence and professional competence. The mastery map of the teacher would be used as a basis for consideration in delivering of coaching programs and professional development of teachers. Output of UKG focused on identifying the weaknesses in the control of pedagogic competence of teachers and professional.

Based on the above reasons, the authors conducted a statistical analysis to study the results of UKG for high school teachers in West Sumatra.The problem of research are as follows: (1) Is there an increase in pedagogic competence and professional competence of teachers year by year? (2) Is there a relationship between the pedagogic competence and professional competence of teachers at senior high school in West Sumatera? And (3) does professional competence affect pedagogic competence of teachers?

1.1. Teacher Competency Test

UKG abbreviated Teacher Competency Test is a test to measure the activities of basic competence on the field of study (subject matter) and pedagogic in the domain of content Teachers. Basic competence fields of study were tested in accordance with the certification field of study (for teachers who are already certified educators) and in accordance with the academic qualifications of teachers (for teachers who are not certified educator). Pedagogic tested competence is the integration of pedagogical concepts into the learning process in the class field of the study. [3]. UKG aims to:

a. obtain an information about the description of teacher competence, in particular pedagogic and professional competence in accordance with established standards.

b. get the teacher competency map that will be taken into consideration in determining the type of education and training to be followed by the teacher in program development and teacher professional development in the form of continuing professional development activities .

c. obtain results that are part of the assessment of teacher performance and will be a matter consideration in the formulation of policies to reward and appreciate to the teachers [4].

The Teachers and Lecturers Act is a political decree which said that educators are professional workers, who are entitled to the rights and obligation of professional. With that expected, educators can devote totally to his profession and to live worthy of the profession. In UUGD, it is determined that an educator of whom have academic qualifications and competence of educators as agents of learning and professional competence of educators includes pedagogical competence, personal competence, professional competence and social competence.

Descriptions of above can be interpreted as follows. Firstly, pedagogical competence is the ability to manage the learning of learners that includes an understanding of the learners, the design and implementation of learning, evaluation of learning outcomes, and the development of learners to actualize various potentials. Secondly, the competence of personality is the personality educator steady, stable, mature, wise, and authoritative, become role models for students, and noble. Thirdly, social competence is the ability of educators to communicate and interact effectively with students, fellow teachers, staff, parents or guardians of students, and the community. Finally, professional competence is the ability of educators in the mastery of learning materials in broad and deep that enable guiding learners gain competency.

1.2. Pedagogic Competence

According to the Law No.14 of 2005 on Teachers and Lecturers teacher competence includes pedagogical competence, personal competence, social competence and professional competence which were acquired through professional education. In the National Education Standards, the elucidation of Article 28 paragraph (3) item raised that pedagogical competence is a competence to manage learning of learners that includes an understanding of the learners, the design and implementation of learning, evaluation of learning outcomes, and the development of learners to actualize various potentials [5].

The aspects of pedagogical competence teacher, absolutely must be owned by each teacher personally. By mastering and applying the ability teaching will give a great influence to teacher personally and give more benefit to the students. They will find it is not only helpful in understanding the lesson materials but also in mastering social competence which is they might not get in their family.

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1.3. Professional Competence

In the National Education Standards, the elucidation of Article 28 paragraph (3) item stated that the definition of competence is the ability of professional to mastery learning materials widely and deeply that allows guiding learners to meet the standards of competence specified in the National Education Standards. In order to achieve the objectives of the National Education educating the nation and developing the whole person desperately needed professional educator roles. Thus the professional teachers are the ones who are experts in their duties to respond appropriately. In addition, professional competence is one of the basic skills that a teacher should possess.

In the professional competence, there are five aspects: 1. Mastering Content, Structure, and Mindset Scientific Concepts that support Subject of teaching. 2. Mastering standard Competence and Basic Competence Subject or Field of Development of teaching. 3. Developing Lessons of teaching Creative. 4. Developing on ongoing basis by doing Profession Reflective action. 5. Taking advantage of Information and Communication Technology for Communicating and Developing Self.

According In to the Law of the Republic of Indonesia No. 20 of 2003 on National Education System, the professorship as an educator professional position. For the professionalism of teachers are required to continue to develop in accordance with the development, science and technology, and the needs of society, including the need for qualified human resources and the capability to be able to compete in both the regional for a national and international levels.

2. RESEARCH METHODS

The aim of study is to determine the relationship pedagogic and professional competence of high school teachers in West Sumatra. The method used in this research is a quantitative approach. Data was obtained from Teacher Competency Test (UKG) of Senior High School during 2012-2014. The data analysis began with data description that displays the data, the value of descriptive statistics and its graphical representation. Then, the paired t-test, correlation analysis and regression analysis are used to analyze the data. The unpaired t- test performed to test whether there is an increase in both teachers' pedagogic competence and professional competence to year-by-year. Correlation analysis and regression analysis were used to examine the existence of the relationship between pedagogic competence and professional competence.

3. RESULTS AND DISCUSSION

Data Analysis of Teacher Competency Test Results of Senioh High School Teacher of West Sumatra.

3.1. Data Description of High School Teacher Competency Test Results

Here is presented the analysis of teacher competency test data (UKG) SMA throughout the country or city in the province of West Sumatra (West Sumatra) from 2012 through 2014. Exposure data analysis is preceded by a description of the data that displays data value, the value of descriptive statistics, and graphical representation. This exposure is intended to present the information that contained in the data. Further it is described the results of inferential statistical analysis which includes the data paired t-test, correlation analysis, and regression analysis.

Data paired t test is used to see wheter there is an increase UKG results for both the competences of one year to the next. Correlation and regression analysis were used to examine the relationship between the pedagogic and professional competences. In the case of regression analysis, pedagogical ability is seen as dependent variables whereas professional capability is viewed as independent variables. Professional capability is considered as an independent variable because it assumed a teacher pedagogical abilities are influenced by their professional ability, but not vice versa. The results of statistic descriptive

The average of the results of UKG SMA in all districts or cities in West Sumatra from 2012 through 2014 has always been above the national average. Mean of results of UKG to the pedagogical competence senior high school teacher at West Sumatra has increased from 2012 to 2013, but fell back from 2013 to 2014. These results showed that the average results of UKG in largely districts or city West Sumatra in 2013 has increased compared with the results in 2012. However, the results fell back in 2014. The same pattern is also visible to the average of the results of UKG to professional ability. Furthermore, the average value professional ability of high school teacher from 2012 to 2014 above of the average value of pedagogic competence. Similarly, an increase in the diversity of the data above average from 2012 through 2014.For pedagogical ability data, there is increase in diversity from 2013 to 2014. It shows that the results of UKG for pedagogical abilities among respective districts or cities in West Sumatra in 2014 more diverse than that of in 2013. This is partly due to the dercrease of the amount of teachers following UKG in 2014 compared with the previous two years.

The average of the results of UKG pedagogical abilities of teachers achieved the highest point in 2013. These results are shown by the position of the line on

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the box in the diagram box to the data of 2013 were higher than the line on two adjacent diagram. Similarly, it appears that the average results of UKG pedagogic competence of teachers in 2014 is more vary than in the previous two years. This is shown by the box and the line at the end of the box that are longer for data in 2014.

Based the average of the results of UKG highest teacher pedagogical abilities are also achieved by 2013. Similarly, it appears that the average results of UKG pedagogical abilities teachers in 2014 more diverse than in the previous two years. In addition, it also shows the existence of two regions in 2013 with a score that is relatively different from other areas, namely Payakumbuh and Mentawai district. In this case,the average value of the results of UKG to the professional ability of teachers in Payakumbuh have a relatively higher value than other areas. In contrast the average value of the results of UKG to the professional competence of teachers in Mentawai has a value that is relatively lower than other areas.

Furthermore, in 2012 the district South Solok and Mentawai are the two regions with the result that most low pedagogic abilities. The value of pedagogic competence in South Solok is at 41.33 and at 41.87 Mentawai. These results were below the national scores. Meanwhile Pasaman and Padang Panjang are the two regions with the highest value 48.54 and 48.44.

Mean while, for the professional competence, South Solok district also an area with the ability lowest with a score of 46.16, and the result is also lower than the national scores. Instead of the Padang Panjang city with the ability of the highest with a score of 54.33.

In 2013, Mentawai region re-listed as having the ability pedagogical lowest with a score of 47.99. While the city of Padang Panjang re-listed as having the highest capability with a score of 56.97. Meanwhile, for the professional ability, Mentawai district also the region with the lowest capability, with a score of 52.27. These results are below the national scores. Instead Payakumbuh was the region with the highest score of 65.93.

Finally, in 2014, Bukittinggi listed as having the results of pedagogical ability lowest with a score of 39, 45. While the district. Dharmasraya is an area with the highest score, namely 57.17. Meanwhile, for the professional ability, Bukittinggi actually listed as having the highest scores namely 67.97 and 50 City as the area with the lowest score is 44.76.

3.2 Paired t test the to Data High School Teacher Competency Test Results

This test is done to see if the average of the results of UKG for a particular capability in one year is higher than the previous year or not. In this case the first time the data paired t test to see whether there is an increased the pedagogical competence of teacher from 2012 to 2013.

Based on the results above shows that the P-value obtained is worth 0.Thus the real level $\alpha = 5\%$ was concluded that there is an increased ability pedagogical teacher from 2012 to 2013.

Furthermore, to see whether there is increase in teacher pedagogic competence from 2013 to 2014, we conducted data analysis with the following result.

Based on the results above showed that the P-value obtained is worth 0.997.Thus the real level $\alpha = 5\%$ was concluded that there was no increase in teachers' pedagogical capability from 2013 to 2014.

Furthermore, the data paired t test was also used to see if there is an increase in the professional ability of teachers from 2012 to 2013.It was showed that the P-value was obtained is worth 0. Thus the real level $\alpha = 5\%$ concluded that there are professional upgrading of teachers from 2012 to 2013.

Furthermore, to see if there is an increase in the professional ability of teachers from 2013 to 2014 conducted data analysis with the following result. Based on the results above showed that the P-value obtained was worth 0.981.Thus the real level $\alpha = 5\%$ was concluded that there was no upgrading professional skills of teachers from 2013 to 2014.

3.3 Correlation Analysis and Regression Analysis Capabilities for Viewing relationship between Pedagogic and professional competence of the Teacher Competency Test Result in SMA

Based on scatter diagrams was shown that increasing the professional capabilities also accompanied by increased pedagogical abilities. The same thing was also shown by the display in Figure 4. These results suggest a link between the ability of pedagogic and professional ability of data from 2012 and UKG 2013.

Meanwhile, based on the scatter diagram shown that it is not always upgrading professional skills are also accompanied by increased pedagogical abilities. These results showed no correlation between the ability of pedagogic and professional ability of the data results of UKG 2014.

In addition to using a scatter diagram as described above, the relationship between the capability of pedagogic and professional ability can be seen from the analysis of correlation and regression analysis follows.

The following software outputs to look at the relationship between pedagogic and professional ability of UKG 2012.

Correlations: Pedagogig12; Profesional12

Pearson correlation of Pedagogic 12 and Profesional 12 = 0.852 P-Value = 0.000

Based on the results, showed that the P-value obtained has a value equal to 0. Thus concluded that

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the real level α = 5% correlation pedagogical competence and professional capabilities of the results of UKG in 2012 as also shown in Figure 3. The value correlation software positive output above shows that the higher a teacher's professional competence, the higher pedagogical competence and vice versa.

The following software outputs to look at the relationship between pedagogic and professional competence of UKG 2013.

Correlations: Pedagogic13; Professional13

Pearson correlation of Pedagogic 13 and Professional13 = 0.636 P-Value = 0.002

Based on the results seen that the P-value obtained has a value equal to 0.02.Thus concluded that the real level α = 5% correlation pedagogical ability and professional capabilities of the results of UKG in 2013 as also shown in Figure 4. The positive correlation on software output above shows that the higher a teacher's professional ability, the higher Similar pedagogical abilities vice versa. However, here are the level of relations between the two abilities are not as tight as relations between the two capabilities in UKG in 2013.

The following software outputs to look at the relationship between pedagogic and professional competence of UKG 2014.

Correlations: Pedagogic14; Professional14

Pearson correlation of Pedagogic14 and Professional14 = 0.249 P-Value = 0.276

Based on the results, showed that the P-value obtained has a value equal to 0.276. Thus concluded that the real level α = 5% there is no relationship pedagogic abilities and professional ability of the results of UKG 2014 as also shown in Figure 5.

Here are presented the results of the regression analysis for the ability of pedagogic and professional ability UKG data from 2012 until 2014 assuming a pedagogic abilities as dependent variables and professional capabilities as independent variables. Following regression output the analysis software to look at the relationship between pedagogic and professional ability of UKG 2012.

Regression Analysis: Pedagogic12 versus Professional 12

The regression equation is Pedagogic 12 = 6.37 + 0.781 Professional12

Predict	Coef	SE	Coef	T	P
Constant	6.369	5.564	1.14		0.267
Professional 12	0.7808	0.1103	7.08		0.000

S = 1.14823 R-Sq = 72.5% R-Sq(adj) = 71.1%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	66.096	66.096	50.13	0.000
Residual Error	19	25,050	1,318		
Total	20	91,146			

Based on the results above shows that the results of UKG 2012 of professional competence affect the pedagogic competence. In this case, for an increase of 1 point score of professional capability will be accompanied with an increase of 0.78 pedagogical ability scores.

Furthermore, the following outcomes are presented the analysis software regression

Regression Analysis: Pedagogic 13 versus Profesional13

The regression equation is

Pedagogic13 = 28.4 + 0.412 Professional13

Predict	Coef	SE	Coef	T	P
Constant	28.369	6.779	4.18		0.001
Professional 13	0.4120	0.1146	3.60		0.002

S = 1.73063 R-Sq = 40.5%

R-Sq (adj) = 37.4%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	38.735	38.735	12.93	0.002
Residual Error	19	56.906	2,995		
Total	20	95.642			

Based on the results above shows that the results of UKG in 2013 professional abilities affect the ability pedagogic. In this case, for an increase of 1 point score of professional capability will be accompanied with a score of 0.412 improve of pedagogical abilities.

Furthermore, the following outcomes are presented the analysis software regression to see the relationship between pedagogic and professional competen of UKG 2014.

Regression Analysis: Pedagogic14 versus Professional14

The regression equation is

Pedagogic14 = 40.7 + 0.167 Professional14

Predict	Coef	SE	Coef	T	P
Constant	40.678	8.374	4,86		0,000
Professional14	0.1667	0.1486	1.12		0.276

S = 4.08809 R-Sq = 6.2% R-Sq (adj) = 1.3%

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	21.03	21.03	1.26	0.276
Residual Error	19	317.54	16.71		
Total	20	338.56			

Based on the results above shows that the results of UKG 2014 professional abilities do not affect the ability of pedagogic.

The following results of Teacher Competency Test Phase I is based on the average value of its

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Professional Pedagogic and according to the highest value by province in West Sumatera

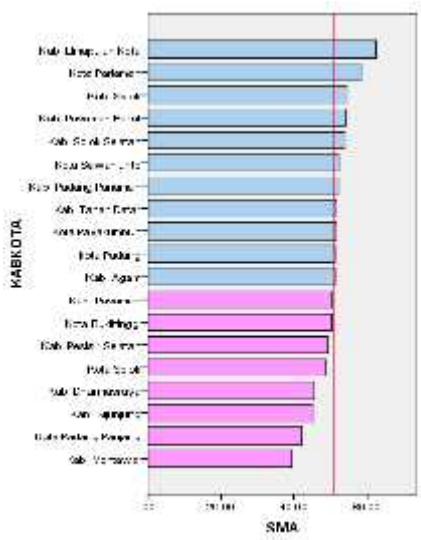

Figure 1

According to above figure, we can conclude that professional competence of teachers in average of the results of UKG SMA in all districts or cities in West Sumatra from 2012 through 2014 had always been above the national average (mean of national score is 45).

Based on description and analysis of data above we obtain that pedagogic competence in 2012 for South Solok district and Mentawai district are lower than others. Meanwhile Pasaman and Padang Panjang are the two regions with the highest value Professional Competence South Solok district also an area with the ability lowest the city of Padang Panjang with the ability of the highest. It showed the existence of two regions in 2013 with a score that is relatively different from other areas, namely Payakumbuh and Mentawai. Payakumbuh had a relatively higher value than other areas. Mentawai had a value that is relatively lower than other areas. In 2014, the avarage value of pedagogic competence of Bukittinggi teachers listed the lowest.Dharmasraya is an area with the highest score. However, professional competence of Bukittinggi actually is the highest scores while District of 50 Kota score is the lowest one.

4. CONCLUSION

Based on the previous description we can conclude that:

a. Pedagogic competence and professional competence of teachers increased from 2012 to 2013, while from 2013 to 2014 it did not.

b. There is positive of correlation between professional competence and pedagogic competence.

c. Based on UKG 2012 and 2013 professional competence affects the pedagogic competence whereas of UKG 2014 abilities of professional did not affect the ability of pedagogic

5. ACKNOWLEDGEMENTS

Gratefulness to Policy Research Centre, Council Research and Development, Ministry of Education and Culture Republic of Indonesia and Goverment District of West Sumatera Province for facilities supporting this research.

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ISBN 978-602-19877-3-5

EFFECT OF MODEL OF GEOMETRY INSTRUCTION THROUGH REALISTIC MATHEMATICS EDUCATION-BASED TO RESPONSE AND GEOMETRY ACHIEVEMENT STUDENT GRADE VII PUBLIC YUNIOR HIGH SCHOOL IN PADANG

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ABSTRACT

The preliminary study on Geometry classes in Public Junior High Schools in Padang, reveals that the result of geometry instructional process was unsatisfactory. The result may be derived from the fact that the learning process places less emphasis on helping the students to construct their own knowledge in Geometry involving the problems of everyday life. This process provides less opportunities for the students to reinvent mathematical concepts under the guidance of teachers. The Realistic Mathematics Education-based for the Geometry instructional model (RME Model) was presumed as an appropriate solution to solve the problem, since this model helps the students to understand the geometry concepts well. This study aimed to examine effect of model of geometry instruction through realistic mathematics education-based to response and geometry achievement student grade VII Public Yunior High School in Padang. The type of research conducted is quasi experimental study. Experiments class using model of geometry instruction through RME-based while the control class using conventional learning process. The research was conducted on the students of grade VII Yunior High School Padang on January to June 2011. Sampling was done by stratified random sample. To obtain research data used achievement test instruments and student questionnaire responses. Data analysis using t-test . The results showed that the responses and the results of student learning geometry using model of geometry instruction through RME is higher than conventional teaching in Yunior Hgh School low, medium and high level. Thus concluded that model of geometry instruction through RME-based effect on learning outcomes and geometry students' response to the learning of mathematics.

Index Terms---Realistic Matematics Education, Geometry Instructional Model, Student Response, Student geometry Achievement

1. RATIONAL

Various attempts have been made by the Government of Indonesia to improve the quality of education is to issue a Government Regulation No.19 / 2005 on the eight National Education Standards as a benchmark for the provision of education at all levels of education. In 2013, published Permendikbud 64 on the Content Standards, No. 54/2013 on Graduates Competency Standards, No. 65/2013 about the standards process. Others Education standards have also been established which Infrastructure Standards, Standards Management, Assessment Standards, Standards Teachers and Education Personnel as well as standard Financing

The national education standards contain the minimum criteria of the educational component that needs to be optimized according to the characteristics and peculiarities of the program in order to improve educational services to students. In addition, national standards are intended as a tool to promote transparency and public accountability in the administration of the national education system that is relevant to improving the quality of education

All efforts by government as described above has not figured satisfactory education in particular areas of West Sumatra. Some indicators that reinforce this argument can be seen from the achievements of the National Examination every year. The low quality of secondary school education achievement is also evident from the results of the Pre UN to the level of West Sumatera Province. Pre-examination of the results of 2009, only about 20% of high school and junior high school students who can exceed the value of 5 or more (Musdi, [13]). So also in the Pre-Examination 2009 National Junior mathematical level of Padang, the percentage of correctly answered questions about the area and perimeter of a plane wake respectively about 32% and 38% (West Sumatra Provincial Education Office). This means that the majority of junior high school students experienced an error reply about the matter this geometry.

The low achievement of students' mathematics learning results were also seen in the subjects of mathematics at secondary school. Research conducted "Trends in International Mathematics and Science Study" (TIMSS, [18]), a comparative study between countries in the world in mathematics, has published the results of his research in 2003 and 2007. In the research report, the position of Indonesia in mathematics for 2003 is ranked 39 of 50 countries with an average of 411, while the international average is 467. In 2007, the position of Indonesia is ranked 36 of 48 countries with an average score of

ISBN 978-602-19877-3-5

397 and the international average 452. From the research conducted by the Ministry of Education USA is seen that in the intervening four years, Indonesia's position does not change significantly, even a decline in the average score obtained by the eighth grade students during the year. Of all the items tested in TIMSS [18], students Indonesia has the lowest value for 16 about geometry tested. Only one problem with the indicator "Making net cube, block, prism and pyramid" Indonesian students reach middle position (around the average) and for the other matter, the position of Indonesian students' scores are in the category of "low" or below average.

In addition, many students who view mathematics as a subject which is very boring, creepy, scary even so many students who try to avoid these subjects. The response of students to math tends not good. There is a tendency of mathematics learning in the classroom minimal link with the real world. This situation is obviously very bad for the development of science and technology forward because almost all subjects that require mathematics as a tool (tool subject). Therefore, changes in the process of learning math fun and touches of everyday life should be a top priority. According to Van de Henvel-Panhuizen [22], when children learn mathematics apart from the experience of their daily life, the child will quickly forget and can not apply

Based on the above opinion, the learning of mathematics in the classroom should be relevant, namely the need for linkages between mathematical concepts to everyday experience of children. In addition, the necessary relevance between mathematical concepts that have been studied children with the reality of their daily lives or in other fields. To that end, the relevance of mathematics learning should take advantage of the child when learning mathematics and mathematics

One of the learning of mathematics-oriented mathematization of everyday experience and apply mathematics in everyday life is Realistic Mathematics Education (RME). RME is consistent with the learning paradigm shift, that paradigm of teaching to the paradigm of learning or a paradigm shift teacher-dominated instruction to the paradigm of Student-directed learning.

Treffers [19] states that the mathematical knowledge of students can be developed starting from the day-to-day knowledge of students. In doing daily activities, which is a real problem for students, is expected they can be directed to rediscover (reinventions) of mathematical concepts. This is also confirmed by Gravemeijer [8] that an essential part of learning mathematics is doing mathematics through problem-solving activities of daily life. According to Freudenthal [6], so valuable to human mathematics, mathematics must be connected to reality, close to the child, and relevant to the community. Thus students will learn math if the math learning starts from the everyday environment of students so that the impression of abstract mathematics to students can be avoided. It is necessary for PMR-based learning device (PMR Model) to be easily understood math and geometry materials exspecially students' responses to math learning becomes high..

RME-based learning model geometry is a learning model geometry with learning objectives and presentation of material that is based on mathematics learning problems of everyday life of students as well as it provides an opportunity to reinvent concepts of mathematics under the guidance of teachers. This model is based on five main theories, namely (1) RME Theory (2) Piaget's theory, (3) Theory Vygotski, and (4) Theory of Bruner. In addition to support it are also supported by the results of relevant research.

An outline of the PMR theory explains that the principle of the learning process in the PMR is to encourage students to explore the role of mathematical ideas so that the mathematical ability of students increased. PMR allows students to follow the mathematics curriculum that is rich in ideas mathematical strong. The strength is mainly due to the phenomenon of didactic principles in PMR linking contextual problems with math that helps students in developing mathematical knowledge (Presmeg, [15]).

Mcnair [12] states that mathematics teaching approach that focuses on the mathematical relation to student life has the potential to improve performance and response of the students in the study of mathematics. The above opinion is supported by Boaler [3] that connects the world of everyday life and the world of mathematics is essential in the learning of mathematics. The reason is that mathematics is seen students during this abstract and formal can seem more concrete if learners can associate mathematics material with their everyday experience.

Gravemeijer [8] states there are three (3) main principles of realistic mathematics education, namely a) guided reinvention and progressive mathematization; b) didactical phenomenology; and c) self-developed model, as follows.

1.1. Guided reinvention and progressive mathematization

This principle states that students should be given the opportunity to experience a process that is similar to the reality of how mathematics is found (Gravemeijer, [8]). This principle assumes that knowledge can not be taught (transmitted) by the teacher, but it can only be built (constructed) by the learner. According to Jaworski [11], teachers must give students the opportunity to gain knowledge of self-constructed (knowledge constructions) by the students themselves so that he is able to account for such knowledge.

De Lange [4] mentions some activities that includes a horizontal component, namely: (1) identifying the specific mathematics in a general

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context, (2) schematizing, (3) formulating and visualizing a problem in different ways, (4) Finding a relationship (discovering relations), (5) discovering regularities, (6) recognizing isomorphic aspects in different problems, (7) transferring a real world problem to a mathematical problem, (8) transferring a real world problem to a known mathematical model.

In contrast, vertical math is math students completed form of formal or informal using the concepts, operations, and procedures applicable mathematics. Some activities that includes mathematics component vertical is as follows (De Lange, 1987): (1) representing a relation in a formula), (2) providing regularities, (3) refining and adjusting models, (4) using different models, (5) combining and integrating models, (6) formulating a new mathematical concept , (7) generalizing..

1.2. Didactical Phenomenology

Principle phenomenon emphasizes the importance of learning about contextual to introduce math concepts to students. This principle should consider two objectives, namely: (1) the application of conformity in the context of teaching and (2) the suitability of an impact in the process of rediscovery (reinvention), shapes and mathematical models of the contextual problems

1.3. Self-developed Model

According Gravemeijer [8], the principle of self-developed models serves to bridge the gap between knowledge of mathematics is not formal and formal mathematics of the students. Students develop the model using mathematical models (formal and informal) that has been known to solve problems contextual of the real situation (real) well-known student, later found "model of" in the form of informal and then followed by find a model in the form of formal and eventually get in the form of problem-solving standard mathematical knowledge. Gravemeijer [8] refer to this process as a transition from a model-of to model for. After this transition models can be used as a model of mathematical reasoning (mathematical reasoning). Treffers, [20] propose a model that appeared in the PMR. With independent development model students learn math through a series of mathematical informal and slowly headed to the formal mathematics beginning with the completion of the contextual problems of the real situation which are students. Thus, according Treffers [19] there are four phases through which students in mathematics, namely the real situation, the model of the problem, mathematical models and formal form

Based on the information in this section can be concluded that there are three main principles in realistic mathematics education, namely: (1) guided discovery and bermatematika progressively, (2) didactical phenomenology; and (3) self-developed model. These three principles form the basis of realistic mathematics learning materials. In addition, the PMR models are also considering several theories such as the theory proposed by Vygotsky and Brunner.

An outline of Vygotsky's theory is explained as follows Bell [2]: (a) The use of symbols obtained by students in solving problems through social interaction. Every function in the cultural development of the students looked at the social level and the individual level; between people and in children. For that to happen social interaction in solving the problem needs to be created and filed groups that allow students to share knowledge and strategy. The group should not be too large (2-3 members) with heterogeneous capabilities. The group's objective is to transform the concepts of spontaneous child through scientific counterpart (scientific counterparts). (b) Development of knowledge requires the intervention of adults in children's thinking. Without the mediation of symbolic, thinking students will be at a low level. Zone of proximal development (zone of proximal development) is an area between the level of actual development as determined by problem solving independent and the level of potential development as determined through problem solving under the guidance of an adult or in collaboration with more couples are capable.

Based on such a view means that the task of solving the problem as well as the filing of the problem can be a form of intervention on the thinking of the child, so the child until it reaches the level of potential development. (c) use ideas Bruner Vygotsky like scaffolding (supporting) to explain how the teacher and the spouse who is able to direct students to help them understand the level of understanding further. In studying the role of teachers, adults, or peers to help bring the knowledge of the child at a higher level. This can be done by providing a cantilever (scaffolds) that are no longer needed by the child after the learning process is completed. Problem-solving skills and creative thinking is the knowledge that later required while still in school or after school is over. Tasks as well as the submission of problem solving in the classroom can be a crutch child reaches the level of problem-solving skills are higher.

Based on exposure in the previous section then developed a geometry-based learning model realistic mathematics education (RME Model) capable of facilitating the development of the students' responses in learning geometry and geometry students improve learning outcomes. Therefore, this research problem: (a) whether the students' response to learning using RME models better than conventional pembelajjaran (b) whether the results of learning geometry students using RME better models of learning konvensionnal. The research objective is to determine the students' response to learning geometry and geometry student learning outcomes junior grade VII of Padang are using RME models.

ISBN 978-602-19877-3-5

2. RESEARCH METHOD

This research is a quantitative research with experimental design is quasi-experimental. At the end of this study, the experimental class (RME Model) and control given the final test and the questionnaire responses of students to learning geometry. RME models have been validated by mathematicians and also considered practicallity aspects. The model consists of Books RME. RME models and other devices that are supported by Lesson Plan, Student Worksheet, Individual Worksheet and Advanced Exercise Sheet. Before the teachers in each class implementing the learning experiment, researchers trained the teachers on how to use any device that supports the PMR models. The study population was the seventh grade students of SMPN of Padang enrolled in semester from January to June 2012. The sample was determined using a stratified sampling technique consisting of the high school category, one school and one school category were lower category. At each school selected category, randomized parallel two grade VII to be class experiments using PMR-based learning geometry (RME Model) and other classes as a grade control using conventional learning. The independent variable in this study is a geometry-based learning and learning in the conventional RME. The dependent variable was the response of students and learning outcomes geometry. This peneitian using student questionnaire responses and achievement test geometry which has been tested beforehand

3. RESULT AND DISCUSSIO

3.1 Result

After the sample data meet the requirements of normality and homogeneity then held hypothesis testing. This study using t-test. The following is a summary of the calculation of hypothesis testing an experimental class and control class for the high school category, medium and low.

Table 1 Mean and t-test results for the Three Categories of Learning Geometry Samples

Category	Mean	t-Cal	t-table	Conclution	
	eksperimet	Control			
High	81,10	72,06	1,98	1,68	Ho Refused
Medium	70,67	61,45	4,07	1,68	Ho Refused
Low	69,00	62,2	2,89	1,68	Ho Refused

Based on the table above, for the three categories of junior high, medium and low occurs with significant differences between experiment classes and the control class. Thus the RME-based learning geometry influence on student learning outcomes geometry. Here is the average response for all three categories of junior high school students.

Table 2. Mean and t-test Student Respond for threee Categories of Sample

Category	Mean		t-Cal	t-table	Conclution
	eksperimet	Control			
High	20,87	16,03	4,76	1,68	Ho Refused
Medium	20,63	17,71	3,53	1,68	Ho Refused
Low	18,97	15,69	3,26	1,68	Ho Refused

From Table 2 shows that the response of the students are learning to use RME models higher than using conventional learning. Thus RME models can influence students' response to learning geometry grade VII SMP Padang. Differences in student responses lasted for three categories of junior high, medium and low.

3.2 Discussion

Based on the results of the study found that the students' learning achievement geometry using PMR models are higher than conventional learning. Students' response to learning geometry using PMR models are also higher than using conventional learning. The percentage of students that scored above the minimum criteria of completeness (KKM) for the high school category, medium and low are respectively 85%, 80% and 78%. This means that most of the students in the class using RME models can have a value above the passing grade. This happens because the model RME make students learn geometry fun because every lesson begins with a physical activity such as folding cartons, cardboard cutting and measuring activities. Student activities is closely related to everyday problems causing their interest to engage in learning. Each student activities designed to implement the mathematical activities and to further enter the horizonal vertical mathematical filled with symbols

ISBN 978-602-19877-3-5

If the observed results of the research that has been presented shows that the RME approach can make students learn math with fun. This is evident from the activities of students, such as, in finding a formula broad flat wake using cardboard through interactions among students. This is consistent with Vygotsky's theory of learning proposed stating that the child's intellectual berkembangannya encouraged interaction among students. These findings reinforce and complement the findings Fauzan [5], Armanto [1], Hadi [10], Oh Nam [14], Streefland [17] and Saragih [16]) that concluded the approach PMR increase some math skills such as the ability of understanding fractions , the ability of logical thinking, mathematical communication, positive attitudes towards mathematics, problem solving and achievement motivation. Results of this study are also consistent findings Tuan Anh Le [21] which has been conducting research realistic mathematics education in primary schools in Vietnam. From the results of pernelitian the host [21 [concluded "Although teachers and students may encounter some obstacles while teaching and learning with RME-based lesson, RME could Become a potential approach for mathematics education and could be Effectively applied to teaching and learning mathematics in Vietnamese school ". The same was done by Streefland [17] which has been carrying out research at Dutch primary schools on the topic of fractions. The research results show that students learn better if they do exploration in the study material fractions using a realistic approach.

PMR models begins with the filing of which is a real problem for students in accordance with the experience and level of knowledge. Problems granted in accordance with the objectives to be achieved in these subjects. Students develop models of symbolic informally to the problems, and learning takes place in an interactive, the students explain and give reasons for his answer, understand the answers to his friend, or agreed to answer his friend, expressed his disapproval, looking for an alternative settlement to another, and reflect against any steps taken or the results of the lesson. Such activities are rare in today's mathematics learning in accordance with what is emphasized by Freudenthal [7] that the mathematics learning activities should involve the movement of the living world into the world of symbols. The same is stated by De Lange (1987) that mathematical can occur at levels different understanding and passed through various activities.

In general, the PMR-based learning process occurs following the principles of activity-based learning. This is reflected in the active involvement of students in discussions, ask questions, answer the problems with more than one way, explaining and showing his work in front of the class and be accountable for his work. The learning principle expressed also by Jaworski [11] that teachers must give students the opportunity to gain knowledge that was established by each student so that they can account for the results of the knowledge construction. This means that the activity of the students who studied with PMR approach during the learning process looks at all three schools rank (high, medium, and low), although at first the students a little bit stiff. This is understandable because this learning model is very different from the usual learning during this time they received from the teacher that students answer questions the teacher activity and obey the teacher only. In addition, the conditions were very different is when students are asked to present their work, later taken by their friends from the other groups.

Teaching experience with PMR approach and the learning results obtained by the students after receiving PMR approach has given motivation to teachers to use PMR approach in teaching mathematics to the front. This is evident in the activity of the teacher getting better after learning to implement PMR approach and the results of discussions with the teacher researcher at every completed lesson. The activities of teachers are getting better in implementing the PMR approach is becoming a critical success factor in improving the students' comprehension and problem-solving abilities that they have mathematically

4. CONCLUTION

Based on the results of the study showed that the response and the achievement of student learning geometry using RME-based learning model geometry is higher than in conventional teaching both junior groups of low, medium or high. Thus concluded that the RME-based learning model geometry influence on geometry learning outcomes and student response to learning geometry. RME models should be used as an alternative learning approach to improve the response and the results of students' mathematics learning. Most students have test scores exceed the passing grade. Therefore, the Department of Education through Mathematics MGMP advisable to implement this RME models horizontally in all secondary schools. RME models support improved math problem solving skills through the use of rich context, mathematical processes, and manufacturing tools / mathematical models by the students themselves. Therefore, the authors of teaching materials realistic mathematics learning should use environmental context that is familiar with student life and rich with mathematical concepts in order to expedite the process of mathematical students. For teachers who want to apply to other math materials, need to develop their own tools you need to pay attention to the components of the Model PMR and characteristics of the subject matter to be developed

ISBN 978-602-19877-3-5

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ISBN 978-602-19877-3-5

IMPROVING THE PROFESSIONAL COMPETENCE OF ELEMENTARY SCHOOL TEACHER THROUGH PROGRAMMED TRAINING IN WORKING UP A STUDENT SHEET BASED ON CRITICAL AND MATHEMATICAL THINKING IN PASAMAN REGENCY

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ABSTRACT

This study is to describe that the activities programmed workshop can improve the professional competence of teachers in preparing students worksheet based critical thinking mathematically in elementary schools Pasaman. The population was all teachers who taught at the elementary level as high as grade class IV, V, and VI at five elementary schools for six districts of 12 (twelve) District in Pasaman. Teachers sampled in this study were teachers teach mathematics. The sample was randomly selected from the study population numbering 84 people .The research was held in August 2015 semester of the school year 2015/2016.

The method used is the workshop method of learning by making students worksheets based critical thinking mathematically in order to improve the professional competence of primary school teachers. The data obtained were analyzed qualitatively the ability of the professional competence of teachers of the study sample. Descriptive analyzes were conducted to determine the relationship workshop program to create and produce a spreadsheet-based students critical thinking mathematically in improving the professional competence of teachers sampled in Pasaman.

The results of the calculation using paired t test with SPSS software, the result that count equal to - 6.35 with probability (sig) 0:00. Therefore the probability 0.000 <0.05 then H_0 was rejected, which means the results of the pretest and post-test results was not the same or significantly different. Output was also displayed differences in mean of 6:12 ie the average difference pretest and posttest moment. This shows that the professional competence of teachers in making students work sheets based critical thinking mathematically programmed prior to the workshop were given pre-test and generates and average value of 38.85 in the category of less competent while after the workshop activities programmed test values obtained heading 44.97 by category competent enough.

***Index Terms*:** professional competence, critical thinking mathematically, students worksheets

1. INTRODUCTION

Professionalism of teachers is often attributed to three factors are quite important, namely the competence of teachers, teacher certification and teacher professional allowance. All three factors are the background that was allegedly closely associated with the quality of education. Professional teachers as evidenced by its competence shall promote the establishment process and product performance which can support the quality of education. Competent teachers can be proven by the receiving of teacher certification following an adequate allowance according to the size of Indonesia.

The problem that arises then, that the teacher is assumed to have had the competence which is only based on the assumption that they have been certified, it seems in the long term it is difficult to be accountable academically. Evidence that certified teacher is present condition, which is generally a quality teacher resources shortly after certification. Therefore, the certification is closely related to the learning process, the certification cannot be assumed to reflect the competence of a superior lifetime. Post-certification should be an early milestone for teachers to constantly improve competence by means of lifelong learning. To facilitate the improvement of teacher competence,training systematic programs are needed because of the increased competence of teachers is an indicator of an increase in the professionalism of teachers themselves.

Teachers in primary and secondary schools in Indonesia is one of the key factors in the success of students in gaining knowledge. Teachers have a responsibility for education and the teaching profession in accordance with competence, as well as the trust that he has received the award. According to National Education System outlined a few things about teachers.[2] First, as a component of teacher educators "are professionals in charge of planning and implementing the learning process, conduct guidance and training, ..." (Article 39, paragraph 2). Second, that in order to provide quality assurance of education outlined their national education standards consisting of "content standards, processes, competence of graduates, educators, facilities and infrastructure,

ISBN 978-602-19877-3-5

management, financing and evaluation of education must be improved in a planned and regular" (Article 35 paragraph 1). Third, that the teacher as an element of educators "must have a minimum qualification and certification authority in accordance with the level of teaching, physical and spiritual health, as well as having the ability to realize the goal of national education" (Article 42, paragraph 1). Law on Teachers and Lecturers [4]. Article 1 (1) states that teachers are professional educators with the primary task of educating, teaching, guiding, directing, train, assess, and evaluate students in formal education, as well as on the level basic education and le middle education .Article 10 paragraph 1 states that teachers must have academic qualifications, competence, teaching certificate, physically and mentally healthy, and have the ability to achieve national education goals. With regard to competence, a teacher must have pedagogic competence, personal competence, social competence, and professional competence acquired through professional education.

Today, there are a number of teachers who have been certified, it will be certified, has gained professional allowance, and will acquire the professional allowance. The fact that the teachers have been certified is a strong assumption, that the teacher has had professional competence. According to [3] Article 1 professional teacher's job is to prepare learning device, implementing the learning, learning assessment and supervision. But it was not easy like the turning back of hands.

The above mentioned is not running effectively in the elementary school in Pasaman Regency. Almost all teachers have not been adept at making students work sheets by themselves. Of the85% of the number of teachers using existing worksheets, and 15% who make their own, and even then only make the course outline as only lists issues only, and do not dig the mathematical ability of students to think critically. From the observations of researchers this is not due to (1) the teachers lack the training to make student worksheet, (2) the teacher is not to develop knowledge through seminars or workshops, (3) lack of ability of teachers to receive training that has been conducted at the level of KKG, (4) a teacher still using the worksheets so that there are no mathematically explores the critical thinking skills of students, and (5) the absence of guidance on an ongoing basis from the principal or a related party.

All those five reasons, suggests that the teacher insight to the importance of learning worksheets in need of attention. Though student worksheet are worksheets made by teachers to lead students to master specific concepts for the purpose of achieving the mastery of concepts is embedded / not quickly forgotten, because the child's own construct thus simplifying the implementation of learning. The above problems if left and did not get the guidance will cause students not critical and creative. The next impact study results are less satisfactory learning. The resulting output is not as expected together. So that the ideals of National Education is not fulfilled in the end the teacher is expected to be a change agent (agent of change) would be a total failure.

From the facts above, researchers will work to improve the competence of teachers in preparing worksheet -based critical thinking mathematically through workshops. Workshop conducted is Fixed. With programmed or planned workshop is expected of all teachers who were in the neighborhood and the researchers were able to create worksheets that can be critical, creative, and innovation itself Plan activities that give researchers want to solve the problem of teachers in the manufacture of worksheet is Fixed Workshop. Workshop programmed undertaken will be implemented at the primary level through training along with all teachers in elementary schools Pasaman.

The reason researchers use the workshop programmed is that firstly workshop is very effective to solve the problems faced by teachers, secondly by workshop participants are doing and get the desired results together, thirdly the workshops between teachers can share knowledge in the problems faced, and fourthly with the workshop results already obtained through the study together. While programmed is a planning or scheduled activities of the four reasons above, the researchers are confident that all teachers in elementary schools Pasaman. Will be able to and be able to create their own worksheets, and can ultimately benefit the world and especially education for teachers and students in elementary concerned.

Departing from the description above problems, in order to give an idea briefly, clearly, decisively, the issue or focus in this paper is as follows: How average are professional competence of elementary school teachers throughout Pasaman Regency?, Is the programmed workshop can make the elementary school teacher in Pasaman Regency have got the ability to make a worksheet that based on mathematically critical thinking? And is the programmed workshop can improve professional competence of the elementary school teacher in Pasaman Regency in mathematically critical thinking?.

1.1. Professional Competence

To give an understanding the professional competence of teachers, here will be described first on the definition of competence. In a large dictionary Indonesian, competence means the authority (power) to determine (decide).[10].According to Moh.Uzer in his book "Becoming Teachers" explains the notion of competence as set forth Competence is something that describes the qualifications or person's ability, both quantitatively and qualitative.[9]

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While the term "professional" is derived from the nature of the profession (job) which means it is capable of doing the job. In Webster's New World Dictionary that professional is defined as engaged in a specified occupation for a pay or as a means of livelihood [1]. That is, a more specialized work for pay or as a means of livelihood.

So that professional competence is defined as ability in mastering academic (subjects taught) and integrated with the teaching abilities of teachers as well so that it has the authority academic

1.2. Workshop Fixed

Workshops or in English called the workshop is an event in which several people gather to solve a specific problem and find a solution. Or workshop is a scientific meeting that small has the same attention and gathered together under the leadership of some of the experts to dig up one or a few specific aspects of a topic. A workshop usually consists of Leadership workshops, Members, and Human Resources.[6]

1.3. Student Worksheet-Based Critical Thinking Mathematically

Worksheet a sheet of paper that contains information and questions that should be done by the students. worksheet is used to optimize student engagement in learning better used as a means for me mathematically improve critical thinking skills. According to the Student worksheet (LKS) is one of the teaching materials. Student worksheet is contains a task that must be done by learners. Sheets are typically in the form of instructions, steps to resolve a task.[5] . Of the opinion can be LKS is known that not only contains exercise which requires students to answer but also contains concepts. For to obtain optimal results from LKS, necessary preparation in planning materials (content) and appearance (design)

Steps in the preparation of LKS is as follows: 1) analysis of the curriculum; 2) draw up a map needs LKS; 3) determine the titles LKS; 4) writing worksheets, writing worksheets can be done with the steps as follows: a) formulate the basic competence, b) determine the assessment tool, c) prepare material, d) consider the structure of instructional materials, e) take into account the various requirements are requirements didactic terms construction and engineering requirements[4]

LKS provide great opportunities for students to develop creativity and the power of reason so that students are able to think critically mathematically. According to Norris defines critical thinking as rational decision-making what is believed and done. [7] Krulik and Rudnik argues that included critical thinking in mathematics is thought that tested, questioned, connect, and evaluate all aspects of the situation or a problem. [8] From the opinions of experts on the above, it can be concluded that critical thinking skills is the ability to solve mathematical problems to search, analyze, and evaluate good reasons in order to take the best decision in solving mathematical problems.

All aspects described above must be accommodated either in a learning process of mathematics that is packaged in a deliberate and well-planned by the teacher in the form of worksheets. The teacher must be able to anticipate the circumstances that may arise when lead students to think, where teachers can deal with how to keep the process of mathematical thinking persists and continues. When the thought process already underway in the classroom, teachers should be facilitated by providing worksheets that can explore students' critical thinking mathematically.

2. RESEARCH METHODS

The method used is the workshop method of learning by making worksheet -based critical thinking mathematically in order to improve the competence of professional work with elementary school teachers. Competency' test to evaluate the professional competence in elementary school teachers who have met the educational qualifications.

The population is all teachers who taught at the elementary level as high as grade class IV, V, and VI at 5 elementary schools for six (6) districts of 12 (twelve) in Pasaman. Teachers sampled in this study were teachers teach Mathematics. The sample in this study are all teachers of grade IV, V, and VI of the five samples of six sub-district schools randomly selected from the study population. Estimates of the number of teachers is 15 (fifteen) per sub-district elementary school teacher with a total sample of 90 teachers.

The data collected is of primary data in the form of test results and an evaluation of the ability of the professional competence of primary school teachers. Secondary data and reports program or activity that had been performed by the government and local governments in improving the professional competence of primary school teachers. Data collected are achieve to the research objectives and analyzed in order to determine, describe and evaluate the professional competence primary school teachers sampled in the study.[5]

Qualitative analysis was performed to measure the professional competence of teachers. Descriptive analysis carried out on the program that has been done with regards to the development and improvement of professional competence aimed by achieving the parameters SNP (Educational of National Standards). Descriptive analysis is used to obtain information of the student's work sheet mathematically-based critical thinking to be made on the material by topic numbers to determine greatest common divisor (GCD)

ISBN 978-602-19877-3-5

3. RESULTS AND DISCUSSION

The results of the calculation using paired t test with SPSS software, the result that was showed that table 1,2,and 3 below

Table 1 Paired Samples Statistics

Paired Samples Statistics

		Mean	N	Std. Devia	Std. Err Mean
Pair 1	Pretest	38.85	77	10.529	1.199
	Posttes	44.97	77	11.028	1.256

A description of the above data obtained were analyzed pairs of variables average - average pretest an average value of 38.85 and a standard deviation 10.53. The average - posttest mean 44.97 that the standard deviation 11.03

Table 2 Paired Samples Correlations

Paired Samples Correlations

	N	Correlatio	Sig.
Pair 1 Pretest & Postt	77	.694	.000

This suggests that the correlation between the current situation with the pretest posttest current circumstances related real / significant probability of < 0.05. So it appears that there is a relationship between the results of pretest to posttest results obtained when after a given treatment in the workshop.

Table 3 Paired Samples Test

Paired Samples Test

	Paired Differences					t	df	Sig. (2-t
	Mea	Std. Dev	Std. E Mea	95% Confid Interval of Differenc Lowe	Uppe			
Pair Pretest -	-6.11	8.447	.962	-8.03	-4.19	-6.3	76	.00

Based on obtained the result that t count equal to -6.35 with probability (sig) 0:00. Therefore the probability 0.000 < 0.05 then H0 is rejected, which means the results of the pretest and post-test results is not the same or significantly different. Output is also displayed differences in mean of 6:12

Finally, the professional competence of teachers in making students worksheets based critical thinking mathematically programmed prior to the workshop are given pre-test and generates an average value of 38.85 in the category of less competent while after the workshop activities programmed test values obtained heading 44.97 by category competent enough.

Based on programmed training has produced students worksheet which is based critical mathematically thinking Its topic numbers to determine greatest common division(GCD) which have been prepared, corresponding to the material that will be taught to the students of elementary school.

The example of students worksheet which is based critical thinking mathematically were followed:

STUDENT WORKSHEET BASED ON MATHEMATICAL CRITICAL THINKING

Name :
Day / Date :
Class : V
Topic : Determining to GCD and LCM

Competence Standard (SK) and
Basic Competence (KD)
SK: Understand and use factors and multiples in problem solving.
KD: Students can determine GCD and LCM of two numbers two digits

After doing these activities students are expected to:
- To understand a GCD.
- Using the concept of the GCD in problem solving

DIRECTIONS
1) Discuss this task in groups, and WS done by each individual
2) Work WS carefully and ask the teacher if there are things that are not clear

ACTIVITY
Consider *martabak* and cake in the following below:

Suppose you and some of your classmates celebrate the birthday of your friends also want to share the cake and *martabak* on all friends. It turns out the cake and *martabak* it should be shared flat (as much) on students

Analysis, include: separating information into its parts, for the relationship between information, organize information

1. Based on the cake and *martabak* above, what can you see?
.....
.....
…….
2. What part of the cake and the *martabak*?
.....
.....
3. By cutting the cake and *martabak*, how many pieces?

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.....
.....

4. That allows the cake and *martabak* it can be shared just as much to how many people? (1, 2, 3, 4, 5, 6, and others).

……
……..

5. From the results of these investigations, the most widely told how many people who got the cake and martabak that can be divided evenly (as much)
.....
.....

Evaluation,

include: Making criteria, rationality
Determining an answer, Assessing an argument

6. Is there the shortest way to get answers to those asked in question 5?
……
……

7. From the comparison of numbers 4 and 5, what did you find?
.....
..... 8. Consider again the cake and martabak above, how the possibilities of the two groups of foods that can be shared just as much to the 2, 3, 4, 6 and 8 people
.....
..... 9. The teacher then asked, is there a faster way to get the answer, namely cakes and martabak it can be divided equally (as much) to a maximum of 6 people?
……
……

Evidence,

include: Providing a logical reason, provide supporting evidence, Determining the concepts contained

10. What is the factor of communion?
.....
..... 11. How are searching for the greatest common factor?
.....
.....

Exercise

Problem solving includes: Creating a problem-solving strategies, problem-solving strategies Running, evaluate the truth of the solution

1. Consider:
 a. 30 red marbles and 20 white marbles.
 b. 12 citrus fruit, *rambutan duku* 16 pieces and 20 pieces.
 c. quail eggs 40 pieces, 30 pieces of chicken eggs, duck eggs 20 pieces

Question: Determine GCD?

How do you determine the completion strategy
……
……
Look at most (maximum) can be shared just as much to how the set of the following objects
……
……

2. Consider again the problem 1 above. If you already know how to obtain the GCD as above, do you have another way? Give your reasons!
.....
.....

Analogy, include: seeing similarities, making conclusions on the basis of similarity

3. Can you imagine a division of an object?
……
……..
Make it an experience that you experience yourself
.....
.....
4.You try to resolve how do you fair in the division?
.....
……..

4. CONCLUSION

Based on the previous description can be concluded as follows:

a. The mean professional competence of elementary school teachers throughout Pasaman Regency are in lower level
b. The product of workshop is LKS, as the preparing of critical thinking based worksheet responded excited by elementary school teachers throughout Pasaman Regency
c. Activities preparing of critical thinking mathematically based worksheet has been able to improve the professional competence of teachers in elementary schools in Pasaman Regency

5. ACKNOWLEDGEMENTS

Gratefulness to Policy Research Centre, Council Research and Development, Ministry of Education and Culture Republic of Indonesia and Goverment District of Pasaman for financial and facilities supporting this research.

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ISBN 978-602-19877-3-5

IMPROVED MATHEMATICAL COMMUNICATION ABILITIES THROUGH IMPLEMENTATION THE FIRING LINE'S STRATEGY AT VII CLASS OF JUNIOR HIGH SCHOOL

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ABSTRACT

The purposes of this research were to improve the ability of students in mathematical communication which they get Firing Line learning after apply the Firing Line and conventional learning. This research is a quasi experiment with design group control non-equivalent. The population of this research is class VIII SMP which one of the junior school in Padang. The class selected as a control group who obtain conventional learning and the other classes as the experimental group gained the firing line learning. The instrument used to collect data in this study consisted of test and observation sheets. Then, test will be analysed with the SPSS 17. The results of this research is the ability of student's mathematical communication who get the Firing Line learning is better than students who get conventional learning.

Index Terms— *The firing line, Communication ability*

1. INTRODUCTION

The purpose of education in developing the ability of learners to be achieved by the learning process. One of the goals of mathematics teaching is to develop students' mathematical abilities. Mathematical ability of students should be in accordance with the purpose of learning mathematics formulated the National Council of Teachers of Mathematics (NCTM, 2000), such as: (1) learn to communicate; (2) learn to reason; (3) learn to solve problems; (4) learn to associate ideas; and (5) learning to represent ideas.

Prepared curriculum also has the aspect of the development of communication skills. Teachers as educators should be able to create a learning environment that fosters student motivation by selecting and using innovative learning methods. Especially on the fourth and fifth items on the purpose of teaching mathematics for elementary and middle school in which students are expected to communicate a problem in various forms.

Mathematical communication abilities need to be implemented in ideas and mathematical concepts that will result in the formation of mathematical understanding and communication. Baroody (Ansary, 2003) states that there are at least two important reasons why communication in mathematics learning need to be developed. First, mathematics is not just a thinking tool, a tool to find patterns, solve problems or draw conclusions, but the math is also an invaluable tool for communicating ideas clearly, accurately, and concisely. Second, mathematics is a social activity and also as a vehicle for interaction between students and students and students and teachers. Baroody, NCTM (2000) also states the importance of the ability to communicate ideas to know mathematics and using mathematics as a tool of communication, which is one of the mathematical power.

In line with the opinion of Baroody, Kimberly (2008) states that the communication is closely linked with the learning process. If the student can communicate ideas and their thoughts, the teacher will be easier to understand what is not understood by the students. Teachers will be more confident in the ability of students to recognize when preparing test questions and can demonstrate a true understanding of the concept. In connection with this, Sumarmo (2010) describes the hallmark of mathematical communication abilities that should be developed in learning, student must be able: (1) connecting the physical material or tangible objects, image, and diagrams into mathematical ideas; (2) explain the ideas, situations and mathematical relationships orally or in writing with real objects, images, graphics, and algebra; (3) states the daily events into the language or mathematical symbols; (4) listening, discussing and writing about mathematics; (5) read with understanding a mathematical representation in writing; (6) make a conjecture, make the argument, formulate definitions and generalizations; and (7) describe and make a statement about mathematics that have been studied.

Low ability students' mathematical communication Indonesia is also shown by the results of international studies such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). PISA (2009) states that the ability of Indonesian junior high school students in solving problems of mathematical problems very weak. The

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PISA study aimed to assess the extent to which students sitting end of year basic education has mastered the knowledge and skills. While TIMSS aims to test some mathematical abilities Elementary School fourth graders and eighth-grade junior high school which includes the capability of knowledge, application, reasoning and communication.

Related to the students' mathematical communication abilities, TIMSS (MONE, 2011) said that indonesian's students are weak in working on the problems that demand arguing and communicating. This is exemplified in the following matter:

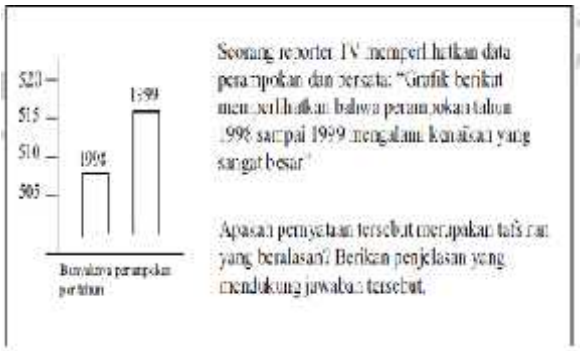

Figure 1.1 Problem Communication Mathematically (TIMMS)

Report the results of the study showed that only 1.15% of students who answered correctly, 1.35% half-true answer, 75.93% tried to answer but one, and that 21.57% did not answer. Results of these studies illustrate that Indonesian students have not been able to develop mathematical communication capabilities to the fullest. One factor that led to this situation is the lack of students' learning experiences that involving communication capabilities to the fullest derived from their thoughts.

The report PISA, TIMSS and some previous studies showed that students' mathematical communication ability is still relatively low. Although it is not an absolute measurement tool for the success of education in Indonesia, but it can be used as an evaluation to motivate the various parties in the world of education that student achievement in Indonesia can be improved, especially in math.

Lack of communication ability of indonesian student is not only demonstrated by the results of international research but also be seen from the results of research conducted by previous researchers as research conducted by the Firdaus (2005) which states that the communication abilities of mathematical students acquire learning-type TAI based issues is still relatively low.

The firing line strategy is one of the cooperative learning that can optimize ability of students to organize students in small groups. Yackel (Kimberly, 2008) stated in his research that the communication that occurs in small groups will enable them to learn to understand the concept, because when they communicate will find differences in understanding a problem. It makes students realize that there has emerged a discrepancy between them, so students should expand their own conceptual thinking to try to find a reasonable answer and then formulate an argument or explanation to the friends group. Small groups with a heterogeneous membership is expected to help students with low skill levels through peer tutors with students whose high skill levels among them.

2. REVIEW OF RELATED THEORY

2.1. Mathematical Communication Abilities

Mathematical communication abilities is the ability of students to construct an argument and expression, and provide a written explanation based on the data and the relevant evidence. The communication process can help students build a sense of what has been learned. When a student is challenged to argue and communicate the results of his thinking, then they learn to convince others of what he reveals. Learning will provide the chance for students to share ideas and classify understanding of mathematics and learn to listen to other people's ideas similar to those, according to that expressed by Wahyudin (2008) that the communication is a way to share ideas and clarify understanding.

Indicator of the level of communication abilities will be considered in this study can be seen in Table 2.1 below.

Table 2.1Communication Mathematical Abilities

No	Indicator	Description
1	Representations	connect real objects, image, and diagrams into the language, symbols, ideas or mathematical models
2	Write	explain, express, demonstrate and describe mathematical ideas in the form of images, tables, graphs, or other mathematical models

2.2. Active Learning Strategies

Active learning strategy aims to enable students and to develop the potential of students to Communicate in the classroom. The low activity of the student in the learning can be the caused by a lack of supply of constructive learning environment as proposed Hudojo (1998). Panen (1997) Suggests that active learning is an approach in the management of the learning system through means of learning the which requires the active involvement of the students towards independent learning. As an approach to learning that leads to independent learning, teaching and learning activities the which are designed to be Able to involve students actively.

Students and teachers in active learning role is to create a meaningful learning experience. In addition,

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active learning can also accommodate differences in student learning modalities. In general there are three prefensi sensory according to Gunawan (2003) is based on a visual (sight), auditory (hearing) and kinesthetic (movement). Active learning requires throughout prefensi students to be enabled. Teachers are required to be able to create a fun and memorable learning for students.

2.3. Strategy of the Firing Line

Strategy of the firing line is one of the active learning strategies. The firing line strategy designed to overcome the difficulties students in understanding a problem and encourage students to share their knowledge to his friend. This strategy will encourage the students to be able to express his opinion on a concept through the game. The firing line is derived from the word "firing" that means shooting. According to Silberman (2006) strategy of the firing line have some procedures as follows.

a. Set a goal using the "Team Shoot"
b. Teachers arrange chairs in a formation of two lined
c. Teachers provide enough seats for all the students in the class.
d. Teachers separating the chairs into a number of teams consisting of 3-5 students on each side.
e. Teachers select two groups to play for example a group X and Y.
f. One of the group X takes one card that has been prepared teacher randomly.
g. Group X choose one of the groups Y are sitting in front of him to answer questions in a card with a predetermined time. The group that serves as as a target may not cooperate, but they are only allowed to answer "yes" if it is true and "no" if it is false. In this case, only students who were fired about who is responsible to solve them. Students group Y will respond in accordance with the question. If the members group Y can not answer then the question will be posed to members of the group X, then if members of the group X is also not able to answer the questions will be gave to the other groups. Students group X is allowed to work with a group to take scores of group Y. This also applies to groups that do not come into play, they also cooperate in resolving the matter.
h. In a period not so long, the teacher announced that it is time for the student members of the group Y to move one seat to his left in his team. Asks the student X to fire duty or questions to the Y students sitting in front of him. Continue with the number of rounds according to the number of tasks given.
i. This went on until time or card provided is runs out.
j. Teachers guide students to make conclusion.

In practice, the seats are arranged in a formation of two lined face. Groups that sit in rows facing only a selected group only. Each student selected from the group will receive a card that contains a question that relates to math on that day. Before the card containing the questions fired, student groups opposed to moving the seat next to him. Strategy of the firing line ends until all the questions given run out.

Questions on the card aims to repeat the lessons given by the teacher. This question is also one way for students to understand the material being taught, with questions on the card, the members of the group will attempt to answer questions raised by the opponent so that students can master the lessons better and can improve learning outcomes in mathematics. Active learning through the strategy of the firing line are used as an alternative solution and overcoming traditional techniques that inhibit students creativity. The firing line is one of the active learning instructional strategies aimed at increasing motivation to learn and improve learning outcomes.

3. THE METHOD OF RESEARCH

3.1. Types of Research

This type of research is a quasi experimental. This design uses a pretest and posttest groups were not randomized (non equivalent control group design), which is illustrated as follows:

Experiment Group : O - - - X - - - - - O
Control Group : O O

Description:
O : Pretest or posttest mathematical communications abilities
X : Learning The firing Line
- - - : The subject is not grouped randomly

3.2. Research Instruments

To obtain the data in this study, researchers used the instrument in the form of tests. Instrument in the form of tests consist of a set of test to measure students' mathematical communication abilities. Mathematical communication ability test arranged in narrative form. Details of the mathematical communication abilities indicators to be measured is as follows.

a. Connect the real objects, image, and diagrams into mathematical ideas.
b. Expressing, demonstrate and describe mathematical ideas in the form of images, tables, graphs or other mathematical models.

Students' mathematical communication abilities can be measured using the test scoring guidelines adapted mathematical communication abilities of holistic scoring rubrics Cai, Lane and Jacabcsin (Ansari 2003).

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Table 3.1 Scoring Guidelines Mathematical Communications Abilities

Score	Criteria
4	Can answer all aspects the questions about of mathematical communication and answered correctly and clear or complete
3	Can answer all aspects the questions almost about communication and answered correctly
2	Can be answered only some aspects of the question of communication and answered correctly
1	Answer does not fit on aspects of the question of communication or give the wrong conclusions
0	Nothing Answer

3.3. Technique Development Instrument

Before the instruments used in research, theinstruments are tested first on students who have obtained materials with respect to this research. The test is done to determine whether such instruments are qualified good instrument or not, the validity, reliability, distinguishing features and level of difficulty.

3.4. Research Procedure

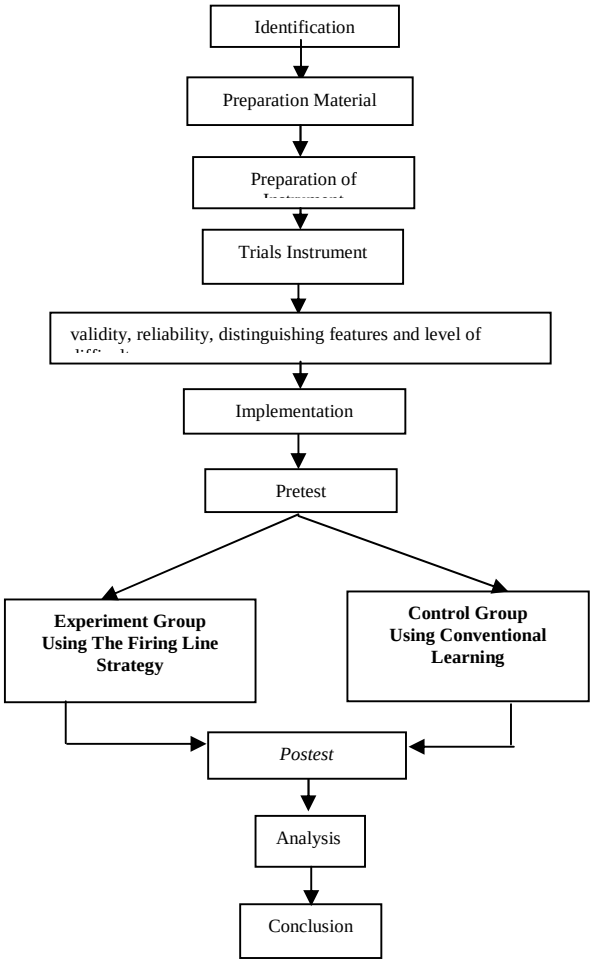

Figure 3.1Research Procedure

3.5. Data Analysis

Quantitative data obtained in this study will be tested statistically. Tests carried out on the results of the test instrument, the data pretest, posttest, and N-gain. Data from pretest, posttest, and N-gain processed using SPSS Software For Windows 16 and Microsoft Excel 2007. The data obtained from the test results of mathematical communication ability is processed through the following steps:

a) Provide students answer scores according to the answer key and scoring guidelines used.
b) Creating a data table pretest and posttest scores of students experimental class and control class.
c) Determine a score improvement of communication capabilities mathematical formula normalized gain Hake (1999), namely:

$$\text{Normalized gain} = \frac{\%(\text{skor postes}) - \%(\text{skor pretes})}{100 - \%(\text{skor pretes})}$$

Normalized gain calculation results are interpreted using the classification of Hake (2002), namely:

Table 3.2Gain normalized classification

Gain (g)	Classification
$g \geq 0{,}70$	High
$0{,}30 \leq g < 0{,}70$	Medium
$g < 0{,}30$	Low

d) Determine the normality of the pretest, posttest and gain normalized mathematical communication skills by using the Shapiro-Wilk statistical test. Based on calculations in mind that the data pretest and posttest scores were normally distributed, but to the data of N-gain distribution is not normal, it can be directly carried out the research hypothesis testing with nonparametric Mann-Whitney test U.
e) Test score data variance homogeneity pretest, posttest and gain normalized.

If the data is normal and homogeneous, then we examine the differences in the average score of pretest and test differences in the average score of the gain normalized using the Independent Sample T-test (t-test), but if the data is not homogeneous, then used the Mann-Whitney U test as a nonparametric test. Two averages equality test in this study performed with SPSS 16 for Windows with significance level $\alpha = 0.05$. Testing criteria, if Sig> 0.05 then H_0 is accepted, and H_0 is rejected otherwise.

4. DESCRIPTION AND DATA ANALYSIS

4.1. Description

The following is a description of the data pretest, posttest, and N-gain in the control and experiment group.

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Table 4.1Descriptive statistics pretest and posttest Mathematical Communication Abilities

Score	Control				Experiment			
	N	X_{min}	X_{maks}	$\bar{x}$	*N*	X_{min}	X_{maks}	$\bar{x}$
Pretest	29	26,56	64,06	41,0	29	32,81	73,44	54,58
Postest	29	46,88	93,75	66,3	29	65,62	93,75	83,19
Ideal Max Score = 100								

Meanwhile, for the average N-gain mathematical communication abilities can be seen in Table 4.2 below.

Table 4.2 Descriptive statistics N-g Mathematical Communication Abilities

Group	*N*	X_{min}	X_{max}	$\bar{x}$
Control	29	0,06	0,88	0,44
Experiment	29	0,18	0,84	0,63

Table 4.2 shows the average N-gain mathematical communication ability in the control group was 0.44 with classification and for a medium increase in the experimental class of 0.63 with the classification of a medium increase. Here's a brief comparison of the average score data presented pretest, posttest, and N-gain students' mathematical communication abilities.

Table 4.3 Scores Mean pretest, posttest, and N-gain Mathematical Communication ability Students

Group	Pretest	Posttest	N-*gain*
Control	41,00	66,32	0,44
Experiment	54,58	83,19	0,63

For more details, Table 4.3 above can be made diagram comparison the average score of pretest and posttest as follows.

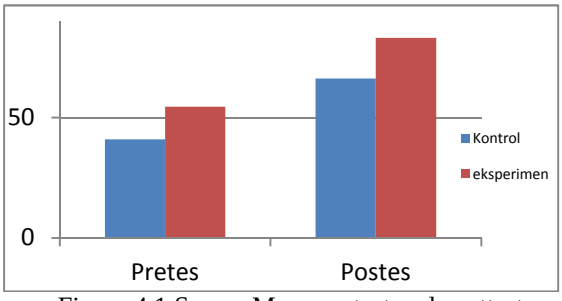

Figure 4.1 Scores Mean pretest and posttest Mathematical Communication Abilities

From Figure 4.1 above, it appears that the average grade is lower than the control experimental class either before or after a given treatment. However, increased after treatment will appear higher when measured with the N-gain. Mean post test experimental group that received the firing line study showed an increase in higher than the control group that received conventional learning.

4.2. Data Analysis

4.2.1. Data Analysis Pretest and Posttest Score

a. Data Normality Test pretest and posttest scores
Pretest score data control class and experimental class both normal distribution.

b. Homogeneity Test pretest and posttest scores
The average score of pretest mathematical communication abilities control group and the average class pretest score experiments come from populations that are not homogeneous. In contrast to the score of pretest, posttest score mathematical communication abilities control group and the average post-test score of experiment group derived from a homogeneous population.

c. The mean difference in test scores pretest
Based on the value of the Z test and the Sig. 2-tailed, there are significant differences between the average scores of mathematical communication abilities pretest in control and experimental group.

d. Mean Difference test Posttest
The average post-test score of students' mathematical communication abilities experimental group better than the control group.

Results of data analysis mathematical communication abilities pretest scores between the experimental and control groups showed differences. It can be seen from the average pre-test score of the experimental and the control group. U-Mann Whitney Test shows sig. 0,000 or less than $\alpha = 0.05$. So there is a significant difference in the ability of the beginning of the experimental and the control group.

Method of learning the firing line shows a significant role in enhancing the ability of mathematical communication. Students learn mathematics through problem cards are provided in the form of the game is able to create an atmosphere of learning math more fun. This is because the spirit of the students are getting in learning mathematics because between groups competing for higher scores. Here's an example of a card used in learning about the firing line.

Figure 4.2 Example Card Problem In The Firing Line Learning

Vygotsky (Suherman, 2003) also states that the learning conditions with a small group of these highlight the interaction within the group, resulting in

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communication between students especially in resolving a problem.

Each question has a score card different. Students will take a card at random before firing the card. Students will compete in answering questions. Teachers will give appreciation to a group that received a high score. The group was formed by teachers based on students' capabilities. So that there is a child in a group of high, medium, and low capability. This is done so as not to cause jealousy among fellow group play.

In the conventional classroom there are still some students who have not been able to communicate mathematical ideas. Factors causing poor communication abilities of students is that they are not accustomed to train mathematical communication abilities. A series of activities on conventional learning cause students just memorize formulas and step to answer the question. This is due to conventional learning are not able to facilitate the communication abilities of students. This is similar to the results of research Erita (2009) who found that teachers tend to teach students learn by rote. This is also supported by the observation of the researchers did that teachers tend to be informative only convey the material in the textbooks.

In addition, students in a conventional classroom are not accustomed to working on the problems or issues that are not routine and communicate the answer in writing. Conventional learning student has not been able to facilitate the sharing of ideas and classify understanding of mathematics and learn to listen to other people's ideas.

After performing learning as much as 6 meetings, then given posttest. Postes given in order to determine the increase in students' mathematical communication abilities in both the control and experimental groups. Based on the results of descriptive statistics in mind that the average post-test score of mathematical communication abilities in the experimental group better than control group.

If we look back a pretest scores both the experimental and control groups then both are relatively the same. But after learning different in the two groups in which the experimental group learning and control group showed that the increase in pretest and posttest scores are differences. Difference pretest and posttest control group was 25.32, while the difference between pretest and posttest experimental class is 28.61. Pretest and posttest difference in these two classes do not differ much. However, the difference in posttest scores of the two groups is significant, namely 16.87. Differences difference in posttest scores mathematical communication abilities sizable This meant that learning the firing line to give effect to an increase in students' mathematical communication abilities.

The above is supported by the results of the test were statistically average difference mathematical communication capabilities with U Mann Whitney test. Based on the average difference test can be concluded that there are significant differences between the average post-test score of students' mathematical communication capability control and experimental group. It happens possible because in the firing line learning students are given the opportunity to participate actively to issue an opinion in learning activities and communicate ideas and ideas through images, graphics, text, or mathematical models. The above is also expressed by Silberman (2006) which states that learning to use active learning strategies (active learning) that the firing line can help students in training social skills of students like to ask, argue, and encourages students are passive to contribute actively in classroom

4.2.2 Data Analysis Score N-gain

Summary of the average score of N-gain mathematical communication ability of students in the control group and the experiment are presented in Table 4.4.

Table 4.4 Results The mean and Classification N-gain Mathematical Communication Abilities

Group	Mean N-*gain*	Clasification
Control	0,44	Medium
Experiment	0,63	Medium

In Table 4.4 above shows that students who acquire learning the firing line have the average score of N-gain higher than students who received conventional learning. Although the classification score of N-gain experimental class and control class, including the medium category, but a score improvement of mathematical communication abilities in experimental group students was higher than the control group. Before testing the difference in the average score of N-gain using test independent sample t-test. It is necessary to do some of the following.

a. Normality Test Data N-gain Score
   Score data N-gain students' mathematical communication abilities indicate that the N-score data mathematical communication abilities gain control group students distributed normally. In contrast, N-gain score mathematical communication abilities experimental group students are not normally distributed
b. The U Mann-Whitney test
   Testing differences in the average score of N-gain performed using the U Mann-Whitney test P-Value or Sig. (One-tailed). The test results showed that the improvement of communication capabilities mathematical learning group of students who received the firing line is better than a group of students who received conventional learning.

Based on the calculation of N-gain mathematical communication abilities acquired difference between the average N-gain experiment and control groups. N-gain calculation is done to determine the quality of an

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increase in mathematical communication between students who received the firing line learning and students who received conventional learning so that analyzing the N-Gain scores of students who received both learning. Both groups are classified as medium.

Based on the test results the mean differences were tested using the U Mann Whitney in the data mathematical communication abilities of N-gain both groups, it can be concluded that the improvement of mathematical communication abilities of students who received the firing line is better than a group of students who received conventional learning.

Factors that caused to improved communication on better experimental group are students in the class are trained or familiar in communicating steps to resolve such problems in declaring an image into mathematical ideas. During the use of learning the firing line, the experimental group students already accustomed to solve problems that require their mathematical communication abilities. By contrast, students in the control group is weak in communicating ideas or mathematical ideas into writing. Based on the research results Lisfina (2012) also stated that the strategy of the firing line can encourage students to improve communication abilities of mathematical them, this is due to the activities in the learning of the firing line has included some aspects of communication such as asking, argue, write down the answers on the board, and commenting answer his friends.

5. CONCLUSIONS, IMPLICATION AND RECOMMENDATION

5.1. Conclusion

Improved mathematical communication abilities students acquire learning the firing line better than students who received conventional learning, but the improvement of communication abilities both groups were classified as medium.

5.2. Implication

a. In general use the firing line learning can contribute to the improvement of students' mathematical communication abilities.
b. Learning of the firing line received a positive response is seen students so that learning has the potential to change the way that students learn mathematics is not necessarily rigid, but mathematics can be learned by doing a game so that students become enthusiastic following study.

5.3. Recommendation

a. Implementation of learning the firing line can create a fun learning environment and make students participate actively in each lesson.
b. This study is only limited to one subject, namely geometry and the limited ability of students to mathematics mathematical communication, therefore it is suggested to other researchers can continue research on the subject and other mathematical ability.

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ISBN 978-602-19877-3-5

THE DEVELOPMENT OF AN AUTHENTIC ASSESSMENT IN GEOMETRIC SUBJECT WHICH IS ORIENTED TO PROBLEM BASED LEARNING (PBL)

Mariam Nasution, Rahmatul Hayati, dan Latisma

ABSTRACT

Constructivism is a learning philosophy which suggests students to develop their understanding from new ideas. Because the PBL is method in which the students actively develop their own understanding, the PBL philosophy is included in constructivism ideology. Therefore, there is a need for students' understanding toward learning material, specifically math. To achieve that understanding, it needs a continuous diagnosis which admits teachers to determine whether the students have achieved the learning concept and knowledge or not. In this case, the teacher can step to give feedback before the students make mistakes in learning. So, there is a need to develop an evaluation system which is comprehensive and integrated in order to evaluate students' applicable ability in math specifically in geometric lesson. The real form of this evaluation system in this research is an authentic assessment. The purpose of this research is: 1) to develop an authentic assessment which is oriented to problem based learning in learning math in geometric, 2) to develop a structural activity in a form of individual task, field task, presentation, and discussion which lead to independence, communicative skills, cooperative learning, ability to discuss the learning outcome and defend opinions. This research is a development research in a form of formative research (Tessmer, 1999 dalam Zulkardi, 2002), which consists of preliminary study, self evaluation, prototyping, and field test study.

The result of this research is 1) the development of an authentic assessment which is oriented to problem based learning in learning match of geometric lesson is valid, practical, and effective, 2) the structural activity in the form of individual task, field task, presentation, and discussion are oriented to problem based learning.

Index Terms— *Authentic Assessment, Problem Based Learning*, Constructivism Approach

1. INTRODUCTION

An evaluation is an important component in learning process. Through an evaluation, the students can see how far their ability in understanding achieved materials. Besides, an evaluation is also a valuable communicative tool for students, teachers, parents and administrators. Through the evaluation, students will be able to convey all aspects of learning domain; they are cognitive, affective, and psychomotor aspects. However, in nowadays learning, this system is more oriented to cognitive ability (specifically said as memorizing concept) which is proved to be successful in a short period, but not successful in longer period and finally can not develop students' life skill. So, there is a need to develop a real evaluation (authentic assessment) which is in a form of data collection which can give a description of students' development. The data which are collected through evaluation activity is not for finding information about students. The effective learning should be lead to help students to be able to learn and not to find information at the end of learning period.

The tendency in the field which shows that the evaluation is directed to cognitive aspect is proved from the test in the school. The test which is hold in the school through spoken or written is directed to cognitive aspect, although the students have implemented various ways of approach. One of them are problem based learning (PBL). Based on the preliminary study in some schools which implement PBL in learning math, it is seen that the evaluation system used by teachers in PBL is still oriented to only cognitive aspect, however learning model which are applied should be able to measure cognitive, affective, and psychomotor aspects. An evaluation is one of important components in PBL. In PBL, the students are given wide topics, and then they are asked to find solution from the problems given. To develop students' understanding, the students need to discuss and debate many concepts and ideas. Students need to test their high thinking skill, so learning could be meaningful. To get understanding from the concept and knowledge, it needs continuous diagnosis process which lead teachers to determine whether the students have achieved the understanding from the concept and knowledge. In this way, the teachers can step to give feedback before the students make farther mistakes in learning. So, it needs to develop a comprehensive and integrative evaluation system to evaluate applicable ability in math which one of them is geometric lesson.

This research is done to prepare students to have applicable ability in math specifically geometric lesson using the PBL learning model and this will be successful if it is combined with authentic assessment. The problem solving in this research is through developing an evaluative system which is oriented to PBL which is evaluated holistically both the process and product using authentic assessment. In PBL model, students are given problems, and then in group

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they will try to solve the problems. To solve the problems, the students need to find information from various sources. Other problem says that problem based learning (PBL) is a learning environment which uses problems for learning; before the students learn something, they have to identify problems in real cases. The problems are formed in order that the students could find their learning need through solving the problems (Pusdiklat, 2004).

In detail, the project of DUE-like UI (2002) says that steps in PBL model are:

a) Identification of the problems
b) Identification of the problems
c) Analysis of the problems
d) Hypothesis
e) Identification of knowledge
f) Identification of known knowledge
g) Determining learning sources
h) Identification of new knowledge
i) Synthesis of old and new knowledge to be applied in problems
j) Concluding unlearning materials
k) Conclusion of the result/ writing report
l) The implementation to the next problems

Through those steps, it is hoped that the students could understand and solve the problems which are given in learning process. Then through those steps, the students could comprehend the knowledge and get real experiences so that it can motivate students to learn. However, without any holistically evaluation, the learning process could not be meaningful for students or teachers. Therefore, the real evaluation is needed so it can show how far students have understood the material.

2. THEORY

2.1 Problem Based Learning (PBL)

Problem Based Learning is based on the thinking that every individual form their understanding through their life experiences (Diane Ronis, 2009). This inquiry learning method requires students to get and process the new information in the suitable way of real or nature brain process. Learning through PBL is a learning process which is started from problems which are found in the environment (Pusdiklat, 2004). Through that approach, the students not only learn about the abstract concepts but also learn how to apply it in their real life environment. Therefore, it is hoped that the students have good ability in understanding materials holistically. One of the examples is in geometric. To see how far students have understood about geometric, a real evaluation is needed in learning process. So, there is a need to develop authentic assessment which is oriented to PBL model in learning geometric.

The steps below give guidelines for teachers to apply the PBL (Diane, 2009)

Step 1. The teacher begins the PBL process through developing real world, open, and problems without solutions. Those problems are related to learning material.

Step 2. After the teacher chooses the problems holistically, they have to think of the ways in which the students use the different research method and tools to find the solution for the problems.

Step 3. The teacher presents the problems for their students. Some of the techniques could be used to apply it.

Step 4. After presenting the problems, the students could begin their research. The teacher could help students to begin it through providing them with some web site lists which are appropriate or learning sources which could prove it. after that, the students do the research, plan their strategies, form the hypothesis, and find the solutions.

2.2 Authentic Assesment

Some experts argue that authentic assessment is similar to performance assessment. (Hart, 1994; Torranca, 1995 dalam Gulikers, Bastiaens & Kirschener, 2004). The evaluation contains some actual works for students which are designed to evaluate what is known and done by the students (Solano-Fores & Shavelson, 1997; Maki, 2001; Moon & Moon & Callahan, 2001 dalam Santrock, 2007).

Other opinions say that authentic assessment is based on the realistic value of tasks and contexts (Herrington & Herrington, 1998 in Gulikers, Bastiaens & Kirschner, 2004). Lang (2006) say that authentic assessment focuses on students' application to their knowledge, get the information from certain sources, integrate the argument well to support the idea, create the jobs from the art or music to present something well, or design and finish the experiment to prove the hypothesis.

From those definitions above, it can be concluded that an authentic assessment is an evaluation procedure which are designed to evaluate what is known and done by the students, to challenge students to apply the new information and ability in real context of certain purposes. The main characteristic is a part which can not be parted from the learning in the classroom, real life reflection, using many measures, method and criterion, also comprehensive and holistical.

According to Maria Ruiz-Primo dan Richard Shavelson (1996) in Diane (2009) Authentic Assessment has at least three components; they are 1) a task which proposes problems and need solutions which needs the use of real life material which reacts to students' actions, 2) a structure of students

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responses, and 3) a marking system which does not only involve correct answers but also an appropriate process which is used in doing it.

Sudrajat (2007) explains that the main characteristics of authentic assessment are done during and after the learning process, can be used for formative and summative, can measure the aility and performances, continuous, integrated, and can be used as feedback. In this research, authentic assessment will be developed using problem based learning model (PBL), so learning can be meaningful for students.

2.3 Scoring Rubrics

According to Mueller (in Nurgiyantoro, 2011: 33) rubric can be understood as scoring scales used in scoring and marking students' certain work. Nurgiyanto (2011: 33) says that the function of rubrics is to determine the low and high achievement if students.

This research will develop a scoring rubric which is suitable for problem based learning (PBL).

3. RESEARCH METHOD

This research was a developmental research in a form of formative research (Tessmer, 1999 in Zulkardi, 2002). This developmental research was directed to produce marking instrument which was oriented to PBL to measure students' concept understanding toward the material through some of these steps:

1) Preliminary Step

In this step, the place and subjects of the research were determined through discussing and communicating it with school principles and subject matter teachers. Also, some preparations were done such as; arranging the research schedule and procedures with teachers.

2) Self Evaluation Step

a) Analysis

This step was the first step of research development. The research analyzed the learning process which was done by the teacher about geometric lesson.

b) Design

In this step, the researcher designed the scoring instrument, as well as scoring rubrics which were oriented to problem based learning (PBL) in geometric subject. This product design was prototype. Each prototype focused on three characteristics; content, construction, and language.

Table 1. characteristics of prototypes

Content	The problems given are suitable for learning material The scoring form and rubrics oriented to problem based learning can measure students' applicable ability in geometric lesson
Construct	The problems given are suitable with a theory which supports and can develop students' analysis and evaluation. The problems given are rich of concepts The problems given can create the concept development continuously.
Language	- Based on EYD - The cases are not complicated - The cases does not have double meaning - Limitation of questions and answers are clear - Using common language

These three characteristics were validated by experts and friends. This way was known as triangulation method.

3) Prototyping (validation, evaluation and revision)

In this step, the products which were made would be evaluated. In this step, the product would be tested. There were groups of testing, they were:

a) Expert Review and One-to-one

The result design of first prototype was developed based on self evaluation which was given for an expert and a student (one-to-one). The result became revision

- Expert Judgement

In this step, suggestions and responses from the expert about the design were written in validation sheets as revision material and statement for problems given, also as an evaluation instrument which was oriented to problem based learning.

- One-to-one)

In this step, the researcher made use of a student as a tester. The result of students' comments would be used to revise the design which was made.

b) Small Group

The revision result from the expert and problems faced by the teachers in testing step became bases to revise the first prototype design which was known as second prototype.

Then the result was tested in a small group (5 students of non research subject). In this step, 5 students of grade VIII SMP N 1 Pantai Cermin were asked to solve problems given; also the teacher evaluated it based on the form of evaluation which was designed. The bases of the result of evaluation were revised and corrected.

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4) Field Test

Suggestions, as well as field test result in the second prototype were used as bases in revising the design of second prototype. The result was then tested to the subjects of the research which in this case as field test. The field test product was tested to students grade VIII SMP N 1 Pantai Cermin to see whether the authentic evaluation has been able to evaluate the learning process through the model of problem based learning. Then, students' and teachers' comment were revised and corrected.

4. RESEARCH FINDING AND DISCUSSION

The assessmeent instrument was validated by 7 mathemathicians. Through the result of validation, it was found that the instrument form orientated to PBL for learners are categorized as good. It can be seen from the answers which have the degree as (1=very low, 2=low, 3=enouhg, 4=good, 5=very good). Based on the content, it was gotten that 4 learners were said to be good and 2 learners said to be enough, whereas 1 learner was categorized as very good. Constructively, it can be concluded that the problem was in the validation criterion. Eventhough, there is a little revision, i. e. there are some sentences, whether the problem itself or assessment instrument of double meaning.

Next, based on the practicality of test result, authentic development of assessmentt is very practical to be used by the teachers. Because, it can be able to assess the learning process. The kind of assessment given in PBL can improve the learnes activities and measure their cognitive, affective, and psycomotoric aspects for developing the learning process. In the small group test step, the researcher took 5 learners who were not as the subjects of research. The result is based on the quistionaires which were spreaded. The assessment form motivate students in learning.

Then, according to the experiment that has given to the learners of SMP in Pantai Cermin. It consists of 40 learners who said that the assessment form is suitable to the learners caracteristic. The assessment refers to the contex and their daily life. In this case, the ressearcher made the assessment indicator for geometry material. In the fild test, the research had 30 learners who seem to be happy for this assessment system, meanwhile 10 learners were unresponse with the kind of assessment system in PBL.

There are some instruments that have been done and developed in this research, they are:

1. Students' Worksheet

It has been arranged that a learner worksheet oriented by problem based learning (PBL) which used in geometry material; teacher used it to see the learners' concept comprehension. The scoring rubrics are used based on PBL.

2. Structured task

This research gave 3 structured tasks in grouping. Then, it should be presented by each group, whereas the other group would give responds. The result of the research is derived from the use of rubric.

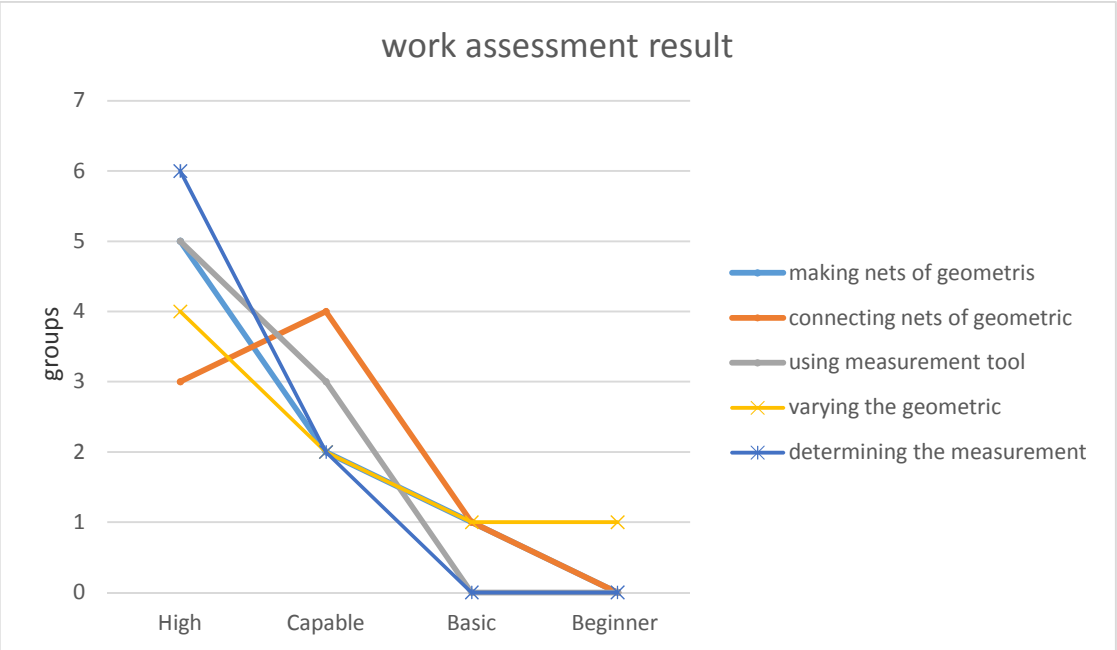
3. Field task

The project would be given to each group as a field task. The score of each task that work in group is based on the instrument.

4. Assessment worksheet

Assessment worksheet has been arranged based on the rubric as reference to evaluate students' work when doing the task and scientific work. The result could be seen below

:



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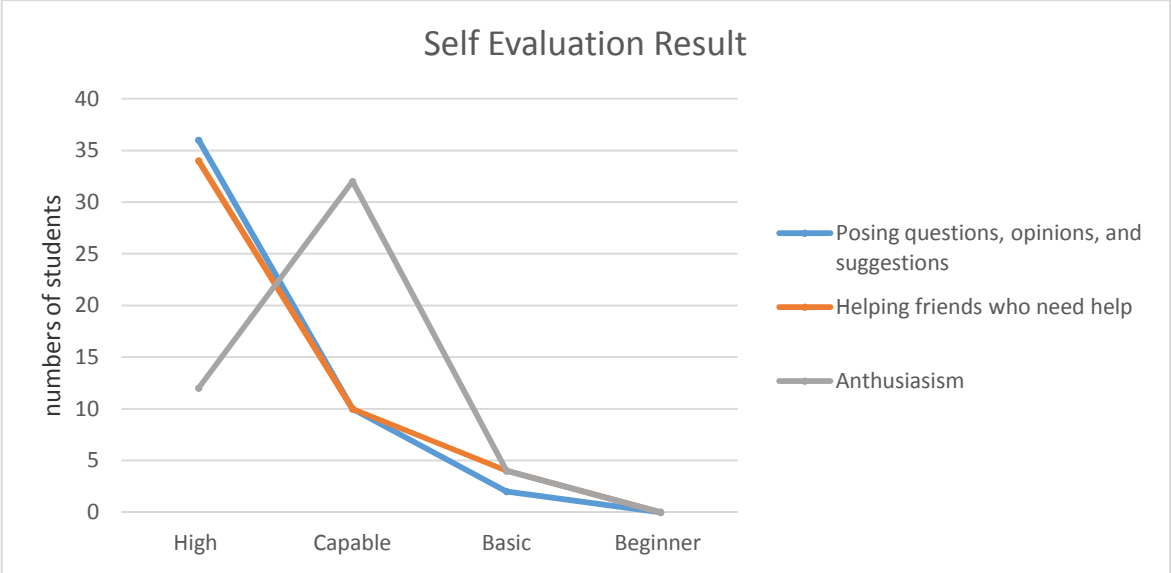
Based on the graphic, it could be seen that every group created a high level in the geometry; at least the indicator which they talk about has relation to geometry.

5. Self evaluation

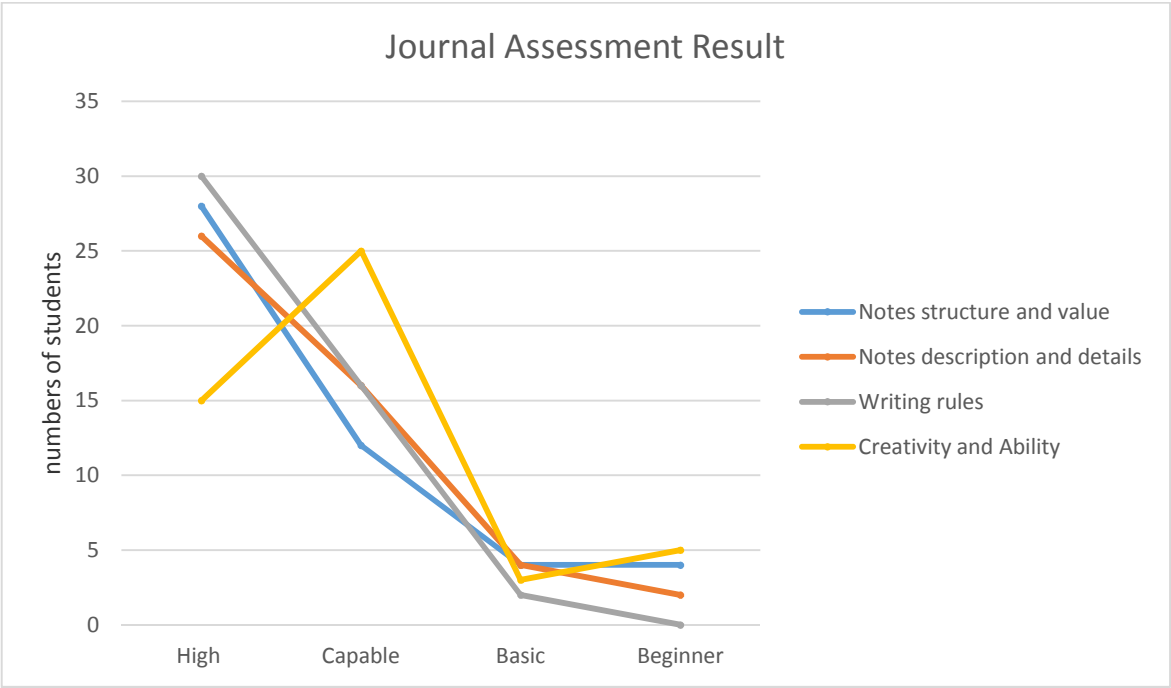
Self evaluation had been arranged based on the rubric. It could be used to evaluate them. The result is shown as below:



From graphic 2, it could be seen that based on the self evaluation worksheet, the learners who asked questions, give suggestion, and opinion are at the high level. In evaluation rubric, the highest levels are the students who gave suggestion about the alternative of problem solving in geometry. Whereas in the first level, nobody who didn't give suggestion about problem solving alternative of geometry. So, it could be concluded that based on the result of self evaluation sheet, learners felt that they could give responds about geometry problem solving alternative to help their friends who need helping, enthusiasm, accommodating on the high level and the skillful i.e. 32 and 12 from 40 learners, so it can be concluded that based on the self evaluation learners themselves, generally they supported their friends and help them when they need a help. Basically, the learners argued that their work was excellent. They could solve the problem given; also they have problem solving alternatives.

6. Journal assessment sheet

Journal assessment sheet had been arranged based on the rubric as reference to evaluate learners' journal. The result could be seen in graphic 3 as below:



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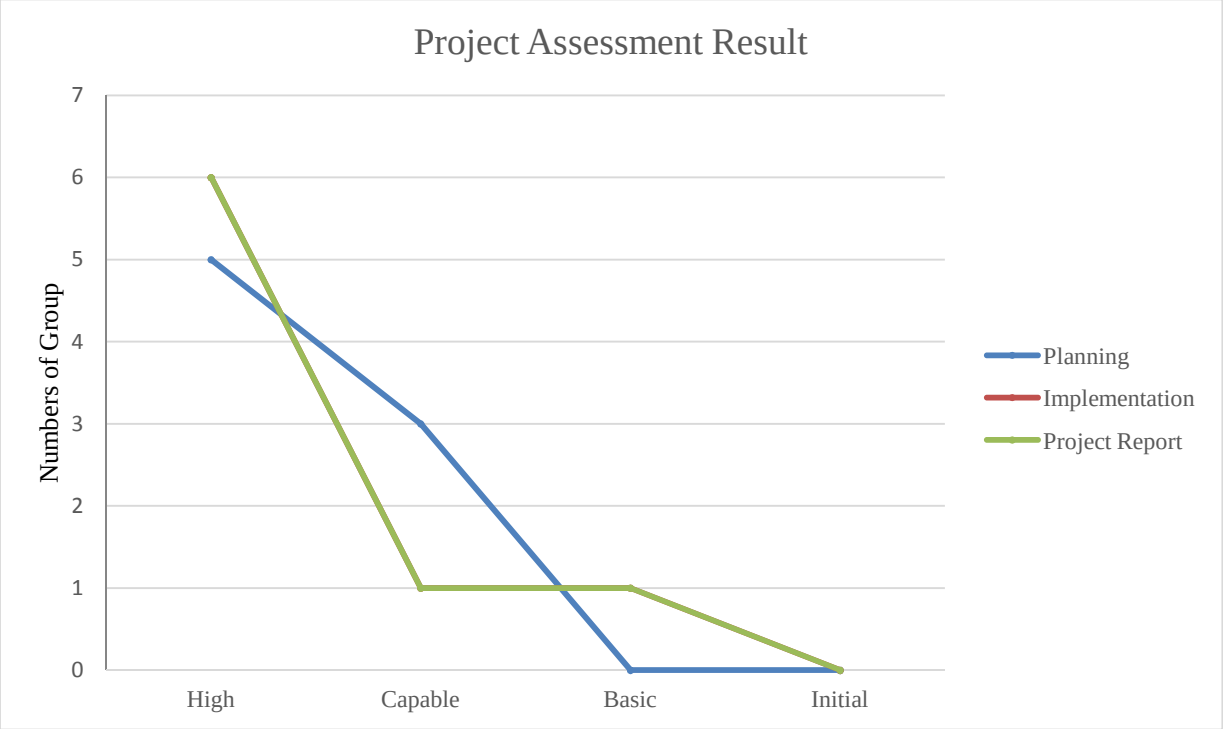
7. Project assessment

The project assessment sheet is arranged based on the rubric that are used as reference to assess students' project. The result of this research is illustrated in grafic 4



Based on the Graphic above, there are many groups in the high level such as in planning, implementation and the project result aspects, and it is based on the assessment rubric.

8. Porto folio Assessment

Porto folio Assessment is arranged based on the rubric that is used as a reference to assess the students projects. The result got based on the research is showed in Graphic 5

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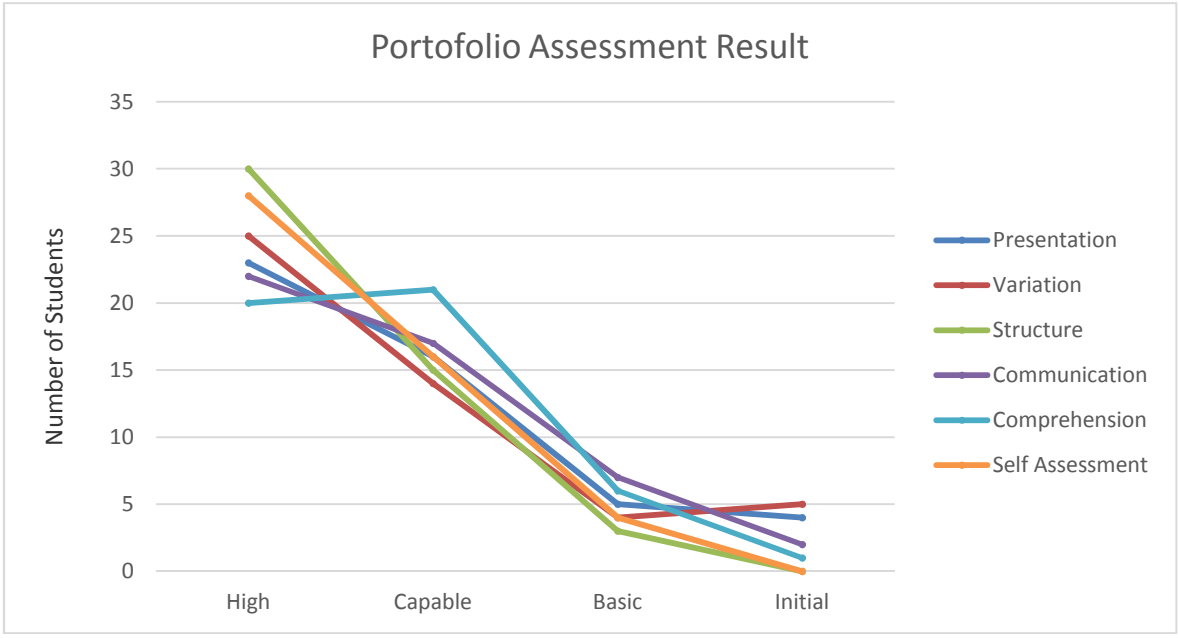

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Based on the Graphic 5, most of the students are in the high level. It is based on the criterion of presentation, variation, structure, communication and self assessment, while based on the comprehension; most of the students are in the capability level. Thus, generally students Portofolio Assessment are good.

Based on the result got from the Assessment instrument, it is concluded, it is very effective in learning process, and authentic Assessment PBL (Problem Based learning) model is one of them. Thus, it can improve the students' activities and motivation in learning process, and they will feel respectfully with things they do.

5. CONCLUSION AND SUGGESTION

1. Conclusion

Based on the discussion and result above, it is concluded that Problem Based Learning Assessment is very useful for the teachers and students. It showed from the assessment result in SMP N Pantai Cermin. It knew based on some criterions, as follow:

a) Through its validity, it is good to be used
b) Through its practicality, teachers and students can apply it easily
c) Through its effectiveness, the model can improve students activities and motivation

Thus, learning by using Problem Based Learning use appropriate assessment to improve activities, result, and students' learning interest, moreover to improve students' learning process.

2. Suggestion

Students are suggested to do the Problem Based Learning (PBL) Assessment as a feedback in learning process, and for the wise teachers, if they have known their weakness, they will give the innovations in learning process to improve the quality of learning.

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ISBN 978-602-19877-3-5

THE PROCESS OF DEDUCTIVE THINKING OF JUNIOR HIGH SCHOOL STUDENT IN COMPLETING GEOMETRIC PROOF BASED ON GENDER

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Abstract

Deductive thinking have attracted mathematicians especially for geometry field. Deductive can be noticed as the way of deduction from general to specific statement which involves mathematical concepts. In other words, deductive thinking consists of three steps started with making general statement (GS), specific statement (SS) and conclusion (C). General statement can be seen as axioms, definitions, and theorems. Meanwhile, specific statement deals with general statement. Then, making a deduction that follows logically when the general statement is applied to the particular statement.

The objective of this study is to describe the process of deductive thinking of junior high school students in solving geometric proof based on gender. To gain this purpose, researcher use problem solving task (TPM) to describe the process of deductive thinking as well as the interview guidance. The participant consists of female and male student who have similar ability.

The study reveals that the process of deductive thinking of junior high school students in accomplishing geometry problems as follows: both of subjects start to make general and specific statement after constructing and labelling geometry shape. There are strong connection between those statement since specific statement refers to general statement. Then, subjects use premises which have been proven their validity and make conclusion deductively. Female subject use the strategy of deductive thinking which is more pressure in algebra process and substitution method. On the other hand, male subject rely on his visual ability so that finding the shortest solution.

1. INTRODUCTION

The students learn geometry as a branch of mathematics at every level of the educational unit. The ideas of geometry have been known before they enter the school. The concept of geometry discusses about point, line, plane and space. These is related to activities to know, understand, apply, analyze, evaluate and create (curriculum 2013). In geometry, these activities have a close relation with the process of deductive thinking. However, the fact show that geometry is still elusive for students. In accordance with this, Idris (2009) stated that *"poor reasoning skills are also another area of concern among secondary school students. Many are unable to extract necessary information from given data and many more are unable to interpret answers and make conclusions"*. The statement describes that poor reasoning skill become a factor why geometry is difficult. Many of them were not able to obtain important information from the given data, interpret the answer and make a conclusion.

The causal factors can be overcome by seeing how the process of deductive thinking of the students in solving geometry problems. This will optimize the learning outcomes and develop their ability to construct formal proof further.

In geometry, the process of deductive thinking can be seen when the students explain the sum of two acute angle in a right triangle is 90. This can be seen from the following statement: " *student explains that the two acute angles in any right triangle add up to* 90^0 *because* 180^0 *minus the right angle leaves* 90^0, *and that is what is left for the two acute angles"* (Fuys, 1988).

Deductive thinking can be expressed as the combination of ideas, which is determined by previous ideas (Samaniego : 2010). In accordance with this, Supriyanto (2013) argued that the way of think in explaining a natural phenomenon by logically drawing conclusions and premises that have been previously defined. In other words, deductive thinking means a way of deductive inference from general to spesific statement. Meanwhile, Rich (1989: 19) states that there are three steps in deductive thinking, namely: (1) making a general statement referring to a whole set or class of things; (2) making a particular statement about one or some of the members of the set or class Referred to the general statement; and (3) making a deduction when it logically follows that the general statement is applied to the particular statement. It is clear that a very strong relationship between the premise and the conclusion follows the premise of the necessity (necessity).

Specifically, there are differences between boys and girls in geometry learning achievement. Research conducted by Trends in International Mathematics and Science Study (TIMMS) of the 8th grade students in the USA compared the students' ability of women to men. *"In 2007 there was no measurable difference in the average mathematics scores of males and females. While differences were*

ISBN 978-602-19877-3-5

not significant, male outperfomed females in three of four mathematics content domain: number (515 v. 506), geometry (483 v. 477), and data and chance (535 v. 527)."There was no measurable difference in the average mathematics scores of the males and females while in geometry male students got six points higher than female students in field geometry.

Slavin (2011: 155) also states that gender in intelligence or academic achievement has been debated for centuries. The issue has become something important since the early 1970s. In Indonesia, there are several schools that consider gender in grouping students. There are schools separating girls and boys, only male or female students. Male students may understand geometry problem easier than female students. Meanwhile, female students may recheck the solution more carefully. Their process of thinking may be influenced by their way in absorb and process the previous information which is obtained.

2. FORMULATION OF THE PROBLEM

Regarding to the research background above, the research questions of the study are as follows: How does the process of deductive thinking of junior high school in completing geometric proof?

3. RESEARCH METHOD

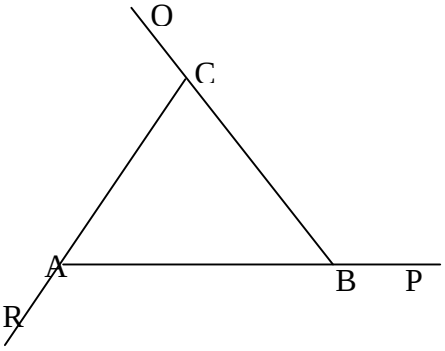
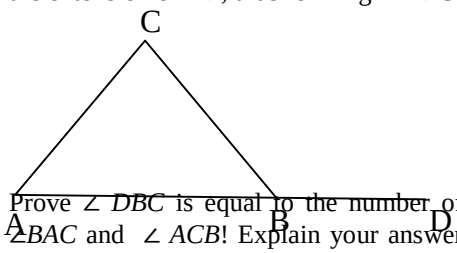
This is qualitative research which emphasizes the process rather than results. The problems observed are restricted to the process of deductive thinking about the topic who have studied in grade 8^{th}. While this type of research include descriptive categories, because this research intends to explore, explain or describe the process of deductive thinking of junior high school students in completing geometry problems based on gender.

There are two participants in this study, male and female students. Moreover, instruments in this study consists of the main and supporting instruments. Firstly, the main instrument is researcher self. This is because the research conducted in-depth interviews to get information. Secondly, proponent instrument consists of three instruments. They are ability (1) test of mathematics, used to determine the participants, (2) Problem-Solving Task (TPM), used to determine how students solve problems of geometry and (3) Interview Guide, used as a referral in the interview.

Collecting data in this study is done by combining two main activities, namely tests and interviews. In the interview process, researcher will explore information continuously untill the valid data obtained. Reseacher use time triangulation by comparing the results of interviews in the test first and second meeting to check the validity of the data.

The data in this study is a qualitative data obtained from the data of problem-solving task and interview data. Data analysis was carried out to uncover the process of deductive thinking of junior high school students in completing geometry problem based on gender. The analysis follows the flow of activities that occur in the same time,namely data reduction, data presentation, and conclusion or verification (Miles and Huberman, 1994).

Triangulation is used to check the validity of the qualitative data. Triangulation is performed in this study is time triangulation which is to compare the results of the interview and answer comprehension of the subject matter of the test at the first time (TPM 1) and second time (TPM 2). These can be seen as follows:

TPM1	Look at the picture below! Point *Q*, *P* and *R*, respectively located in the extension of *BC*, *AB* and *AC*, thus forming ∠ CBP, ∠ *ACQ* and ∠ *BAR*.  Prove that ∠ *CBP* + ∠*ACQ* + ∠ *BAR* = 360^0! Explain your answer and give the reasons at every step!
TPM2	Look at the picture below! Point *D* lies in the extension of *AD*, thus forming ∠ *BDC*.  Prove ∠ *DBC* is equal to the number of ∠*BAC* and ∠ *ACB*! Explain your answer and give the reasons at every step!

4. THE RESULT OF THE RESEARCH PROJECT

a. The Process of Deductive Thinking of Female Students

Based on this research, it was found that the subjects in completing geometry problems began to formulate a general statement with constructing and labeling the given shape. She constructed the shape by marking supplementary angle and extending a segment line. In addition, the subject give the name of triangle based on the triangle point. If there are a lot of triangles then she would give an another code. Furthermore, the subject

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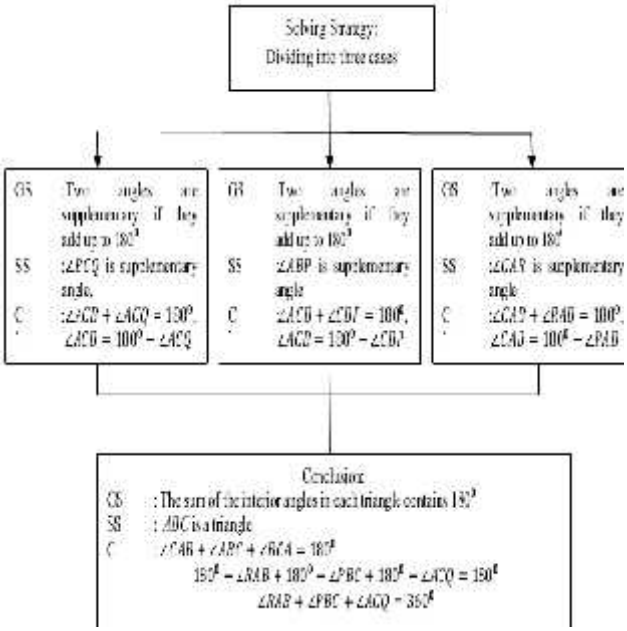
mentions a general statement that the sum of angles in triangle is 180^0 and write it behind the shape. In geometry, it is known as theorem. The participants was also stated that the sum of supplementary angle is 180^0.

In formulating a specific statement, a subject observe constructed given and mention the logical argument that refers to a general statement. She could group the supplementary angle and state *ABC* as a triangle. Both of these statements refer to general statements. Between general and specific statements are very close relation.

In doing conclusion, a participant had a strategy to resolve the problem. In the beginning, she assume that ABC is a isosceles triangle although finally she reliazed that it was wrong. Subject mention the strategy by dividing the image into several parts. After that, the subject firstly complete one section because the others have the same solution. In accordance with this, Krutetski (in Nafi'an: 2011) says that women are superior in accuracy, precision, accuracy, and thoroughness thought.

For more details, the process of deductive thinking of female student can be seen in Figure below.



(Adopted from Firmanti, 2014)

Based on the picture above, it can be described that the participant conclude the problem deductively from general to specific statement. Moreover, the subject emphasize more on the process algebra such as the use of substitution method and doing arithmetic operations. This is consistent with the results of PISA 2003 in Hong Kong and the United States stating that female students who are 15 years old get higher grades in algebra (in Loong: 2010).

b. The Process of Deductive Thinking of Male Student

Based on this research, it was found that the participant in completing geometry problems began to formulate a general statement by marking the supplementary angle in the given shape. He need to redraw if the picture is unclear. Then, he gave the name of shape based on alphabetical order and used the small letters. Furthermore, he mentioned the sum of triangle and supplementary angle is 180^0 which is respectively as general statement. He wrote it on the answer sheet. In geometry, this is called by theorems and definitions.

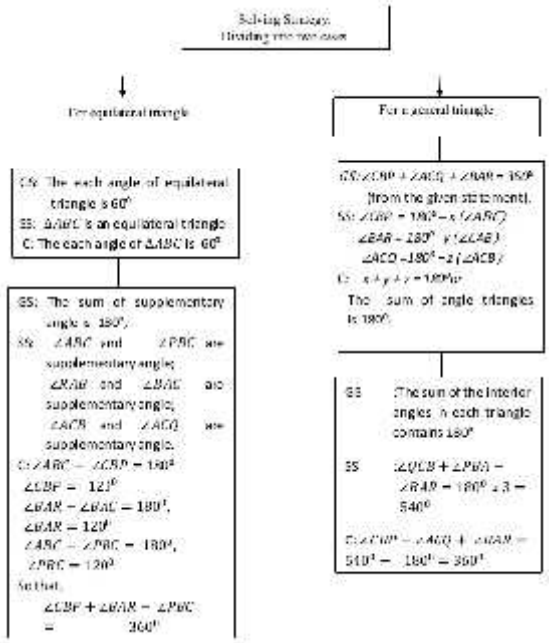
In formulating a special statement, he mentioned the logical argument that refers to a general statement based on constructed shape. Then, he also group the angles which is included to supplementary angle. This statement refers to the the sum of supplementary angle is 180^0. At the beginning, subject also stated that *ABC* is equilateral triangles so that the each angles is 60^0.

In doing conclusion, subject use deductive thinking strategies. When the subject saw an appropriateness between what is proved and what is done, he turned back to the given shape. Since at the first time, subject stated that ΔABC is an equilateral triangle, he just found the solution just for that case. However, after mediation, he was aware that ΔABC is not an equilateral triangle so that he thought for another solution that can apply to all types of triangles.

Subject used premises that have been proven the truth. As is consistent with the opinion of Suriasumantri (2009) which states that deductive thinking is the process of taking conclusion based on the premises that the truth has been proven. He gave deductive arguments. For instance, the sum of supplementary angle can be obtained by the half of the angles of a circle. This is because the supplementary angle can be formed from a circle divided into two parts through the center point so that the angle is equal to $360^0 : 2 = 180^0$.

To be more clear, the process of deductive thinking of male student can be seen in the picture below.

ISBN 978-602-19877-3-5



Based on the picture, the participant do a deductive inference from general to specific statement. Moreover, he think more easily and flexibly by looking through the entire perspektive from the constructed shape. It means that he find the quickest way to prove this problem. In accordance with this, Utomo (2013) stated that in general male student more easily understand the problem in geometry. Then, Dagun (in Laili, 2009) also stated that the way of thinking men and women are different where the men were analyzed more flexible and have a good visual ability.

5. CONCLUSION

We can conclude the similarity and different of male and female student from the table below:

No	Indicator	Female student	Male student
1	Formulating the initial Statement	• sum in a correct and label the given shape with the vertices of the triangle. • mention a general statement with regard to what is to be proved and what he has done • establish common statement by writing on the shape constructed	• sum in a correct and label the given shape and redraw the picture if it is unclear. • give the name of shape based on alphabetical order by using small letters • mention a general statement with regard to what is to be proved and write it on the answer sheet.
2	Formulating Specific Statement	• mention a logical argument that refers to a general statement.	• formulate a logical argument that refers to a general statement.
3	Doing Conclusion	• use strategies to solve the problem by make algebraic and divide the image into several parts. • use the premises that have been proven the truth and try to prove it by giving deductive arguments. • withdraw the conclusion from general statement to specific statement • solve the problem with the substitution method and doing arithmatic operations of algebra.	• use strategies deductive thinking and make assumptions about the type of ΔABC. • use the premises that have been proven the truth by giving deductive arguments so that the conclusions obtained are also valid • see again the picture in the problem if there is an appropriateness between what is to be proved and what he has done • withdraw the conclusion from general statement to specific statement • solve the problem by using an easier way and flexible thinking.

From the table, we can conclude that the process of deductive thinking of male and female student generally similar. However, there is a little bit difference between them such as in doing conclusion, male student finds the fastest way. Meanwhile, female student uses algebra process and more careful.

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ISBN 978-602-19877-3-5

ANALYSIS VALIDITY LKM BASED CONTEXTUAL Algebra BASIC IN STKIP PGRI SUMBAR

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ABSTRACT

Achievement of competence in basic algebra course is supported by many factors. One factor that is able to support the achievement of expected competencies is the use of teaching materials. At this lecture the students rely on textbooks as the handle on the lecture. However, textbooks are not able to actively engage students in learning. Lack of student involvement in building an understanding of the concept led to easy to forget the material. This implies a low learning outcomes. Therefore, it needs a lecture materials that can help students, in the form of LKM. The research objective is to develop a contextual-based LKM valid by using 4D model (define, design, develop, and desseminate). Research has been conducted to define and design stage. At define obtained the following results 1). Basic Algebra material is in conformity with the standards of competence and basic competences subjects. 2). material on LKM used are in accordance with the syllabus. 3). Most students have difficulty understanding the concept, 4). students have not been able to develop the information obtained in the course face to face because of the logic and systematic way of thinking students who are not able to construct knowledge, 5). students often are not able to develop a theory, because there are many students who memorize the theory without understanding the meaning contained, 6). lecturer difficulty of choosing the right way to communicate the theory lectures.

Index Terms— Basic Algebra, LKM, Contextual

1. PRELIMINARY

Learning is a process of systematically developing several components that include faculty, learning tools, students, learning, learning strategies, and assessment. This means that the learning is one of the important components in the learning process. It is necessary for a variety of learning tools for learning mathematics in the classroom can be run properly. Learning device needs to have the teaching staff to implement the learning process in the classroom one of them is the teaching materials.

Based on observations and formal interviews were conducted for lecturers and students of Mathematics Education in STKIP PGRI West Sumatra, especially in the course Algebra Basics, obtain information that in general, students do not already have teaching materials adequate for the learning process conducive, especially teaching materials in the form of print. Printed instructional materials used in the lecture for this is textbook. Textbooks that students are advised to have a low basic algebra books 1 and 2.

Incomprehension of students to the presentation of the material in the textbook causes less motivated students to learn independently. This means that, where textbooks have not been able to build motivation and increase the activity of the students. This adversely affects the student results. Here are the data of student learning outcomes in the form of final grades in Basic Algebra lectures.

Table 1. Final Value Basic Algebra Mathematics Education Study Program Student STKIP PGRI West Sumatra

Tahun 2013/2014		
Nilai	**Jumlah Mahasiswa**	**Persentase**
A	32	17.8%
B	54	30%
C	39	21.7%
D	39	21.7%
E	16	8.8%
Jumlah	180	

(Sumber: Bagian Administrasi Prodi)

LKM in accordance with the demands of the curriculum and improve learning outcomes and the activities of the course is the answer to all the above problems. Through the use of the LKM expected students are motivated to learn independently so that the lecture would be more effective and efficient because students are able to understand their own course materials will be studied. Students active in learning so no need to wait for the lecturer presents the material and be able to solve problems without the generous support of the lecturer.

LKM that will be developed in this study are contextual-based LKM. LKM is expected to lead the students to be actively involved in making discoveries on the concept of the material to be studied. Lecturers act as the directing and guiding students in the

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learning process. Thus, the activity can be increased student tuition. In addition, the LKM is designed as attractive as possible and packaged using understandable language so as to raise students' curiosity in learning. Activity and increased motivation expected trigger increased student results.

2. METHODS AND PROCEDURES

This type of research that be done is research and development (Research and development / R & D). According Sugiyono (2010: 407), R & D is a research method that is used to produce a particular product and test the effectiveness of the product. The products that be developed is LKM Elementary Algebra contextual-based.

This research aims to develop a valid Basic Algebra LKM, in terms of content and construct.LKM development procedure using 4-D models proposed by Thiagarajan et al, in Trianto (2007: 65). This model consists of four phases, namely the definition phase (define), stage design (design), stage of development (develop), and the dissemination phase (disseminate). In this study only done three stages, namely the definition phase, design phase and the development phase. At this explanation will be described define and design stages:

1. The definition phase (define)

This phase is done to look at the picture of conditions in the field related to the learning process in the Basic Algebra STKIP PGRI West Sumatra, and then analyze the problems. The process is carried out as follows.

a. Analyzing the syllabus aims to determine whether the material being taught is in conformity with the standards of competence and basic competences subjects.

b.Analyze textbooks Basic Algebra, to see the contents of the book conformity with the standards of competence and basic competences which must be accomplished students. The books that have been fit to be used as a reference for drafting and sample questions as well as guided exercises on LKM to be developed.

c. reviewing the literature related to the development of LKM.

d.To study the characteristics of the students to facilitate compiled language level in the LKM and lurch about.

e. Interviews with colleagues and students that aims to identify the problems / obstacles are encountered in the field in connection with the lecture Elementary Algebra.

2. Design (design)

Results from the definition phase is used at the design stage. At this stage, the action taken is to design LKM Elementary Algebra. LKM contains standards of competence, subject matter, a summary of the material, example problems, guided practice, and bibliography. LKM presentation of the material can be done in several meetings that have been adapted to the syllabus.

3. RESULTS AND DISCUSSION

To obtain a valid LKM, conducted several stages according to model 4-D. The results obtained in this stage can be described as follows.

a. The definition phase (define)

This phase is done to look at the picture of conditions in the field related to the lecture Elementary Algebra in STKIP PGRI West Sumatra. At this stage, such measures syllabus analysis, analysis of textbooks, literature analysis, analysis of the characteristics of students and interviews with colleagues. The results obtained in each step is as follows.

1) Analysis of Syllabus

Based on the results of the analysis of the syllabus known that Competency Standards (SK) of this course is the student can use the concept of linear equations, quadratic equation and inequalities in solving everyday problems. Furthermore, the Basic Competency (KD) which is expected to be achieved after the students take courses Algebra Elementary is a student directed to understand the concepts of linear systems of one, two, three, four and five variables, students are directed to understand the concept of Quadratic Equations and students discuss and practice solving problems (matter) Students are directed to understand the concept of inequality, and students are able to apply these concepts in solving everyday problems.

2) Analysis Textbook

Analysis undertaken textbook aims to see whether the contents of the book are in accordance with competence in the syllabus. Textbooks analyzed are textbooks that had been used in the lecture basic algebra, namely P. wijdenes. Low Algebra I. 1960. Jakarta: Noor Komaladan P. wijdenes. 1958. Low Algebra II. Jakarta: Noor Komala

Based on the analysis that has been done shows that the lecture material contained in this text consists of Linear Equations, Linear Functions, Quadratic Equations, Quadratic Functions, Inequality, Rational Equations and Sequences and Series. But in this study to develop LKM on the material linear equations, quadratic equations, and Inequality.

Based on the analysis described, the development of LKM conducted with reference to the existing syllabus. Presentation of the LKM is designed in such a way so as to facilitate the students to independently link between the material taught with real-world situations students and encourage students to make connections between the knowledge possessed by the application in their daily lives. Therefore, the development of LKM designed with a contextual basis.

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3) Analysis of Literature

Activity analyze literature is an activity undertaken to collect materials related to the design of the LKM. Structure characteristic of an LKM is important in the design. LKM has a characteristic, which is designed based on contextual. Contextual been Contextual Learning (Contextual Teaching and Learning) is a concept of learning that help teachers link between the material taught with real-world situations students and encourage students to make connections between the knowledge possessed by the application in their lives daily (MONE, 2003).

4). Analysis of Student Characteristics

According to Kemp (1994: 61) in the early planning is essential to pay attention to the characteristics, capabilities and experience of both groups of students or individuals. In order for LKM that are developed according to the needs of students, researchers studied the characteristics of students with observation.

Based on the observations that have been made in the lecture during this time, it is known that outlines the characteristics of student learning in the lecture Elementary Algebra is as follows.

a) Student's easy to forget the concepts that are learned if students are not involved in the process of building understanding of concepts such as making discoveries. Learning resources are used has not been able to engage students actively.

b) self-learning difficulties Students with learning resources are limited.

c) Students who listen and respond and can solve the problems associated with the materials provided lecturers are students with high academic ability.

4) Interview with Friends Fellow

Based on interviews, it is known that during this lecture Basic Algebra refer only to the textbook and use the lecture method. Students are many rely on explanation Lecturer in understanding the material. This means, students have not been able to learn independently. Therefore, we need a practical teaching materials from lecturers with certain development methods so as to facilitate students to learn independently. Thus, students are not too much in need of assistance lecturer in lectures

b. Design (design)

Results at the stage of defining used as the basis at the design stage. At this stage the researchers designed LKM contextual based on lectures Elementary Algebra. LKM is designed with a contextual basis in order to facilitate the students to independently link between the material taught with real-world situations students and encourage students to make connections between the knowledge possessed by the application in their daily lives. Based on the analyzes performed on the stage of defining, contextual-based LKM then designed for Basic Algebra courses. LKM designed consists of 3 parts: LKM 1 on Systems of Linear Equations, the LKM 2 of the equation Squares and MFIs 3 on Inequality. Each LKM can be used for one-time meeting.

This research resulted in the development of products such as contextual-based LKM. LKM facilitates self-learning process for students. Once the LKM has already been drafted, and then test the validity. The tests showed that the validity of the LKM-based Contextual Elementary Algebra for lectures on Mathematics Education Program student STKIP Sumatra PGRI included in the criteria valid and very valid. This means, MFIs developed can measure what should be measured appropriately. This is in line with the opinion of Djaali (2004: 65) states that an instrument is said to be valid if the instrument could be used to measure what should be measured.

Contextual LKM based on lectures Basic Algebra is valid based on the assessment of the validator. The material presented in accordance with the competence to be achieved. The material has been presented with a sequence of systematic and formulated based on the elements Contextual learning so as to facilitate students to learn independently and linking the material to life. The material presented at the LKM has provided the opportunity for students to link everyday life with the material being studied. This is in line with the opinion of Contextual Learning (Contextual Teaching and Learning) is a concept of learning that help teachers link between the material taught with real-world situations students and encourage students to make connections between the knowledge possessed by the application in their lives daily (MONE, 2003)

The concepts described in the material reinforced by linking the material with everyday life. It is proven to improve students' understanding of concepts learned. In addition, sample questions, and exercises self-relevant material presented so that students do not find significant obstacles in understanding and preparing the solution.

The main competence and supporters have presented clearly so that students can know what competencies are to be achieved during the lectures. LKM usage instructions can be guided well by the students so that by the time the lecture was not found significant obstacles regarding how the use of LKM in learning. Visually, the writing of concepts, ideas, terms and formulas that exist on the LKM has been presented clearly. This is evident from the absence of student questions about the writing on the LKM.

Presentation materials have been paraphrase the idea to be achieved so that the students have no difficulty in grasping the intent to be conveyed. Presentation materials has also led the formation and understanding of concepts as presented in a defined sequence and sequences. In addition, the presentation of the material has been actively involving students find the concept independently. Pictures presented clearly with varying colors so as to assist students in understanding the concepts learned. LKM have presented the problem formulation which will be the focus for students in making discoveries. LKM also presents data required students to perform discoveries

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on the issues formulated. And if the student is constrained in understanding LKM could discuss with his students (learning community) and reflection (associate new material on the failure by the other.

Phrases used in accordance with the rules of Indonesian. Phrases used also involve logical thinking ability of students. The structure of the sentence in accordance with the level of student understanding. The shape and size of the letters on the LKM has been in accordance with the capacity of students legibility. In addition, the phrase used in the presentation of the LKM does not give a double meaning (ambiguous).

4. CONCLUSION

LKM based contextual developed through the definition phase (define), stage design (design) and stage of development (develop). Based on the research results, we concluded that the LKM in the course Algebra valid base has a good validity of the feasibility aspects of content, presentation, linguistic and kegrafikan.

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ISBN 978-602-19877-3-5

PROFILE ABILITY THINK CRITICALLY STUDENT IN COMPLETING MATHEMATICAL PROBLEMS BASED ON THE LEVEL OF ACADEMIC ABILITY

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ABSTRACT

This research aims to describe profile ability think critically student in completing mathematical problems based on the level of academic ability. Subject in this research are students of the 2nd semester on 2014/2015 academic year who studied at mathematics education of FKIP UIR Pekanbaru who was following lectured Calculus 2. The subject divided by three groups namely students with high skill level, medium and low level. This classification based on value obtained student on the lecture calculus 1. The techniques of collection data in this research is using test and interview. Based on the results of research known that: (1) students on the high level group are generally have good enough the ability to generalize, but have less capability to identified and justified the concept and analyzes algorithms; (2) studens on the medium level group have capability of being in general afford to identified and justified the concept, generalize, and analyzes algorithms; (3) students on the low level group are not capable to identified and justified the concepts of, generalize, and analyzes algorithms.

Index Terms: Critical Thinking Ability Profile, Calculus 2, Level of Academic Ability.

1. INTRODUCTION

1.1 Background

In each of Indonesia's national education curriculum, mathematics courses are always taught every level of education, not least in college. This indicates that it is expected to learn mathematics, the availability of Indonesian human resources that are reliable, that is capable of critical thinking, systematic, logical, creative and careful can be fulfilled. One important aspect in mathematics is the ability to think critically. This is in line with what is recommended by the Committee on the Undergroude Program in Mathematics in Karlimah (2010: 2) that "the six basic recommendations for the department, programs, and courses in mathematics. One recommendation explains that each course in mathematics should be an activity that will assist students in the development of analytical, critical reasoning, problem solving, and communication skills.

Klurik and Rudnick (Sabandar, 2008) states that included critical thinking in mathematics is thought that test, questioning, connecting, evaluating all aspects of the situation or a problem. Based on the opinion and Rudnick Klurik above, it can be stated that the critical thinking skills, the students will become more curious because of the encouragement of curiosity and a desire to obtain the truth. Critical thinking habits improve mathematical abilities of students, because the students are encouraged to perform a variety of activities, such as face many challenges in learning, finding new things, and resolving the problems of non-routine.

Based on the above statement, it can be concluded that the critical thinking skills can create and train someone to do (doing the math) in the learning of mathematics.

1.2 Problem's Formulation

Based on the above background, the formulation of the problem in this research is: How is Profile Student Critical Thinking Ability in Solving Mathematics Subjects Calculus 2 Based on Academic Ability Levels?

2. RESEARCH METHOD

A study started from a problem or research question to answer and end the problems in question. If the answer to the problems in the form of a narrative qualitative depiction of the state of something in question, then the study is expressed as a descriptive study. Through a qualitative approach in this study, the facts either orally or in writing from a human source who has observed and other relevant documents described what it is and to then be studied and presented as possible to answer research questions. This research is descriptive research with a qualitative approach.

3. RESEARCH SUBJECTS

Subjects in this study were students of second semester of academic year 2014/2015 Mathematics Education Study Program FKIP UIR Pekanbaru who are following a course of calculus 2. The selection of this subject is based on several considerations, namely: (a) the second semester students have received course calculus 1 , so that it can be said they are already qualified to learn calculus 2; (b) the student is interviewed, because researchers are faculty

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of the student. Subjects were divided into three groups: students with high ability level, medium and low. This grouping is based on values obtained by students in the course of calculus 1

4. RESULT AND DISCUSSION

Collecting data in this study conducted in room A6.09 - A6.14 Campus FKIP UIR Pekanbaru on 11-13 May 2015 at 09:00 to 12:00 hours GMT. After the research subjects working on sheet instruments critical thinking mathematically, then researchers determined the subject to be interviewed based on their level of academic ability. Once the interview process is complete, the researchers conducted an analysis of research data.

Data analysis is done by exposing research subjects answer in writing and then continued by presenting the results of research interviews with the subject. Finally, researchers will carry out the results of triangulation of data that have been obtained.

Based on three indicators of critical thinking skills that researchers use in this study, which are: (1) the ability to identify and justify the concept, namely the ability to give a reason to the mastery of concepts; (2) the ability to generalize, namely the ability to supplement the data or information support; (3) the ability to analyze the algorithm, namely the ability to evaluate or examine an algorithm, this study showed that subjects who are at high-level academic skills almost all have the ability to generalize, namely the ability to supplement the data or information in support. Furthermore, only a fraction of the subject at a high academic ability who have the ability to identify and justify the concept. While nearly all subjects at high academic abilities could not finish the three test questions for the indicator. This means that most of the subjects on the high academic ability can be said not to have the ability to analyze the algorithm.

Based on interviews with subjects which researchers have found that the high ability of almost any subject can express and understand and be able to work on the problems test for indicator no. 2 or indicator of the ability to generalize, while the indicator no. 1 or the ability to identify and justify the concept, based on interviews showed that subjects on a high academic ability majority can not design a parabolic curve that intersects with the plot line and the y-axis, consequently they are wrong in determining the limits of the integral are used to determine the extent. Furthermore, based on interviews found that subjects on a high academic ability can not analyze the given problem, because most subjects at high academic ability forgotten the integral concept of trigonometric functions. To the subject in academic ability being, only a fraction subjects were able to generalize or supplement the data or information in support. As for the ability to identify and justify the concept and the ability to analyze algorithm, almost all subjects in academic ability was not. Based on the results of research interviews with the subject, it was found that almost all of the subject does not have the understanding to identify and justify the concept and analysis algorithms.

Furthermore, to a subject in low academic ability, almost all of them are not able to complete all the test questions were given. This indicates that the subjects on the low academic ability in general do not have the ability to identify and justify the concept, the ability to generalize the algorithm as well as the ability to analyze the algorithm. Based on interviews with the researchers on the ability of low academic subjects, it was found that almost all of them do not know how to solve the given test. This indicates that the subject in low academic ability do not yet have an understanding to resolve.For more details, the results of the analysis of critical thinking skills profiles based on the ability of academic subjects are presented in Table 1 below

Table 1. Profile Student Critical Thinking Ability in Solving Mathematics in Calculus II Course Based on Level of Academic Ability

Ability level	Indikator Kemampuan Berpikir Kritis		
	The ability to identify andjustify the concept, namely the ability to give a reason to the mastery of concepts	**The abilityto generalize, namely the ability to supplement the data or information that supports**	**The ability to analyze the algorithm, namely the ability to evaluate or examine an algorithm**
Height	A small portion subjectis able to draw a sketch graph quadratic functions, consequently the subject is difficult to define the upper and lower limits are used to calculate the are arequested.	Almost all subjects capable of and understand the given problem and solve it properly	Almost all subjects can not analyze and evaluate and provide improvements to the existing problems because they forget the integral concept of trigonometric functions
Medium	Almost all subjects can	A small portion subject	Almost all subjects can

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	not describe sketch quadratic function graph, because they do not understand	is able to doa generalization, because the subject does not understand how to generalize	not do the analysis and providean evaluation of the algorithm are given because they do not understand the concepts that will be used.
Low	Almost all subjects can not describe sketch quadratic function graph, because they do not understand	Almost all subjects can not generalize the algorithm because they do not understand how to solve the problem given	Almost all subjects can not do the analysis and provide an evaluation of the algorithm are given because they do not understand the concepts that will be used.

5. CONCLUSIONS

Overall, the study subjects at a high level of academic ability in general have the ability to generalize fairly well, but are less able to identify and justify the concept and analyze algorithms. While the subject at the level of academic ability were, in general, are less able to identify and justify the concept, generalize the algorithm, and analyzing algorithms. Further to the subject at a low level of academic ability, are generally not able to identify and justify the concept, generalize the algorithm, and analyzing algorithms.

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ISBN 978-602-19877-3-5

UNIFOMLY LOCALLY SMALL RIEMANN SUMS (ULSRS) VERSUS HENSTOCK EQUI INTEGRABLE FUNCTIONSFROM $\Re^n$ INTO ℓ^p, $(1 \le p < \infty)$

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ABSTRACT

In this paper we discuss Henstock α -integrable functionsfrom the Euclidean spaces $\Re^n$ into the Sequences space $\ell^p, (1 \le p < \infty)$,Definition and some theorems Locally Small Riemann Sums(LSRS), Definition and some theoremsUnifomly Locally Small Riemann Sums(ULSRS) and Investigated Equivalency HenstockEqui α -integrable functions from the Euclidean spaces $\Re^n$ into the Sequences space $\ell^p, (1 \le p < \infty)$ with Unifomly Locally Small Riemann Sums(ULSRS)functionsfrom the Euclidean spaces $\Re^n$ into the Sequences space $\ell^p, (1 \le p < \infty)$.

Index Terms*----*HenstockEqui-integrable functions, UnifomlyLocally Small Riemann Sums (ULSRS). Equivalency

1. INTRODUCTION

In 1960, Henstockand Kurzweil separately admitted Riemann integral by changing constantan δ into positive δ functionand the arranged integral was equivalence. Accordingly, the integral is known as Henstock-Kurzweilintegralorextended Riemannintegral[1]

This integral fascinated a large number of scientists, so that many researches were done to discover its characteristics and applications.One of them was Locally Small Riemann Sums (LSRS).The meaning of the characteristic at Locally Small Riemann Sumsfor the Real function group of real number integraled Henstockwas firstly given and booked by Lee (1989). Indrati (2002)admitted it for the real function in Euclide n dimension, later Suherman (2003) developed it for the vector functionin Euclide spaces dimensionand Aniswita (2006) developed it for the sequence function.[2]

Based on the explanation above, the theorem of convergent function integraled Henstock at once will be investigated at once from Euclide $\Re^n$ spacesinto sequences space ℓ^p , $(1 \le p < \infty)$ andUnifomly Locally Small Riemann Sums (ULSRS) with its equivalence. Several definitions and theorems needed are given below:

Definition 1.1(Henstock Integral)*Let* $\overline{f}$ *functionfrom* $\Re^n$ *into* ℓ^p *and* $E \subset \Re^n$ **.**A *Function* $\overline{f} : E \subset \Re^n \to \ell^p$ *is calledHenstock* α *- integrableonE, (* $\overline{f} \in R^*\left(E, \ell^p, \alpha\right)$ *),if exist an unique* $\overline{a} = \{a_k\} \in \ell^p$ *with characteristic for everyconstanta* $\varepsilon > 0$ *there exist positif* δ *functions on E such thatfor every Perron* δ *-fine partition* $\mathcal{D} = \left\{\left(D, \overline{x}\right)\right\} = \left\{\left(D_i, \overline{x}_i\right) : i = 1,2,...,r\right\}$ *atEis applied*

$$\left\|(\mathcal{D})\sum \overline{f}(\overline{x})\,\alpha(D) - \overline{a}\right\|_p = \left\|\sum_{i=1}^{r} \overline{f}(\overline{x}_i)\,\alpha(D_i) - \overline{a}\right\|_p < \varepsilon$$

Example1.2 Let *cell* $E \subset \Re^n$ *,and function* $\overline{f} : E \to \ell^p$ *with* $\overline{f}(\overline{x}) = \overline{c} = \{c_k\} \in \ell^p$ *for every* $\overline{x} \in E$ *we will show* $\overline{f} \in R^*\left(E, \ell^p, \alpha\right)$ *with* $(R^*)\int_E \overline{f}\, d\alpha = \overline{c}\,\alpha(E)$.

Proof:

It is given a number $\varepsilon > 0$ and is chosen positive δ function and $\delta\left(\overline{x}\right)$ =1 for every $\overline{x} \in E$ .If $\mathcal{D} = \left\{\left(D, \overline{x}\right)\right\}$ Perron partition δ - *fine*at*E*so that it is gotten

$$\left\|(\mathcal{D})\sum \overline{f}(\overline{x})\,\alpha(D) - \overline{c}\,\alpha(E)\right\|_p = \left\|(\mathcal{D})\sum \overline{c}\,\alpha(D) - \overline{c}\,\alpha(E)\right\|_p$$

$$= \left\|\overline{c}\,(\mathcal{D})\sum \alpha(D) - \overline{c}\,\alpha(E)\right\|_p$$

[1]Gordon*The Integral of Lebegue, Denjoy, Perron and Henstock,* American Mathematical Society, USA.

[2] Aniswita, *Integral HenstockFungsidariruang Euclid eke RuangBarisan*JurnalAnalisa STAIN Bukittinggi

ISBN 978-602-19877-3-5

=

$$\left\| \overline{c}\left(\alpha\left(E\right)-\alpha\left(E\right)\right)\right\|_p = 0 < \varepsilon .$$

In other words, it is proofed $\overline{f} \in R^*\left(E,\ell^p,\alpha\right)$ *and* $(R^*)\int_E \overline{f}\, d\alpha = \overline{c}\,\alpha(E)$.

Theorem 1.3(Cauchy criteria) *It is given volume* α *function at* $\Re^n$ *and cell* $E \subset \Re^n$. *Function* $\overline{f} \in R^*\left(E,\ell^p,\alpha\right)$ *if and only if for every number* $\varepsilon > 0$ *contains positive* δ *function at Eso for every two partitions* $\mathcal{D}_1 = \left\{\left(D_1,\overline{x}\right)\right\}$ *and* $\mathcal{D}_2 = \left\{\left(D_2,\overline{x}\right)\right\}$ *atEis applied*

$$\left\|\left(\mathcal{D}_1\right)\sum \overline{f}(\overline{x})\,\alpha(D_1)-\left(\mathcal{D}_2\right)\sum \overline{f}(\overline{x})\,\alpha\,(D_2)\right\|_p < \varepsilon$$

Function definition from Euclide $\Re^n$ spacesinto sequences ℓ^p space, ($1 \le p < \infty$) which belongs to Locally Small Riemann Sums (LSRS) characteristicis given in the definition below*:*

Definition 1.4 It is given volume α *function at* $\Re^n$, *sel* $E \subset \Re^n$, *and function* $\overline{f} : E \to \ell^p$ *measured-*α *at cell E. Function* $\overline{f}$ *is said to have Locally Small Riemann Sums (LSRS) characteristic toward* α *at cell E written by* $\overline{f} \in LSRS\left(E,\ell^p,\alpha\right)$ *if for every number* $\varepsilon > 0$ *positive* δ *function at E so for every* $\overline{y} \in E$ *for every Perron partition* δ *-fine* $\mathcal{D} = \left\{\left(D,\overline{x}\right)\right\}$ *at cell* $C \subset B\left(\overline{y},\delta(\overline{y})\right)$ *and* $\overline{y} \in C$ *is applied*

$$\left\|(\mathcal{D})\sum \overline{f}(\overline{x})\,\alpha(D)\right\|_p = \left\{\sum_{k=1}^{\infty}\left|(\mathcal{D})\sum f_k(\overline{x})\,\alpha(D)\right|^p\right\}^{\frac{1}{p}} < \varepsilon$$

.

Theorem 1.5*It is given volume* α *function at* $\Re^n$, *cell* $E \subset \Re^n$,*and function* $\overline{f} : E \to \ell^p$ *measured-*α *at cell E. If* $\overline{f} \in R^*\left(E,\ell^p,\alpha\right)$ *so* $\overline{f} \in LSRS\left(E,\ell^p,\alpha\right)$

Theorem 1.6 It is given *volume* α *function at* $\Re^n$, *cell* $E \subset \Re^n$,*and function* $\overline{f} : E \to \ell^p$ *measured-*α *at cell E. If* $\overline{f} \in LSRS\left(E,\ell^p,\alpha\right)$ *so* $\overline{f} \in R^*\left(C,\ell^p,\alpha\right)$*for every cell* $C \subseteq E^0$.[3]

2. FUNCTION INTEGRALED HENSTOCK AT ONCE FROM $\Re^n$ INTO ℓ^p, ($1 \le p < \infty$)

In this part, it will be given the definition of function integraled Henstock at once and many related theorems.

Definition 2.1*It is given the volume function* α *at* $\Re^n$, *cell* $E \subset \Re^n$,*and function* $\overline{f}_k : E \subset \Re^n \to \ell^p$ *for every k, (k=1,2,…). Sequences of function* $\left\{\overline{f}_k\right\}$*is said that****integraled-*** α ***at once*** *(HenstockEqui* α *-integrable) at cell E if forevery number* $\varepsilon > 0$ *contains positive* δ *function at E so that for everyPerron partition* δ *–fine* $\mathcal{D} = \left\{\left(D,\overline{x}\right)\right\}$ *at E is applied*

$$\left\|\left(\mathcal{D}\right)\sum \overline{f}_k\left(\overline{x}\right)\alpha(D)-\left(R^*\right)\int_E \overline{f}_k\left(\overline{x}\right)d\alpha\right\|_p < \varepsilon ,$$

for every k.

Theorem2.2*It is given volume function* α *at* $\Re^n$, *cell* $E \subset \Re^n$, *and function* $\overline{f} : E \subset \Re^n \to \ell^p$. *Function* $\overline{f}$ *integraled-* α *Henstock (Henstock* α *-Integrable) atE if and only, if ranks of function* $\overline{f} = \left\{f_k\right\}$, $f_k : \Re^n \to \Re$ *for every k, (k=1,2 ...) integraled-* α *Henstock at once (Henstock Equi* α *-integrable) atEby ranks* $\left\{\left(R^*\right)\int_E f_k\, d\alpha\right\} \in \ell^p$ *furthermore,* $(R^*)\int_E \overline{f}\, d\alpha = \left\{\left(R^*\right)\int_E f_k\, d\alpha\right\}$.

Proof:
(Necessary requirement)
It is $\overline{f} \in R^*\left(E,\ell^p,\alpha\right)$ so based on $\overline{a} = \left\{a_k\right\} = (R^*)\int_E \overline{f}\, d\alpha \in \ell^p$ by characteristic for every number $\varepsilon > 0$ contains positive δ function at*E*so for every Perron partition δ -fine $\mathcal{D} = \left\{\left(D,\overline{x}\right)\right\}$ at*E* is applied

$$\left\|(\mathcal{D})\sum \overline{f}(\overline{x})\,\alpha(D)-\overline{a}\right\|_p < \varepsilon \quad \text{or}$$

$$\left(\sum_{k=1}^{\infty}\left|(\mathcal{D})\sum f_k(\overline{x})\,\alpha\,(D)-a_k\right|^p\right)^{\frac{1}{p}} < \varepsilon$$

.
The result

[3]Aniswita, Locally Small Riemann Sum …

ISBN 978-602-19877-3-5

$$\left|(\mathcal{D})\sum f_k(\bar{x})\,\alpha(D)-a_k\right|<\varepsilon \quad , \quad \text{for every } k.$$

In other words, sequences of function $\bar{f}=\{f_k\}$, $f_k:\Re^n\to\Re$ for every k,(k =1,2,...) integraled-α Henstock at once (Henstock Equi α -integrable) at $E$by integral value $a_k=(R^*)\int_E f_k\,d\alpha\in R$, for every k.

Moreover, because $\bar{a}=\{a_k\}=(R^*)\int_E \bar{f}\,d\alpha\in\ell^p$, it is clear $\left\{(R^*)\int_E f_k\,d\alpha\right\}\in\ell^p$ and then

$$(R^*)\int_E \bar{f}\,d\alpha=\left\{(R^*)\int_E f_k\,d\alpha\right\}.$$

(Adequate requirement)

It is formed the ranks $\bar{a}=\{a_k\}=\left\{(R^*)\int_E f_k\,d\alpha\right\}$.

It is $\left\{(R^*)\int_E f_k\,d\alpha\right\}\in\ell^p$ it is clear $\bar{a}=\left\{(R^*)\int_E f_k\,d\alpha\right\}\in\ell^p$. If $\mathcal{D}^*=\{(D,\bar{x})\}$ partisi Perron partition δ^*- fine *atE*is gotten

$$(\mathcal{D}^*)\sum \bar{f}(\bar{x})\,\alpha(D) = \left\{(\mathcal{D}^*)\sum f_k(\bar{x})\,\alpha(D)\right\}\in\ell^p.$$

Furthermore,

$$(\mathcal{D}^*)\sum \bar{f}(\bar{x})\,\alpha(D)-\bar{a} = \left\{(\mathcal{D}^*)\sum f_k(\bar{x})\,\alpha(D)-(R^*)\int_E f_k\,d\alpha\right\}\in\ell^p$$

$$\sum_{k=1}^{\infty}\left|(\mathcal{D}^*)\sum f_k(\bar{x})\,\alpha(D)-(R^*)\int_E f_k\,d\alpha\right|^p<\infty$$

.

Therefore, for every number $\varepsilon>0$ it contains real number n_0 so it is applied

$$\sum_{k>n_0}\left|(\mathcal{D}^*)\sum f_k(\bar{x})\,\alpha(D)-(R^*)\int_E f_k\,d\alpha\right|^p<\frac{\varepsilon^p}{2} \quad (1)$$

Sequences of function $\bar{f}=\{f_k\}$, $f_k:\Re^n\to\Re$ for every *k, (k= 1, 2, ...)* integraled-α Henstock at once at *E* so it contains positive δ function at *E* by $\delta(\bar{x})\le\delta^*(\bar{x})$ for every $\bar{x}\in E$. If $\mathcal{D}=\{(D,\bar{x})\}$ Perron partition δ -fine at *E* is applied

$$\left|(\mathcal{D})\sum f_k(\bar{x})\,\alpha(D)-(R^*)\int_E f_k\,d\alpha\right|<\frac{\varepsilon}{(2.n_0)^{\frac{1}{p}}} \quad (2)$$

.

From unequal (1) and (2), if $\mathcal{D}=\{(D,\bar{x})\}$ Perron partition δ -fine at *E is gotten*

$$\left\|(\mathcal{D})\sum \bar{f}(\bar{x})\,\alpha(D)-(R^*)\int_E \bar{f}\,d\alpha\right\|_p =$$

$$\left(\sum_{k=1}^{\infty}\left|(\mathcal{D})\sum f_k(\bar{x})\,\alpha(D_0)-(R^*)\int_E f_k\,d\alpha\right|^p\right)^{\frac{1}{p}}$$

$$\left\{\left(\sum_{k=1}^{n_0}\left|(\mathcal{D})\sum f_k(\bar{x})\,\alpha(D)-(R^*)\int_E f_k\,d\alpha\right|^p\right)+\left(\sum_{k>n_0}\left|(\mathcal{D})\sum f_k(\bar{x})\,\alpha(D)-(R^*)\int_E f_k\,d\alpha\right|^p\right)\right\}^{\frac{1}{p}}$$

$$<\left(n_0\frac{\varepsilon^p}{2.n_0}+\frac{\varepsilon^p}{2}\right)^{\frac{1}{p}} = \varepsilon.$$

In otherwords, itisproofedthat $\bar{f}\in R^*(E,\ell^p,\alpha)$.

The theoremabove shows the relationship between function from $\bar{f}:E\subset\Re^n\to\ell^p$ as sequences of functions from $\bar{f}=\{f_k\}$, $f_k:\Re^n\to\Re$.

3. *UNIFOMLY LOCALLY SMALL RIEMANN SUMS (ULSRS)*FUNCTION FROM $\Re^n$ INTO ℓ^p, $(1\le p<\infty)$

This part will explain the definition and theorem related to *Uniformly Locally Small Riemann Sums (ULSRS)function from* Euclide spacesto sequences space.

Definisi 3.1*It is given to volume function* α *at* $\Re^n$, *cell* $E\subset\Re^n$ *and function* $\bar{f}_k:E\subset\Re^n\to\ell^p$ *for every k, (k=1, 2, 3, ...). sequencess of function measured* $\left\{\bar{f}_k\right\}$ *by the same LSRS characteristic or Unifomly Locally Small Riemann Sums (ULSRS) at cell* $E\subset\Re^n$ if for every number $\varepsilon>0$ *it contains positive* δ *function at E so that for every* $\bar{y}\in E$ *and*

ISBN 978-602-19877-3-5

for every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at cell $C\subset B(\bar{y},\delta(\bar{y}))$ and $\bar{y}\in C$ is applied

$$\left\|(\mathcal{D})\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p<\varepsilon\ ,\ \textit{for every k.}$$

The convergent of function with ULSRS characteristic is given to the Lemma below:

Lemma 2.3*If ranks of function measured $\{\overline{f}_k\}$ by the same LSRS characteristic at cell $E\subset\Re^n$ and $\overline{f}_k\to\overline{f}$ h.d. at cell E so function $\overline{f}$ is LSRS characteristic.*

Proof:
Without cutting down the meaning, it is regarded as $\overline{f}_k\to\overline{f}$ at cell E because if $\overline{f}$ function integraled Henstock at cell E and $\overline{g}=\overline{f}$ h.d. at cell E thus, $\overline{g}$ integraled Henstock, furthermore, $\overline{g}$ is a function by LSRS characteristic at cell E.
Thus, $\overline{f}_k\to\overline{f}$ means for every number $\varepsilon>0$ and for every $\bar{x}\in E$ contains positive $k_{0,\bar{x}}$ number by the characteristic for every $k\ge k_{0,\bar{x}}$ is applied

$$\left\|\overline{f}_k(\bar{x})-\overline{f}(\bar{x})\right\|_p<\frac{\varepsilon}{2^k\alpha(E)}.$$

Sequences of function measured $\{\overline{f}_k\}$ by the same LSRS characteristic at cell $E\subset\Re^n$ contain positive δ function at E so for every $\bar{y}\in E$ is applied

$$\left\|(\mathcal{D})\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p<\varepsilon.$$

For every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at cell $C\subset B(\bar{y},\delta(\bar{y}))$ and $\bar{y}\in C$ for every k. Furthermore, for every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at cell E, related point number is limited. So that, according to lemma Henstock, for every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at cell $C\subset B(\bar{y},\delta(\bar{y}))$ and $\bar{y}\in C$ is applied

$$\left\|(\mathcal{D})\sum \overline{f}(\bar{x})\alpha(D)\right\|_p\le$$
$$\left\|(\mathcal{D})\sum \overline{f}(\bar{x})\alpha(D)-(\mathcal{D})\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p+$$
$$\left\|(\mathcal{D})\sum \overline{f}_k(\bar{x})\right\|_p<3\varepsilon.$$

by $k=maks\{k_{0,\bar{x}}:\bar{x}\in D\}$. □

4. THE EQUIVALENCY BETWEEN*UNIFOMLY LOCALLY SMALL RIEMANN SUMS (ULSRS),* (1 ≤ p< ∞)AND *FUNCTION OF* INTEGRALED HENSTOCK AT ONCEFROM $\Re^n$ INTO ℓ^p

It will be investigated at this part the relationship between Uniformly Locally Small Riemann Sums (ULSRS) characteristic and function of integraledHenstock at once. The definition of ULSRS characteristic and function convergent theorem by ULSRS characteristic came with the thought about the convergent of integral function at once as the theorem below:

Theorem 4.1 If sequences of function measured $\{\overline{f}_k\}$ *is rank of function integraled Henstock at once at cell* $E\subset\Re^n$ and $\overline{f}_k\to\overline{f}$ *h.d. at cell E for* $k\to\infty$ *so* $\overline{f}$ *integraled Henstock at cell E and* $\lim_{k\to\infty}(R^*)\int_E \overline{f}_k d\alpha=(R^*)\int_E \overline{f}d\alpha$.

Proof:
Without cutting down the meaning, it is regarded as $\overline{f}_k\to\overline{f}$ at cell E. It means for every number $\varepsilon>0$ and for every $\bar{x}\in E$ contain positive number $k_{\bar{x}}$ by the characteristic for every $k\ge k_{\bar{x}}$ is applied

$$\left\|\overline{f}_k(\bar{x})-\overline{f}(\bar{x})\right\|_p<\frac{\varepsilon}{\alpha(E)}.$$

Sequences of function measured $\{\overline{f}_k\}$ is sequences of function integraled Henstock at once at cell $E\subset\Re^n$ so that it contains positive δ function at cell *E* by characteristic for every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at *E* is applied

$$\left\|(\mathcal{D})\sum \overline{f}_k(\bar{x})\,\alpha(D)-(R^*)\int_E \overline{f}_k d\alpha\right\|_p<\frac{\varepsilon}{2^{k+1}}\ ,$$

for every k
Related point number for every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at E is limited so it can be taken $K=maks\{k_{\bar{x}}:\bar{x}\in D\}$.
Therefore, for $k,m\ge N$ it is gotten

$$\left\|(R^*)\int_E \overline{f}_k\,d\alpha-(R^*)\int_E \overline{f}_m\right\|_p\le$$
$$\left\|(\mathcal{D})\sum \overline{f}_k(\bar{x})\,\alpha(D)-(R^*)\int_E \overline{f}_k d\alpha\right\|_p+$$

ISBN 978-602-19877-3-5

$$\left\|(\mathcal{D})\sum \overline{f}_k(\bar{x})\,\alpha(D)-(\mathcal{D})\sum \overline{f}_m(\bar{x})\alpha(D)\right\|_p +$$
$$\left\|(\mathcal{D})\sum \overline{f}_m(\bar{x})\,\alpha(D)-(R^*)\int_E \overline{f}_m d\alpha\right\|_p$$

$$\le \sum\frac{\varepsilon}{2^k}+(\mathcal{D})\sum\left\|\overline{f}_n(\bar{x})-\overline{f}_m(\bar{x})\right\|_p\alpha(D) \quad + \quad \sum\frac{\varepsilon}{2^k}$$

$$<\varepsilon+\frac{\varepsilon}{\alpha(E)}\sum\alpha(D)+\varepsilon=3\varepsilon\,.$$

Thus, $\{\overline{f}_k\}$ is a Cauchy sequence, the result $\{\overline{f}_k\}$ convergent, to $\bar{a}$. It means it contains positive number k_0 by characteristic for every $k\ge k_0$ is applied

$$\left\|(R^*)\int_E \overline{f}_k d\alpha-\bar{a}\right\|_p<\varepsilon\,.$$

For every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at E it is taken $K=maks\{k_0,k_{\bar{x}}:\bar{x}\in D\}$ so for every Perron partition δ -fine $\mathcal{D}=\{(D,\bar{x})\}$ at E is applied

$$\left\|(\mathcal{D})\sum \overline{f}(\bar{x})\,\alpha(D)-\bar{a}\right\|_p \le$$
$$\left\|(\mathcal{D})\sum \overline{f}(\bar{x})\,\alpha(D)-(\mathcal{D})\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p +$$
$$\left\|(\mathcal{D})\sum \overline{f}_k(\bar{x})\,\alpha(D)-(R^*)\int_E \overline{f}_k d\alpha\right\|_p$$
$$\left\|(R^*)\int_E \overline{f}_k-\bar{a}\right\|_p<3\varepsilon\,.$$

In other words, it is proofed that $\overline{f}$ integraled Henstock at cell E and $\lim_{k\to\infty}(R^*)\int_E \overline{f}_k d\alpha=(R^*)\int_E \overline{f}d\alpha$.

Theorema 4.2 *If sequences of function measured* $\{\overline{f}_k\}$ *with the same LSRS at cell* $E\subset\Re^n$ *so* $\{\overline{f}_k\}$ *integraled Henstock at once at cell E.*

Proof:

Ranks of function measured $\{\overline{f}_k\}$ with the same LSRS at cell E , it means for every number $\varepsilon>0$ it contained positive δ_* function at E by the characteristic for every $\bar{y}\in E$ and for every partition Perron δ_* -fine $\mathcal{D}_*=\{(D,\bar{x})\}$ at cell $C\subset B(\bar{y},\delta(\bar{y}))$ and $\bar{y}\in C$ is applied

$$\left\|(\mathcal{D}_*)\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p<\varepsilon\,,$$

For every k.

Sequencesof function measured $\{\overline{f}_k\}$ convergent h.d. at cell E so that based on Egoroff Theorem it is contained open-group O dengan $\alpha(O)<\frac{\varepsilon}{2^k}$ by $\{\overline{f}_k\}$ characteristic of same convergent at $E\setminus O$. accordingly, it contains positive number K_0 by the characteristic for every $k\ge K_0$ is applied

$$\left\|\overline{f}_k(\bar{x})-\overline{f}(\bar{x})\right\|_p<\frac{\varepsilon}{7\alpha(D)}\,,\quad \text{for every } \bar{x}\in E\setminus O\,.$$

For every k, $\overline{f}_k\in R^*(E,\ell^p,\alpha)$ so that it contains positive δ_k function at cell E by the characteristic for every two partitions δ_k -fine $\mathcal{D}^1_k$, $\mathcal{D}^2_k$ at E is applied

$$\left\|\left(\mathcal{D}^1_k\right)\sum \overline{f}_k(\bar{x})\,\alpha(D)-\left(\mathcal{D}^2_k\right)\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p<\frac{\varepsilon}{7}$$

.

It is taken positive δ function at cell E by

$$\delta(\bar{x})=\begin{cases}\min\{\delta_*(\bar{x}),\delta_1(\bar{x}),...,\delta_{K_0}(\bar{x})\}, \forall\,\bar{x}\in E\setminus O\\ \min\{\delta_*(\bar{x}),\delta_1(\bar{x}),...,\delta_{K_0}(\bar{x}),d(\bar{x},\delta(O))\}, \forall\,\bar{x}\in O\end{cases}$$

.

Accordingly, for every two partisions δ -fine $\mathcal{D}^1$, $\mathcal{D}^2$ at E

1. If $k<K_0$ it is gotten

$$\left\|\left(\mathcal{D}^1\right)\sum \overline{f}_k(\bar{x})\,\alpha(D)-\left(\mathcal{D}^2\right)\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p<\frac{\varepsilon}{7}$$

.

2. Jika $k\ge K_0$

$$\left\|\left(\mathcal{D}^1\right)\sum \overline{f}_k(\bar{x})\,\alpha(D)-\left(\mathcal{D}^2\right)\sum \overline{f}_k(\bar{x})\alpha(D)\right\|_p<\frac{\varepsilon}{7}$$

$\le$

ISBN 978-602-19877-3-5

$$\left\| \left(\mathcal{D}^1\right)\sum \overline{f}_k(\overline{x})\,\alpha(D) - \left(\mathcal{D}^1\right)\sum \overline{f}_{K_0}(\overline{x})\alpha(D) \right\|_p$$

+

$$\left\| \left(\mathcal{D}^1\right)\sum \overline{f}_{K_0}(\overline{x})\,\alpha(D) - \left(\mathcal{D}^2\right)\sum \overline{f}_{K_0}(\overline{x})\alpha(D) \right\|_p$$

+

$$\left\| \left(\mathcal{D}^2\right)\sum \overline{f}_{K_0}(\overline{x})\,\alpha(D) - \left(\mathcal{D}^2\right)\sum \overline{f}_k(\overline{x})\alpha(D) \right\|_p +$$

$$< \left(\mathcal{D}^1\right) \sum_{\overline{x}\in E\setminus O} \left\| \overline{f}_k(\overline{x})\alpha(D) - \overline{f}_{K_0}(\overline{x})\alpha(D) \right\|_p + \frac{\varepsilon}{7} +$$

$$\left\| \left(\mathcal{D}^1\right)\sum_{x\in O} \overline{f}_k(\overline{x})\alpha(D) \right\|_p +$$

$$\left\| \left(\mathcal{D}^1\right)\sum_{x\in O} \overline{f}_{K_0}(\overline{x})\alpha(D) \right\|_p +$$

$$\left(\mathcal{D}^2\right) \sum_{\overline{x}\in E\setminus O} \left\| \overline{f}_k(\overline{x})\alpha(D) - \overline{f}_{K_0}(\overline{x})\alpha(D) \right\|_p +$$

$$\left\| \left(\mathcal{D}^1\right)\sum_{x\in O} \overline{f}_k(\overline{x})\alpha(D) \right\|_p$$

$$\left\| \left(\mathcal{D}^1\right)\sum_{x\in O} \overline{f}_{K_0}(\overline{x})\alpha(D) \right\|_p$$

$$< \frac{\varepsilon}{7}+\frac{\varepsilon}{7}+\frac{\varepsilon}{7}+\frac{\varepsilon}{7}+\frac{\varepsilon}{7}+\frac{\varepsilon}{7}+\frac{\varepsilon}{7} = \varepsilon .$$

It is proofed if sequences of functions is measured $\{\overline{f}_k\}$ by the same LSRS characteristic at cell E so $\{\overline{f}_k\}$ integraled Henstock at once at cell E.The equivalency of sequences of function integraled Henstock at oncewith ULSRS produced convergent theorem Integraled Henstock LSRS version as the theorem below:

Theorem4.3 *If the sequences of function is measured* $\{\overline{f}_k\}$ *by the same LSRS characteristic at cell* $E \subset \Re^n$ *and* $\overline{f}_k \to \overline{f}$ *h.d. at cell E for* $k \to \infty$ *so function* $\overline{f}$ *integraled Henstock at cell E and* $\lim_{k\to\infty} (R^*)\int_E \overline{f}_k d\alpha = (R^*)\int_E \overline{f}\, d\alpha$.

Proof:

Lemma 2.3 caused function $\overline{f}$ LSRS characteristic at cell E and is appropriate with Theorem1.10is acquired function $\overline{f}$ integraled Henstock at cell E by $\lim_{k\to\infty} (R^*)\int_E \overline{f}_k d\alpha = (R^*)\int_E \overline{f}\, d\alpha$.

5. CONCLUSION

Based on the explanation above, iit is conluded that there is an equivalency between ULSRS characteristic and ranks of convergent functios at once integraled.

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ISBN 978-602-19877-3-5

ESTIMATION ACTUAL VALUE BASED ON OUTPUT VALUE TOOLS OF A MEASURE USING THE INVERSE REGRESSION

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ABSTRACT

The need for digital measuring devices have been served with the development of science and technology. But because of the factors of production , the equipment sometimes produce output is lower or higher than it should be (actual / real). If the output value is not the same as the actual value, it may cause an error in the interpretation of the data. This can be solved by the inverse of the simple linear regression (inverse estimation). Thus, the problem in this research is "What form of estimating the actual value based on the output value of a measuring instrument with using the inverse of the simple linear regression?" The conclusion of the research, that the actual value can be estimated based on the output value of a tool measuring both classical as well as inverse.

Index Terms: Tool Measuring, Estimation, Actual Value, Output Value, Inverse Regression

1. INTRODUCTION

The need for digital measuring devices have been served with the development of science and technology . But because of the factors of production, the equipment sometimes produce output is lower or higher than it should be (actual / real)

If the output value issued by a measurement tool is not the same as the value of the actual (inaccurate), certainly can cause an error in the interpretation of the circumstances related to the measurement value . If this is not known and the gauge should make a decision , then it can lead to decisions that result would not be in accordance with the problems to be solved.

One example of such problems is the digital blood pressure measuring devices. On a digital blood pressure measuring instrument specified output value generated is higher than the actual situation . If the value of output produced is higher than the actual value, then the doctor or the nurse that use the tool will make decisions that are not in accordance with the patient's condition. For example, based on measurements by means of that patient's blood pressure is determined in the normal category , when in fact the patient's blood pressure was in the low category. Surely the patient's illness is not resolved in accordance with the problem

To solve the problem, we need a way so that the tool can still be used but the decision of the value of output produced can be interpreted in accordance with the actual value. This method relates to the existence of a transformation information that connects these two values

Phenomena that exist on the issue is affecting the actual value of the output value, the output value is not affecting the actual value . It can be said that there is a causal relationship between the two circumstances . If the relations of the linear then according [5] relationships can be analyzed either by using simple linear regression analysis

In the simple linear regression analysis , the relationship between variables associated with an equation called the simple linear regression model . The model [5] is $y = \beta_0 + \beta_1 x + \varepsilon$. Because the actual value affects the output value, the output value in this matter is the response variable y and the actual value of the regressor variable x

The parameter value β_0 and β_1 in model can be estimated based on sample data. If b_0 is an estimator for β_0 and b_1 is an estimator for β_1, then obtained the fitted regression linear model $\hat{y} = b_0 + b_1 x$. This model show that the output value can be estimated based on the actual value.

Based on the fitted regression linear model, can know the value of the output if the actual value is unknown. Because one of the uses of regression is to predictions, it can be formed an interval to the value expected. Interval of values that supposedly is called the prediction interval [5]. If that would fitted is the output value will be obtained prediction interval for the output value associated with an actual value is unknown. Similarly , if that would fitted is the actual value will be obtained prediction interval for the actual value that corresponds to a known output value.

At the above problems, which will supposedly is the actual value based on the value of output . As a result, the regression model can not be used in the most direct way. According to [2], this can be solved by reverse approach that called inverse regression estimation. Inverse estimation is the inverse of the simple linear regression.

In general, there are two methods to solve inverse simple linear regression, which is the classical method and the inverse method [6]. Classical methods looked at in reverse from a linear regression analysis, while the method of inverse change regressor variables into response variable and the response

ISBN 978-602-19877-3-5

variable into regressor variable from simple linear regression analysis [10].

Classical methods is used for estimate a actual value x_o that relate with output value y_o with model $\hat{y}_o = b_0 + b_1 x_o$. As a result, obtainable $\hat{x}_o = \frac{y_o - b_0}{b_1}$. While in inverse method, to estimate a actual value x_o that relate with output value y_o is used the fitted model $\hat{x}_o = a_0 + a_1 y_o$.

Model $\hat{x} = a_0 + a_1 y$ is a fit model from model simple linear regression $x = \alpha_0 + \alpha_1 y + \varepsilon'$. In this case, a_0 is estimator for α_0 and a_1 is estimator for α_1 .

Based on inverse simple linear regression, they can use to estimate actual value relating with output value that produced by a measurement. Thus, the accuracy of the output no longer be a problem, because the information from that measurement can be transformed in accordance with the state of its actual value.

Classical method and inverse method may provide a different estimation for x_o unknown value. Similiarly, for prediction interval of values x_o , there is a difference [10].

In the event of both methods produce different actual value, it will cause an error in the interpretation of the circumstances relating to the value data. If this condition is not known and the gauge should make a decision, then it is certainly the one that make the decision would not be in accordance with the problems to be solved. To that end, a review of the results that are given by the measuring instrument is needed. Thus, the problem in this research is "What form of estimating the actual value based on the output value of a measuring instrument with using the inverse of the simple linear regression?"

2. RESEARCH METHODS

Approaches used in this study is the analyze theory of the causal relationship in regression analysis. There any steps taken to answer the issue raised are the following,

First, examine about problems that occur in measuring devices, that is determining the characteristic of observational data on the device (output value) and the characteristic of real observation data (actual value).

Second, examine whether the assumptions are met by the data refer to a simple linear regression analysis.

Third, determine linear regression models were fit to the data, where the regressor variable is real data (actual value) and the response variable is tool data (output value). In this case, the phenomenon is real condition affect the output numbers on the tool

Fourth, determine the parameters in the model. Thus, the actual value can be determined and predition interval by using classical methods.

Fifth, determine the actual value and prediction interval by using the inverse method.

3. RESULTS AND DISCUSSIONS

Suppose there are n samples of the measurement results of a tool. Value issued by a tool called the value of the output of the tool and the actual values referred to the actual value

3.1. Response Variable is Output Value of The Instrument

Relationship actual value and the output value can be demonstrated by using a model of simple linear regression

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i$$

On the problem of determining the actual value based on the output value of a instrument identical to the determination of the value of regressor variable x by the value of the response variable y . Because the output value is known, in this case the value of the response variable y in the equation is known.

If seen from the value of the response variable y and the value of regressor x then both the value of this variable is visible varies . For value the same response variable y can be related to the value of x different regressor variable, and vice versa. Consequently, if it becomes an output value (the value of the response variable y) then surely you want an actual value (the value of regressor variable x) . Therefore , in this study conducted centering on the regressor variable x.

3.1.1. Centralization of The Regressor Variable x

Centralization of the regressor variable x is done by using $(x - \bar{x})$. This centralization is the steps in Graybill Method [10]. For the next step , if done the centralization then equation (1) becomes

$$y_i = \gamma_0 + \gamma_1 (x_i - \bar{x}) + \varepsilon_i$$

Then, $\varepsilon_i = y_i - \gamma_0 - \gamma_1 (x_i - \bar{x})$

For that, will be determined $\hat{\gamma}_0$ dan $\hat{\gamma}_1$ as parameter estimation γ_0 and γ_1 by using the least squares method.

The least squares method aims to minimize the sum of squared errors such that minimum. The error sum of squares is

$$S = \sum_{i=1}^{n} \varepsilon_i^{\,2} = \sum_{i=1}^{n} [\, y_i - \gamma_0 - \gamma_1 (x_i - \bar{x}) \,]^2$$

Least squares estimator for γ_0 and γ_1 , namely $\hat{\gamma}_0$ dan $\hat{\gamma}_1$, must be

ISBN 978-602-19877-3-5

$$\sum_{i=1}^{n} y_i - \hat{\gamma}_1 \sum_{i=1}^{n} (x_i - \bar{x}) = n\,\hat{\gamma}_0 ,$$

or, $\hat{\gamma}_0 = \dfrac{\sum_{i=1}^{n} y_i}{n} - \hat{\gamma}_1 \dfrac{\sum_{i=1}^{n} (x_i - \bar{x})}{n}$

Because $\sum_{i=1}^{n} (x_i - \bar{x}) = 0$ then $\hat{\gamma}_0 = \bar{y}$

and $\hat{\gamma}_1 = \dfrac{\sum_{i=1}^{n} y_i (x_i - \bar{x})}{\sum_{i=1}^{n} (x_i - \bar{x})^2}$

Thus, the prediction model for

$$y_i = \gamma_0 + \gamma_1 (x_i - \bar{x}) + \varepsilon_i$$

is

$$\hat{y}_i = \bar{y} + \hat{\gamma}_1 (x_i - \bar{x})$$

where $\bar{y} = \dfrac{1}{n}\sum_{i=1}^{n} y_i$ and $\bar{x} = \dfrac{1}{n}\sum_{i=1}^{n} x_i$

3.1.2. Estimation For Actual Value

Measuring with a tool often the actual value is unknown, but the output value can be known from the output tool . Suppose there is a sample of size n + k . Then the estimation for x_0 [3] is

$$\bar{y}_0 = \hat{\gamma}_0 + \hat{\gamma}_1 (\hat{x}_0 - \bar{x})$$

$$\bar{y}_0 - \hat{\gamma}_0 = \hat{\gamma}_1 (\hat{x}_0 - \bar{x})$$

$$\frac{\bar{y}_0 - \hat{\gamma}_0}{\hat{\gamma}_1} = (\hat{x}_0 - \bar{x})$$

$$\hat{x}_0 = \bar{x} + \frac{\bar{y}_0 - \hat{\gamma}_0}{\hat{\gamma}_1}$$

$$\hat{x}_0 = \bar{x} + \frac{\bar{y}_0 - \bar{y}}{\hat{\gamma}_1} \quad , \text{ with } \hat{\gamma}_1 \neq 0$$

where $\bar{y}_0 = \dfrac{1}{k}\sum_{i=n+1}^{n+k} y_i$

On one measure , for a new observation y_0 value will be equal to the value of the variable x_0 prediction on classical methods, so $\bar{y}_0 = y_0$. Therefore, $\hat{\gamma}_1 = \hat{\beta}_1$. Thus,

$$\hat{x}_0 - \bar{x} = \frac{y_0 - \bar{y}}{\hat{\beta}_1}$$

$$\hat{\beta}_1 (\hat{x}_0 - \bar{x}) = y_0 - \bar{y}$$

$$\hat{\beta}_1 \hat{x}_0 = y_0 - (\bar{y} - \hat{\beta}_1 \bar{x})$$

$$\hat{\beta}_1 \hat{x}_0 = y_0 - (\bar{y} - \hat{\gamma}_1 \bar{x})$$

Because $\hat{\beta}_0 = \bar{y} - \hat{\gamma}_1 \bar{x}$, then

$$\hat{\beta}_1 \hat{x}_0 = y_0 - \hat{\beta}_0$$

Thus, the estimate obtained for the actual value is

$$\hat{x}_0 = \frac{y_0 - \hat{\beta}_0}{\hat{\beta}_1} = \bar{x} + \frac{\bar{y}_0 - \hat{\gamma}_0}{\hat{\gamma}_1}$$

Because the actual value varies , the interval will be determined for the actual value . To determine the actual value interval are required the following.

3.1.3. Variance Estimation (σ^2)

Suppose there is a sample of size n + k. Then for a sample of size n , obtained error or residual is

$$e_i = y_i - \hat{y}_i = y_i - \hat{\gamma}_0 - \hat{\gamma}_1 (\hat{x}_0 - \bar{x})$$

For the next a sample of size k , which measures the value of observation y with $k \geq 1$ at x_0 unknown, sum of squares residual is

$$\sum_{i=n+1}^{n+k} e_i^{\,2} = = \sum_{i=n+1}^{n+k} (y_i - \bar{y}_0)^2$$

It is obtained

$$\sum_{i=1}^{n+k} e_i^{\,2} = \sum_{i=1}^{n} e_i^{\,2} + \sum_{i=n+1}^{n+k} e_i^{\,2}$$

$$= \sum_{i=1}^{n} [\, y_i - \hat{\gamma}_0 - \hat{\gamma}_1 (\hat{x}_0 - \bar{x}) \,]^2 + \sum_{i=n+1}^{n+k} (y_i - \bar{y}_0)^2$$

Then the estimate for σ^2 is

$$\hat{\sigma}^2 = \frac{\sum_{i=1}^{n+k} e_i^{\,2}}{n + k - 3}$$

For a new observation y_0 will be determined prediction actual value x_0. Because the actual value varies , it can be seen only for a new observation value Because the actual value varies , it can be seen only for a new observation value y_0 , ie k = 1 . So that,

$$\hat{\sigma}^2 = \frac{\sum_{i=1}^{n+1} e_i^{\,2}}{n - 2}$$

Because there is only one new observation value y_0 , then $\bar{y}_0 = y_{n+1}$. So that,

$$\hat{\sigma}^2 = \frac{1}{n-2} \sum_{i=1}^{n} \left[y_i - \hat{\gamma}_0 - \hat{\gamma}_1 (x_i - \bar{x}) \right]^2$$

The parameters that have been estimated above $\hat{\gamma}_0$, $\hat{\gamma}_1$, dan $\hat{\sigma}^2$ are estimator Best Linear Unbiased Estimator / BLUE [11].

ISBN 978-602-19877-3-5

An estimator is said to be biased if the value of expectation is equal to the value of the actual parameter. An estimator is said to be the best if the estimator has the smallest variance value compared with other estimator is also unbiased.

3.1.4. Prediction Interval For Actual Value

Based on what has been stated above, ie for a new observation y_0 will be determined prediction actual value x_0. In this case, $y_i = \bar{y}_0$. As a result,

$$E(e_i) = E[\bar{y}_0 - \hat{\gamma}_0 - \hat{\gamma}_1(x_0 - \bar{x})] = 0$$

$$\text{Var}[\bar{y}_0 - \hat{\gamma}_0 - \hat{\gamma}_1(x_0 - \bar{x})] =$$

$$\sigma^2 + \frac{\sigma^2}{n} + (x_0 - \bar{x})^2 \frac{\sigma^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2} =$$

$$\sigma^2\left[1 + \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}\right]$$

Then, $\dfrac{\sum_{i=1}^{n}\left[y_i - \hat{\gamma}_0 - \hat{\gamma}_1(x_i - \bar{x})\right]^2}{\sigma^2} \sim \chi^2_{n-2}$

So that,

$$T = \frac{\dfrac{\bar{y}_0 - \hat{\gamma}_0 - \hat{\gamma}_1(x_0 - \bar{x})}{\sqrt{\sigma^2 A^2}}}{\sqrt{(n-2)\left(\dfrac{\hat{\sigma}^2}{\sigma^2}\right)/(n-2)}} =$$

$$\frac{\bar{y}_0 - \hat{\gamma}_0 - \hat{\gamma}_1(x_0 - \bar{x})}{\hat{\sigma} A} \sim t_{\alpha/2,(n-2)}$$

with $A^2 = 1 + \dfrac{1}{n} + \dfrac{(x_0 - \bar{x})^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$

Note that $P(-t_{\alpha/2,(n-2)} \le T \le t_{\alpha/2,(n-2)}) = 1 - \alpha$. With confidence $(1 - \alpha)$ 100% , then

$$\left[\frac{\bar{y}_0 - \hat{\gamma}_0 - \hat{\gamma}_1(x_0 - \bar{x})}{\hat{\sigma} A}\right]^2 \le t^2_{\alpha/2,(n-2)}$$

$$[\bar{y}_0 - \hat{\gamma}_0 - \hat{\gamma}_1(x_0 - \bar{x})]^2 -$$

$$\hat{\sigma}^2\left[1 + \frac{1}{n} + \frac{(x_0 - \bar{x})^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}\right] t^2_{\alpha/2,(n-2)} \le 0$$

So that,

$$\left[\hat{\gamma}_1^2 - \frac{\hat{\sigma}^2 t^2_{\alpha/2,(n-2)}}{\sum_{i=1}^{n}(x_i - \bar{x})^2}\right](x_i - \bar{x})^2 -$$

$$2\hat{\gamma}_1(\bar{y}_0 - \hat{\gamma}_0)(x_0 - \bar{x}) +$$

$$\left[(\bar{y}_0 - \hat{\gamma}_0)^2 - \hat{\sigma}^2 t^2_{\alpha/2,(n-2)}\left(1 + \frac{1}{n}\right)\right] \le 0$$

and,

$$[-2\hat{\gamma}_1(\bar{y}_0 - \hat{\gamma}_0)]^2 -$$

$$4\left[\hat{\gamma}_1^2 - \frac{\hat{\sigma}^2 t^2_{\alpha/2,(n-2)}}{\sum_{i=1}^{n}(x_i - \bar{x})^2}\right]$$

$$\left[(\bar{y}_0 - \hat{\gamma}_0)^2 - \hat{\sigma}^2 t^2_{\alpha/2,(n-2)}\left(1 + \frac{1}{n}\right)\right] =$$

$$4\hat{\sigma}^2 t^2_{\alpha/2,(n-2)}\left\{a\left(1 + \frac{1}{n}\right) + \frac{(\bar{y}_0 - \hat{\gamma}_0)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}\right\}$$

where $a = \hat{\gamma}_1^2 - \dfrac{\hat{\sigma}^2 t^2_{\alpha/2,(n-2)}}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$

Then the predictions obtained actual value x_0 for the confidence interval $(1 - \alpha)$ 100% as follows

$$(x_0 - \bar{x}) = \frac{\hat{\gamma}_1(\bar{y}_0 - \hat{\gamma}_0)}{a} \pm$$

$$\frac{\hat{\sigma} t_{\alpha/2,(n-2)}\sqrt{\left\{a\left(1 + \frac{1}{n}\right) + \dfrac{(\bar{y}_0 - \hat{\gamma}_0)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}\right\}}}{a}$$

where $a = \hat{\gamma}_1^2 - \dfrac{\hat{\sigma}^2 t^2_{\alpha/2,(n-2)}}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$

3.2. Response Variable is Actual Value of The Instrument

Estimated value for regressor variable can be obtained by exchanging the role of regresssor variable into the response variable , and vice versa. When using linear regression models x on y , must be fulfilled assumption that y is a certain value and not a

ISBN 978-602-19877-3-5

random variable and also x must be filled with the assumption that x is a random variable.

Simple linear regresssion x on y is $x = \alpha_1 + \alpha_2 y + \varepsilon'$. If given the value for the variable x, let x_o (unknown) and can be obtained observed value y corresponding to x_o , let y_o. Estimated for x_o is

$$\hat{x}_o = a_0 + a_1 y_o$$

where $$a_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$$

Similiarly, a simple linear regresssion of y on x , parameter estimators a_0 dan a_1 can be obtained by using the least squares method

Prediction interval for actual value x_o can be estimated using

$$\hat{x}_o - t_{\alpha/2,n-2}\sqrt{MS_{Res}\left(1+\frac{1}{n}+\frac{(y_o-\bar{y})^2}{\sum_{i=1}^{n}(y_i-\bar{y})^2}\right)} \le x_o \le \hat{x}_o + t_{\alpha/2,n-2}\sqrt{MS_{Res}\left(1+\frac{1}{n}+\frac{(y_o-\bar{y})^2}{\sum_{i=1}^{n}(y_i-\bar{y})^2}\right)}$$

4. CONCLUSION

Based on the results obtained conclusions that actual value can be predicted from the output value of a measuring instrument using the inverse of the simple linear regression in the following way..

First, if response variable is output from measurement, then

$$\hat{x}_0 = \frac{y_0 - \hat{\beta}_0}{\hat{\beta}_1} = \bar{x} + \frac{\bar{y}_0 - \hat{\gamma}_0}{\hat{\gamma}_1}$$

where $$\hat{\gamma}_1 = \frac{\sum_{i=1}^{n} y_i (x_i - \bar{x})}{\sum_{i=1}^{n} (x_i - \bar{x})^2}$$

$$\hat{\gamma}_0 = \frac{\sum_{i=1}^{n} y_i}{n} - \hat{\gamma}_1 \frac{\sum_{i=1}^{n} (x_i - \bar{x})}{n} = \bar{y}$$

Second, if response variable is actual value, then $\hat{x}_o = p + q y_o$ where

$$q = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$$

$$p = \bar{x} - q\bar{y} .$$

Prediction interval for actual value base on output value from measurement using the inverse of the simple linear regression can be formed in the following way.

First, if response variable is output value from measurement, then

$$\bar{x} + \frac{\hat{\gamma}_1(\bar{y}_0 - \hat{\gamma}_0)}{a} - \frac{\hat{\sigma} t_{\alpha/2,(n-2)}\sqrt{\left\{a\left(1+\frac{1}{n}\right)+\frac{(\bar{y}_0-\hat{\gamma}_0)^2}{\sum_{i=1}^{n}(x_i-\bar{x})^2}\right\}}}{a} \le x_0 \le \bar{x} + \frac{\hat{\gamma}_1(\bar{y}_0 - \hat{\gamma}_0)}{a} - \frac{\hat{\sigma} t_{\alpha/2,(n-2)}\sqrt{\left\{a\left(1+\frac{1}{n}\right)+\frac{(\bar{y}_0-\hat{\gamma}_0)^2}{\sum_{i=1}^{n}(x_i-\bar{x})^2}\right\}}}{a}$$

with $$a = \hat{\gamma}_1^{\,2} - \frac{\hat{\sigma}^2 t^2_{\alpha/2,(n-2)}}{\sum_{i=1}^{n}(x_i-\bar{x})^2}$$

Second, if response variable is actual value from measurement, then

$$\hat{x}_o - t_{\alpha/2,n-2}\sqrt{\hat{\sigma}^2\left(1+\frac{1}{n}+\frac{(y_o-\bar{y})^2}{\sum_{i=1}^{n}(y_i-\bar{y})^2}\right)} \le x_o \le \hat{x}_o - t_{\alpha/2,n-2}\sqrt{\hat{\sigma}^2\left(1+\frac{1}{n}+\frac{(y_o-\bar{y})^2}{\sum_{i=1}^{n}(y_i-\bar{y})^2}\right)}$$

ISBN 978-602-19877-3-5

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ISBN 978-602-19877-3-5

VALUING EMPLOYEE STOCK OPTIONS (ESO) UNDER EMPLOYEE FORFEITURE RATE

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ABSTRACT

Employee Stock Option (ESO) is a type of call options which granted to employees of a company for free as a form of compensation to its employees. ESO entitles employees to buy shares of the company within a period of time and certain vesting period. ESO has a difference with the usual options traded, so this is what distinguishes it calculated from the other types of options. In this paper will be used the CRR binomial method (Cox-Ross-Rubinstein) in calculating the fair value of ESO, which applied in several models, which are popular models and the new model. The models are SFAS 123 (R) model, and the Hull-White model, as well as new models that employee forfeiture rate model where in this model has taken into account the employee exit rate. The employee exit rate effect will be reflected right after the exercise, which decreases the outstanding stock price. Then the results of this model will be compared with the SFAS 123 (R) model, and the Hull-White model. At the end of this paper will also be shown the influence of several specific parameters to the ESO's value. Parameters which observed are volatility parameter, interest rate, dividends and employees forfeiture rate.

Index Terms : Employee Stock Options, SFAS 123 (R) Model, Hull-White Model, Employee Forfeiture Rate Model

1. INTRODUCTION

Options are a form of financial derivatives in the form of an agreement between the two parties, namely the issuing party the option seller (writer) to the option buyer (holder), in which a holder is given the right (not the obligation) to buy or sell an asset to the writer at a specified price (strike price) and within (maturity time) is set.

Based on the rights owned by the owner of the option, the option is divided into two kinds of options, both options are:

Call option (call option) which is the option that gives the right (not the obligation) to the holder to buy an asset of a writer at a specified price (the strike price, exercise price) and at a predetermined time (expiry date, maturity time). Put option (put option) is the option that gives the right (not the obligation) to holder to sell an asset to the writer at a specified price (strike price / exercise price) and at a predetermined time (expiry date / maturity time). The payoff of the option at maturity is:

$$\text{Call} = C = \text{Max}\{S(T) - K, 0\}$$
and
$$\text{Put} = P = \text{Max}\{K - S(T), 0\}$$

where T is maturity time, S(T) is stock price at the maturity time, K is strike price, C call option, and P is put option[4]

One option commonly used form is the Employee Stock Option (ESO). Employee stock options are a different type of call options with an option that can be traded on the options market, where this option is given free of charge by a company (writer) to a group of employees (holder) specified in the company as a form of incentive. ESO is one of the incentives given by the company in addition to salary, bonuses, allowances, insurance and others.

Source shares of ESO offered may include the issuance of new shares and can also result buy-back of shares (shares repurchased by the company) from existing shareholders. So ESO is one of the company's strategy of providing incentive for employees with stock-based compensation. The amount of compensation expense, related to the determination of fair value ESO, which under SFAS No. 53 is determined by option pricing model include the formulation of the Black-Scholes or Binomial method.

The purpose of the employee stock option itself is a desire to align the company, employees, and shareholders. For the purpose of the company ESO are:

a. By giving ESO is expected to spur and motivate employee morale to be optimized, thus increasing the performance of the company, which in turn makes the company's stock price rose / improved.
b. In order for companies to retain employees and achieve superior, because ESO an incentive for employees who excel in a company.
c. To foster a sense of belonging and sense of responsibility of an employee of the company.

As for the employees themselves, with the increase in the company's stock price will be obtained profit from a large payoff when clicking ESO exercise. As for shareholders, giving ESO this will

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have an impact on improving the huge dividends if the share price rises. What is meant by the employees here is not just an ordinary worker, but also including members of the board of directors and commissioners. As for receivers ESO itself, can be done thoroughly to all employees without the selection process, or Even if through selection, carried out by the post or other, more qualitative criteria, depending on the purpose given ESO [10].

In general, employee stock options (ESO) has some differences with the options that are traded on the options market generally. ESO is what distinguishes the difference with other options in the calculation [8]. Among the special features is the difference are:

a. A call option issued by a corporation on shares of the company itself.
b. Having a waiting period (vesting period), where the waiting period is the option can not be implemented (diexercise). If the employee left the company either voluntarily or not during the waiting period, then the option will be canceled. But if the employee left the company after a waiting period, the option can be exercised immediately (early exercise) if the market price of shares in the state-in-the-money, but the option can not be implemented if the stock market price in an out-of-the-money.
c. Employees are not allowed to sell its ESO (changing hands). So that if an employee wants to immediately realize its ESO in cash, then the employee must sell the shares to be acquired. This situation encourages ESO to be implemented more quickly before the maturity date (early exercise). This is possible because ESO can be executed at any time, begins after a waiting period ends until maturity.
d. ESO generally have a maturity period of time (several years) and usually 10 years.

In this paper will be used assuming that the ESO may change hands / ignore the special feature on point c above.

The value of the ESO is calculated in order for companies using ESO as a form of incentive to its employees can prepare / reserve fund for the purposes of the ESO, which is valued at fair value. This is done so that when the ESO diexercise, the company is ready with the reserved funds. At this writing ESO value will be determined using 3 in which two of them are frequently used models, namely the model of SFAS 123 (R), and the Hull-White models. Then the results obtained in this model will be compared with the model Employee forfeiture rate which in this model employee rate factors are out of the company are taken into account. Next will be the influence of certain parameters on the price of ESO. At this writing the number of employees who left the company is modeled as a Poisson process with a rate of λ. So the chances of an employee leaving the company is given by $\left(1 - e^{-\lambda \Delta t}\right)$.

1.1. Calculated Models for ESO

In this paper will be used Binomial method CRR (Cox, Ross, Rubienstein) in determining the fair value option. According to Cox, Ross, and Rubinstein for the value u and d and p can be used:

$$u \approx e^{\sigma\sqrt{\Delta t}}, \quad d = \frac{1}{u} = \frac{1}{e^{\sigma\sqrt{\Delta t}}} = e^{-\sigma\sqrt{\Delta t}}, \qquad p = \frac{e^{r\Delta t} - d}{u - d}$$

Let at $t_0 = 0$ the stock price is S_0, so the value of stock according to binomial models at $t_1 = 1.\Delta t$ which given by $S_0 u$ or $S_0 d$. Next at t_2 will be valued as one of $S_0 d^2, S_0 ud$ or $S_0 u^2$. By using the recursion , so at $t_j = j.\Delta t$ will be present $j + 1$ stock price which will be happen, that given by:

$$S_{i,j} = S_0 u^i d^{j-i}, \quad i = 0,1,2, \dots, j$$

with $S_{i,j}$ show the stock price at t_j and there are i times of increasing stock price and decreasing stock price as many as $j - i$ times, whice count from $t_0 = 0$. At the maturity time $t_M = M.\Delta t = T$, there are M +1 of stock price that is $\{S_{i,M}\}_{i=0,1,\dots,M}$. To determine the value of the stock price on the binomial tree, then the calculation by movement backward (backward), while to determine the value of the option then do the calculations with forward motion (forward).

1.2. SFAS 123 (R) Model

Under Statement of Financial Accounting Standard No. 123 (revised 2004) issued by the Financial Accounting Standards Boards (FASB) on Share-Based Payments (SFAS 123R), or better known as share-based payment, stated that all entities must recognize that payment employee stock options based on the amount of fair value.

Under the rules of SFAS 123 (R) for the calculation of the fair value of ESO used the Black-Scholes formula or by using the Binomial method. This is because the binomial method is more flexible than the formulation BS. In addition binomial method also is convergent towards the formulation BS and also able to combine Characteristic and special features of the ESO.

In calculations using the model of SFAS 123 (R), to be used when due ESO expected lifetime of the options. Where great expectations for the lifetime of the option at each node in the binomial tree is not necessarily the same. This is because of the possibility not to do exercise on a particular node because it depends on the position of the option at the time. The following are the calculation of expected lifetime of the options:

Suppose there are N subselang during the lifetime of ESO, the T is maturity time so that for each interval having a length of $\Delta t = \frac{T}{N}$. Let $E_{i,j}$ express as the expectation of life time at $j\Delta t$ for node - i, with $j = 0,1,2, \dots, N$ and $i = 0,1,2, \dots, j$, v is the end of the waiting period and D is the dividend. For a life time expectation value when due, is given by $E_{i,N} = 0$, and $p = \frac{e^{(r-D)\Delta t} - d}{u - d}$. While for the maturity

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time period $(0 \le j \le N-1)$, must be fulfilling the criterion below:
Along the maturity time $j\Delta t < v$:

a. Expectations lifetime for each increment i, is given by:
$$p \times E_{i+1,j+1}$$
b. Lifetime expectation for any decreament i, is given by:
$$(1-p) \times E_{i,j+1}$$

So the value of expectations of lifetime during the waiting period are:
$$E_{i,j} = p \times E_{i+1,j+1} + (1-p) \times E_{i,j+1} + \Delta t$$
After vesting period $j\Delta t \ge v$

a. If the option was exercised, so the expectation of life time is $E_{i,j} = 0$.
b. If the option is kept, so the expectation of life time is :
   1) If the employee leave the company with probability $1 - e^{-\lambda\Delta t}$ so the expectation of life time is :
   $$E_{i,j} = \left(1 - e^{-\lambda\Delta t}\right)0 = 0$$
   2) If the employee doesn't leave the company $e^{-\lambda\Delta t}$, so the expectation of life time is : :
   $$E_{i,j} = e^{-\lambda\Delta t}(p \times E_{i+1,j+1} + (1-p) \times E_{i,j+1} + \Delta t)$$

So to the criteria of time after the waiting period expires, the value of expectations of life is given by:
$$E_{i,j} = \left(1 - e^{-\lambda\Delta t}\right).0 + e^{-\lambda\Delta t}(p \times E_{i+1,j+1} + (1-p) \times E_{i,j+1} + \Delta t)$$
The value of expectations for the entire life of the option is $E_{0,0}$.

Furthermore, to obtain the value of ESO using a model of SFAS 123 (R), the first European call option value is calculated using the binomial CRR, which for the time of maturity used E_0,0 obtained in the above manner, the interest rate r, and to strike price K.

Furthermore, after the obtained value of the European call option, it is then determined the value of ESO by using SFAS 123 (R) model as follows:
$$C^{\text{SFAS 123 (R)}} = \left(e^{-\lambda}\right)^{v} \times C^{\text{T=expected life}}$$
Where $C^{\text{SFAS 123 (R)}}$ stating the amount ESO using a model of SFAS 123 (R), $C^{\text{T=expected life}}$ declare the value of the European call options with a time to maturity is $E_{0,0}$ obtained as the above, and multiplied by $\left(e^{-\lambda}\right)^{v}$, where $e^{-\lambda}$ an opportunity employees who remain in the company during the waiting period [7]. In this model, the weakness is not accounting for the rate of employees who left the company after a waiting period.

1.3. HULL-WHITE Model

In this model has taken into account the opportunities of employees to leave the company after a waiting period. Explicitly this model combines the strategy of early exercise by assuming that in the period after the waiting period ends until the time of maturity, the option will be executed if the stock price at least for a multiple M of the strike price $(S_{i,j} \ge MK)$ [6].

On each short time interval of Δt during the waiting period, the opportunity represented by the employee leaves the company $1 - e^{-\lambda\Delta t}$, with λ is the rate of employees leaving the company per year. While after the waiting period, within a short time interval Δt, there are chances that the employee leaves the company $1 - e^{-\lambda\Delta t}$. In these circumstances an employee will immediately mengexercise its options if the stock price is in a state in-the-money. However, if the share price is in a state of out-of-the-money option should not be diexercise.

Suppose there are N subselang during the lifetime of ESO, the T is maturity time so that for each interval having a length of $\Delta t = \frac{T}{N}$. Let $S_{i,j}$ and $C_{i,j}$ respectively shows the value of stock, and the option price at $j\Delta t$ for node -i, with $j = 0,1,2,\dots,N$ and $i = 0,1,2,\dots,j$, v is the end of the waiting period, r is the risk-free interest rates, D is dividends and K is the strike price. For the share price at each node is obtained by performing forward motion (forward) using the binomial CRR is $S_0 u^i d^{j-i}$ and $u = e^{\sigma\sqrt{\Delta t}}, d = e^{-\sigma\sqrt{\Delta t}}, p = \frac{e^{(r-D)\Delta t} - d}{u-d}$, while for the price of the option itself is calculated by the motion backward (backward) that starts with calculating the option price at maturity is (j = N). For option value when due, given by the intrinsic value that is equal $C_{i,N} = \max\{S_{i,N} - K, 0\}$. while for the node $(0 \le j \le N-1)$, must be fulfilling the criterion below:
Along the vesting period is $j.\Delta t < v$:

a. If the employee leaves the company with opportunities for $1 - e^{-\lambda\Delta t}$ then the option will be canceled so that the value 0.
b. If the employee don't leaves the company with opportunities for $e^{-\lambda\Delta t}$ so the option value must be $e^{-\lambda\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$.
   So the option price during the waiting period is obtained from the sum of the two points above, namely:
$$C_{i,j} = 0 + e^{-\lambda\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right) = e^{-\lambda\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$$
Along the period after vesting period is $j\Delta t \ge v$
c. If the share price is greater than or equal to the exercise strategy criteria $(S_{i,j} \ge MK)$, then the option will be exercised. If the employee leaves the company with opportunities $1 - e^{-\lambda\Delta t}$, then the option value is:

$\left(1 - e^{-\lambda\Delta t}\right)(S_{i,j} - K)$. However, if employees remain in the company with opportunities $e^{-\lambda\Delta t}$, the the option value which granted is $e^{-\lambda\Delta t}\left(S_{i,j} - K\right)$. so, for this criterion must be fulfilling by:

ISBN 978-602-19877-3-5

$$C_{i,j} = \left(1 - e^{-\lambda\Delta t}\right).\left(S_{i,j} - K\right) + e^{-\lambda\Delta t}.\left(S_{i,j} - K\right) = S_{i,j} - K$$

d. When the stock price less than the exercise criteria ($S_{i,j} < MK$), if the employee leaves the company with opportunities $1 - e^{-\lambda\Delta t}$, the the option value will be granted as $\left(1 - e^{-\lambda\Delta t}\right)\max\{S_{i,j} - K, 0\}$. However, if the employees remained in the company with opportunities $e^{-\lambda\Delta t}$, then the option value is $e^{-\lambda\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$. So the option price for this criterion is:

$$C_{i,j} = \left(1 - e^{-\lambda\Delta t}\right)\max\{S_{i,j} - K, 0\} + e^{-\lambda\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$$

And for ESO Value will be fulfilled by $C_{0,0}$.

1.4. Employee Forfeiture Rate Model

Earlier in the calculation of the value of ESO using a model of SFAS 123 (R), having obtained a European call option value by using backward induction, then the next to gain value $C^{\text{SFAS 123(R)}}$ and multiplied by $\left(e^{-\lambda}\right)^{v}$ which is an opportunity employees remain in the company during the waiting period. From these assumptions stated that the rate of employees who left the company is constant. However the assumption that the rate of employees who left the company is a constant, is not realistic.

In this model will be considered the rate of employees who left the company before and after the waiting period. During the waiting period between the stock price at the rate of employees who left the company there is a negative correlation. The position of the option can be measured with $\frac{S_{i,j}}{K}$. As for the rate of employees who came out was measured by reverse that $\frac{K}{S_{i,j}}$ (negative correlation). At which time stock prices rise and stood at on-the-money employee will tend to remain in the company for some reason. However, if the share price down and are at the out-of-the-money employee is assumed to be likely to leave the company for a reason as well. So the chances of employees leaving the company will be corrected by a correction factor that is $K/S_{i,j}$.

While for a time after the waiting period will be corrected by using the exercise ratio (R_n).. According to Liao & Lyuu (2009), after a waiting period of exercise ratio (R_n). used the following criteria:

$$0 < S_{i,j} - K \le e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$$

So the chances of employees who left the company corrected by a correction factor $e^{-(\lambda \pm R_n)\Delta t}$. This is because there is a positive correlation between exercise ratio at a rate of employees who left the company. If the value of a positive exercise (the position of in-the-money), then on some particular reason an employee will immediately mengexercise option. This means an increase in exercise ratio, so that will be used upward adjustment by R_n is $e^{-(\lambda+R_n)\Delta t}$, where the employee after the options exercised have a great opportunity / free to leave the company. However, if the value is 0 or negative exercise (the position of at-the-money and out-of-the money), then on some particular reason an employee will retain the option and wait until they were in a position in-the-money. This translates into a decrease in exercise ratio, then used a downward adjustment is $e^{-(\lambda - R_n)\Delta t}$, this is because employees will not mengexercise the option in these conditions, so that employees opted to stay at the company to be in a position in-the-money. From the description of $e^{-(\lambda \pm R_n)\Delta t}$ namely as early exercise ratio.

Model Employee forfeiture rate is calculated by considering some aspects as described previously. Suppose there are N sub interval during the lifetime of ESO, the T is maturity time so that for each interval having a length of $\Delta t = \frac{T}{N}$. Let $S_{i,j}$ and $C_{i,j}$ respectively show that the stock price, and the option value at $j\Delta t$ in node - i, with $j = 0,1,2,\ldots,N$ and $i = 0,1,2,\ldots,j$, v is the end of vesting period, r is risk free interest rate , D is dividen, K is strike price. For the share price at each node is obtained by performing forward motion (forward) using the binomial CRR is $S_0 u^i d^{j-i}$ with $u = e^{\sigma\sqrt{\Delta t}}, d = e^{-\sigma\sqrt{\Delta t}}, p = \frac{e^{(r-D)\Delta t} - d}{u - d}$, while for the price of the option itself is calculated by the motion backward (backward) that starts with calculating the option price at maturity is $(j = N)$. For the value of the option at maturity, given by the intrinsic value that is equal $C_{i,N} = \max\{S_{i,N} - K, 0\}; j = 0,1,\ldots,N$. While for the other node $(0 \le j \le N-1)$, must be fulfilled by:

Along vesting period $j\Delta t < v$:

a. If the criterion $\frac{K}{S_{i.j}} < 1$ (in-the-money) is fulfilling, then:

$$C_{i,j} = e^{-\lambda\frac{K}{S_{i.j}}\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right).$$

b. If the criterion $\frac{K}{S_{i.j}} \ge 1$ (out-of-the-money) is fulfilling, then:

$$C_{i,j} = 0$$

Afthe the vesting time period $j\Delta t \ge v$

c. If the criterions is fulfilled by $S_{i.j} - K > e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$ then the option will be exercised with the provision that if the employee leaves the company with probability $1 - e^{-(\lambda+R_n)\Delta t}$, so the option price be given by $\left(1 - e^{-(\lambda+R_n)\Delta t}\right)\left(S_{i.j} - K\right)$. However, if the employees remained in the company with probabilities $e^{-(\lambda+R_n)\Delta t}$, so the option price is $e^{-(\lambda+R_n)\Delta t}\left(S_{i.j} - K\right)$. Thus the option price for these criteria are met by:

ISBN 978-602-19877-3-5

$$C_{i,j} = \left(1 - e^{-(\lambda+R_n)\Delta t}\right).\left(S_{i.j} - K\right) + e^{-(\lambda+R_n)\Delta t}.\left(S_{i.j} - K\right) = S_{i.j} - K$$

d. If the criterions is fulfilled by $0 < S_{i.j} - K \leq e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$ then the option will be exercised with the provision that if the employee leaves the company with probability $1 - e^{-(\lambda+R_n)\Delta t}$, the option price be given by $\left(1 - e^{-(\lambda+R_n)\Delta t}\right)\left(S_{i.j} - K\right)$. However, if the employees remained in the company with probabilities $e^{-(\lambda+R_n)\Delta t}$, so the option price is $e^{-(\lambda+R_n)\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$, Thus the option price for these criteria are met by:

$$C_{i,j} = \left(1 - e^{-(\lambda+R_n)\Delta t}\right)\left(S_{i.j} - K\right) + e^{-(\lambda+R_n)\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$$

e. If the criterions is fulfilled by $S_{i.j} - K \leq 0$, so must be fullfilles by $e^{-(\lambda-R_n)\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$, Thus the option price for these criteria are met by:

$$C_{i,j} = e^{-(\lambda-R_n)\Delta t}e^{-r\Delta t}\left(pC_{i+1,j+1} + (1-p)C_{i,j+1}\right)$$

For the ESO value is given by $C_{0,0}$.

2. RESULT

Prior seen how the value of the model OSN under SFAS 123 (R), Hull-White, and a model employee forfeiture rate in advance in terms of how changes in expectations of future life options on the model of SFAS 123 (R) under certain parameters.

$S = 50;\ K = 50; r = 5\%; T = 10\ years;\ D = 1\%;\ \lambda = 0.03;\ \sigma = 30\%;$

Vesting time	Expected Life
1	2.3760
2	3.6468
3	4.7185
4	5.6772

Table 1: The influence of vesting time to Expected Life

$S = 50;\ K = 50; r = 5\%; ; v = 3\ years; D = 1\%;\ \lambda = 0.03;\ \sigma = 30\%;$

Period	Expected Life
9	4.5670
10	4.7185
11	4.8958
12	5.2106

Table 2: The influence of T to Expected Life

$S = 50;\ K = 50; r = 5\%; T = 10\ years;\ v = 3\ years; D = 1\%;\ \lambda = 0.03;$

Volatility (σ)	Expected Life
10%	3.5324
20%	4.3770
30%	4.7185
40%	5.2867

Table 3: The influence of volatility to Expected Life

$S = 50;\ K = 50; T = 10\ years;\ v = 3\ years; D = 1\%;\ ;\ \sigma = 30\%;$

Exit Rate (λ)	Expected Life
0.01	4.8239
0.02	4.7701
0.03	4.7185
0.04	4.6692

Table 4: The influence of exit rate to Expected Life

$S = 50;\ K = 50; T = 10\ years;\ v = 3\ years; D = 1\%;\ \lambda = 0.03;\ \sigma = 30\%;$

Interest Rate (r)	Expected Life
4%	4.8701
5%	4.7185
6%	4.5733
7%	4.4350

Table 5: The influence of interest rate to Expected Life

From the results obtained in the tables above, it can be seen that the waiting period, time to maturity, and volatility has a positive correlation with the time expected lifetime of the options. The greater the value of these parameters will result in greater the expected life span of the option period. However, contrary to the parameters of interest rates and the rate of employees leaving the company. These parameters are negatively correlated with the expected lifetime of the options. So if the value of this parameter enlarges the lifetime expectation time options will be narrowed. This is because when the value of the interest rate and the rate of employee enlarged, it will be as soon as possible indicating ESO diexercise.

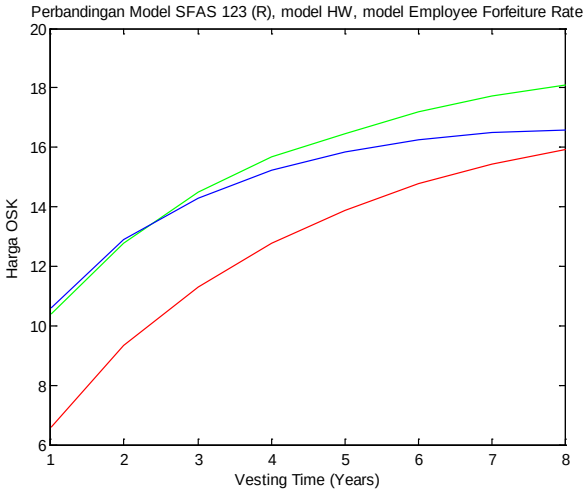
Further to the model value of ESO under SFAS 123 (R), Hull-White, and models Dilution seen from the following case: Suppose given a question of determining the value of employee stock options (ESO) with known that:

$$S = 50;\ K = 50; r = 5\%;\ T = 10\ years;\ v = 1 - 8\ years;\ D = 1\%\ \lambda = 0.03; \sigma = 30\%;\ \omega = 2500;\ \theta = 50$$

ISBN 978-602-19877-3-5

Vesting time	SFAS 123 (R)	Hull-White	Employee Forfeiture Rate
1	10.6106	6.5788	10.4005
2	12.8838	9.3414	12.7709
3	14.3053	11.2914	14.5062
4	15.2335	12.7612	15.6924
5	15.8537	13.8927	16.4687
6	16.2397	14.7665	17.1779
7	16.4803	15.4354	17.7188
8	16.5700	15.9367	18.0910

Tabel 6: ESO value with SFAS 123 (R), Hull-White and Employee Forfeiture Rate models



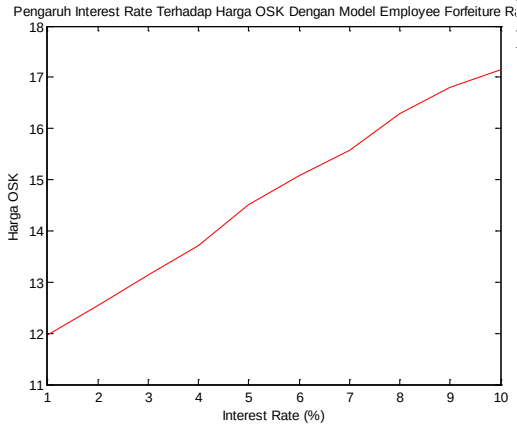
Pict 1: ESO price graphic by using SFAS 123 (R), Hull-White, and Employee Forfeiture Rate

From the results in Table 6 above shows that the value of employee stock options (ESO) by calculation using a model of SFAS 123 (R) and Hull-White models rose for every increase in the waiting period (vesting time). The increase in the value of the option that occurs in this model is quite large. As well as to value employee stock options (ESO) by calculation using a model Employee forfeiture rate experienced a sharp rise also to any increase in the waiting period (vesting time). In Figure 2, if we compare the value charts ESO using a model Employee forfeiture Rate model with SFAS 123 (R), and the model of the Hull-White model Hull-White and model of SFAS 123 (R), an increase in the price of ESO for each increment waiting period sharply and so was the model of the Employee forfeiture rate. The annual rise in the model Employee forfeiture rate significantly.

The Effect of Specific Parameter Value Model ESO Against the Employee Model forfeiture Rate

Suppose given a question of determining the value of employee stock options (ESO) which known that:

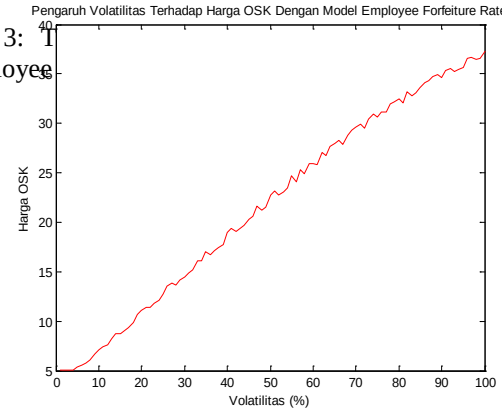
$S = 50;\ K = 50; r = 1\% - 10\%; T = 10\ ; years$
$v = 3\ years; D = 1\%;\ \lambda = 0.03;\ \sigma = 30\%;$



Pict 2: The influense of parameter r in Employee Forfeiture Rate model

$S = 50;\ K = 50; r = 5\%; T = 10\ years\ ; v = 3\ years;$
$D = 1\%;\ \lambda = 1\% - 10\%;\ \sigma = 30\%;$

Pict 3: T
Employee



$S = 50;\ K = 50; r = 5\%; T = 10\ years\ ; v = 3\ years;$
$D = 1\% - 10\%;\ \lambda = 0.03;\ \sigma = 30\%;$

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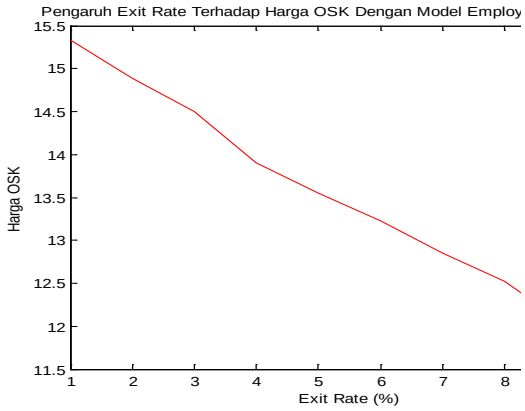
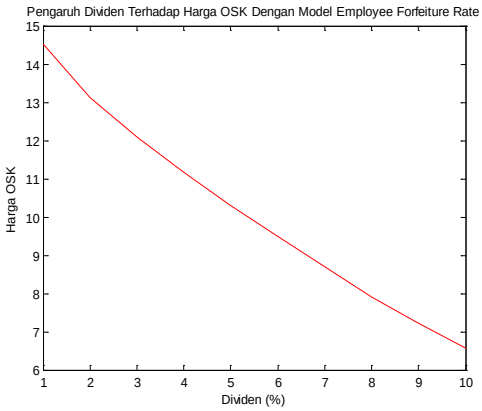


Pict 4: The influense of parameter λ in Employee Forfeiture Rate model



Pict 5: The influense of parameter D in Employee Forfeiture Rate model

Rom the results which obtained on the problem, as in the picture above it can be seen that the value of ESO increase for each increase in interest rates (interest rate) and volatility. This is because when interest rates rise, the stock price will go up, so the value of pay-off of opsipun also will increase. As well as on the value of the volatility, the current rise, the value will result in fluctuations in stock prices, which in this case the stock price moves up or down so that the stock price is difficult to predict. Because of this possibility of stock price rise will be even greater. So ESO also tend to be diexercise at a great value. But for the parameters and the dividend rate of the employee leaves the company applies vice versa. When the value of these parameters will swell then shrink ESO price. This is because the larger the dividends issued by the increase in stock prices will also shrink as well semakain if the rate of employees who left the company enlarges it will be a lot of ESO are not implemented by the employee. This has resulted in the value of ESO has narrowed.

3. CONCLUSION

From the results that have been obtained in the previous section, it can be concluded that:

1. The value of employee stock options (ESO) by calculation using a model Employee forfeiture rate experienced a significant increase for each increase in the waiting period (vesting time), and so also for models of SFAS 123 (R) and model of Hull-White, price ESO has increased to any increase in the waiting period.
2. Parameter r (interest rate) and σ (volatility), is positively correlated with the value of ESO, so the price of ESO increasing as the value of r further, this is because the stock price goes up when r goes up, so does the increase in volatility which resulted in share price more volatile.
3. Parameter D (Dividends) and λ (the rate of employees who left the company), negatively correlated with the value of ESO. So that when the value of dividend increases, the stock price increases will shrink because of the amount of the dividend is given, as well as the increase in the rate of employees who left the company, will lead to more and more options that are not diexercise because the employee leaves the company.

4. ACKNOWLEDGEMENT

We thank to Universitas Negeri Padang and Institut Teknologi Bandung who provided insight and expertise that greatly assisted the research.

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ISBN 978-602-19877-3-5

AN OVERVIEW OF METHODS FOR INCREASING THE PERFORMANCE OF GENETIC ALGORITHM

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ABSTRACT

Genetic algorithm is a heuristic search algorithm based on the idea of natural selection that occurs in the process of evolution and genetic operations. one of the important stages in the genetic algorithm is a crossover process. Performance of the genetic algorithm depends on several aspects such as: population size, population diversity, the selection process, the method of crossover, and mutation. Population size also determines the performance as it relates to computing time and accuracy of population and it diversity helps a population adapt quickly to changes in the environment and it allows the population to continue searching for productive niches, thus avoiding becoming trapped at local optima. Selection process also important in Genetic Algorithm relates to choosing the best individu and maintaining a genetic diversity within the population of candidate solutions throughout generations and lastly, the mutation will affect genetic algorithm for prevent falling all solutions in population into a local optimum of solved problems. In this paper, we present the results of various studies relating to various aspects that can affect the performance of the genetic algorithm.

Index Terms— Genetic Algorithm, Population, Crossover, and Mutation

1. INTRODUCTION

Genetic algorithms (GAs) are a class of evolutionary algorithms made popular by John Holland and his colleagues during the 1970s [1]. Genetic Algorithm is a searching method used for choosing the best solution of the different problems, based on the mechanism of natural selection. That is, from the initial population, through several evolutionary steps, a set of new more appropriate solutions are achieved that led to the global optimal solution [2].GA is a useful tool for solving optimization problems, especially optimization problems with large search space [3].Genetic algorithms can be understood as an intelligent probabilistic search algorithm which can be applied to avariety of combinatorial optimization problems [4].

The basic concept of GAs is designed to simulate processes in natural system necessary for evolution. The main operator of GA to search in pool of possible solutions is Crossover, Mutation and selection

A population of candidate solution to an optimization or search problem called individuals encoded by byte sequences called genome evolve towards an optimal solution. At each generation the fitness of each individuals is evaluated, and some individuals are stochastically selected(based on their fitness) and modified (combined and randomly mutated) to generate a new population. This new population is used in the next iteration of the algorithm. The algorithm terminate when a maximum number of iteration is reached or a satisfactory solution is found [5].

2. WORKING OF GENETIC ALGORITHM

Genetic Algorithm (GA) is adaptive heuristic based on ideas of natural selection and genetics. Genetic algorithm is one of the most known categories of evolutionary algorithm. A GA works with a number of solutions which collectively is known as population in each iteration which is chosen randomly. These are adaptive heuristic search algorithms postulated on the evolutionary ideas of natural selection and genetic. The basic concept of these evolutionary algorithms is to stimulate process in natural system necessary for evolution. GA's are used for numerical and computational optimization and based on study the evolutionary aspects of models of social systems. The GA performs a balanced search on various nodes and there is a need to retain population diversity exploration so that any important information cannot be lost because there is a great need to focus on fit portions of the population.

The simplest form of genetic algorithm involves three types of operators: selection, crossover, and mutation [6].

Selection This operator selects chromosomes in the population for reproduction. The fitter the chromosome, the more times it is likely to be selected to reproduce.

Crossover This operator randomly chooses a locus and exchanges the subsequences before and after that locus between two chromosomes to create two offspring. For example, the strings

ISBN 978-602-19877-3-5

10000100 and 11111111 could be crossed over after the third locus in each to produce the two offspring 10011111 and 11100100. The crossover operator roughly mimics biological recombination between two single−chromosome (haploid) organisms.

Mutation This operator randomly flips some of the bits in a chromosome. For example, the string 00000100 might be mutated in its second position to yield 01000100. Mutation can occur at each bit position in a string with some probability, usually very small (e.g., 0.001).

The process of genetic algroritma can be seen in Figure 1.

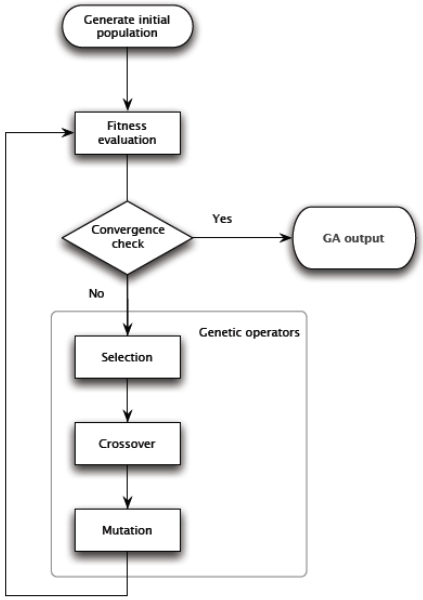

Fig. 1 Flowchart of Genetic Algorithm [7]

3. *FACTORS INFLUENCING GENETIC ALGORITHM*

Some factors to take into account when we want to focus about performance of genetic such as: population size, population diversity, the selection process, the method of crossover, and mutation.

3.1. Population Size

Roeva *et. al* [8] doing a research an investigation of the influence of the population size on the genetic algorithm (GA) performance for a model parameter identification problem, is considered. Population sizes between 5 and 200 chromosomes in the population are tested with constant number of generations. In order to obtain
meaningful information about the influence of the population size a considerable number of independent runs of the GA are performed. The observed results show that the optimal population size is 100 chromosomes for 200 generations. In this
case accurate model parameters values are obtained in reasonable computational time. Further increase of the population size, above 100 chromosomes, does not improve the solution accuracy. Moreover, the computational time is increased significantly.

Gomez and Hougen [9] in their study about the initial population diversity and genetic algorithm performance, have a result that the best number of the population size in the neighborhood is 100, fewer individuals or more individuals than that neighborhood can cost more function evaluations to reach an optimum (global for the case of the one-max and local for the case of the deceptive function) or the divergence of the algorithm.

Raja and Bhaskaran [10], have made a research to minimize a number of population in genetic algorithm using Population Reduction (PR) Method. This research give a result that using Population Reduction (PR) Methode get better performance than standard genetic algorithm.

From all of the result, we can make a conclusion that If the population size is very less, there is a chance to have premature convergence and if is high, unnecessary executions takes place to complete the process. Convergence velocity automatically increased. Hence correct optimal population size should be identified.

3.2. Population Diversity

We Have made a previous research about the influence of alpha value as multiplier factor on arithmetic crossover. This research give a result that the alpha value give an impact to the population diversity and the population diversity will give an impact to the performance of genetic algorithm results both for the whole arithmetic crossover method, simple arithmetic crossover, and a single arithmetic crossover [11].

The result of our previour research can be seen in Table 1 and Figure 1.

Table 1. Alpha Value Effect to the Performance of Genetic Algorithm

Methode	Alpha Value				
	0.1	0.3	0.5	0.7	0.9
Whole Arithmetic	0.00003546	0.00003345	0.00003379	0.00003467	0.00003356
Simple Arithmetic	0.00003431	0.00003265	0.00003679	0.00003501	0.00003296
Single Arithmetic	0.00003331	0.00003386	0.00003495	0.00003479	0.00003368

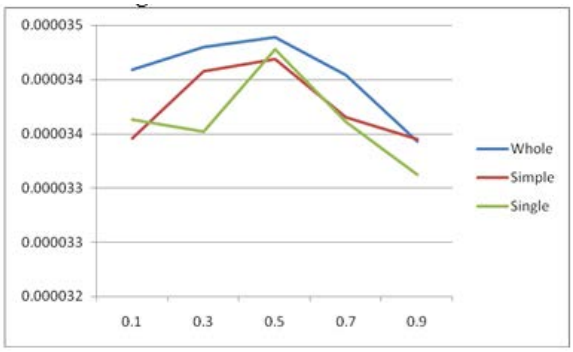

Figure 1. Alpha Value Effect to the Performance of Genetic Algorithm

We see that after the first hundred generations, An alpha parameters of 0.5 seems to offer the highest

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diversity over the whole time period. This condition applies to the whole arithmetic, simple arithmetic and single arithmetic. Increasing diversity is demonstrated by the increase in performance that occurs along with an increase in the value of alpha.

Gupta and Ghafir [12] in their research about An Overview of Methods Maintaining Diversity in Genetic Algorithm, have made the some result that the population diversity can give an impact to the performance of genetic algorithm. Population Diversity is considered as the primary reason for premature convergence. So a very homogeneous Population is found i.e. little Population Diversity is considered as the major reason for a Genetic Algorithm to premature converge. Premature convergence occurs when the population of a GA reaches such a suboptimal state that the genetic operators can no longer produce offspring that outperform their parents.

3.3. Selection Process

Jebari and Madiafi [13] in their research about 6 (six) most popular Selection Methods for Genetic Algorithm such as: the roulette wheel selection (RWS), the stochastic universal sampling (SUS), the linear rank selection (LRS), the exponential rank selection (ERS), the tournament selection (TOS), and the truncation selection (TRS). Their result also give a result that the selection process also determine the performance of genetic algorithm. Different selection method give difference performance as can be seen in Table 2.

Table 2. The Performance of Genetic Algorithm Based on Selection Method

Test Functions	Selection Method						
	RWS	SUS	LRS	ERS	TOS	TRS	CS
f_1	18	7	7	7	5	7	**4**
f_2	5	7	0	5	0	0	**0**
f_3	34	34	34	34	34	34	**0**
f_4	98	98	96	96	95	96	**0**

Razali and Geraghty [14] also make an experiments to see the influence of selection method to the performance of genetic algorithm. Their research make a comparison of the tournament roultte wheel, proportional roulette wheel, dan rank based roulette wheel selection method. The result can be seen in Table 3.

Table 3. Results of The Best Solution for All Instances

Instances	Known optimal solution	Tournament	Proportional	Rank-based
10-city	-	2.8567	2.8567	2.8567
20-city	-	4.0772	4.0772	4.0772
30-city	-	4.8352	4.9075	4.6683
40-city	-	6.1992	6.5127	5.7311
burma14	30.8785	30.8785	30.8785	30.8785
bay29	9074	9077	9079	9074
dantzig42	679	725	760	679
eil51	425	470	513	430

Table 3 from the research, shows the best results obtained for eight TSP instances run with different selection strategy. It is clearly shows that GA with rank-based roulette wheel selection always gives the highest solution quality (i.e. minimum travelling distance) for all TSP instances tested. This is then followed by tournament and proportional roulette wheel. Tournament and proportional roulette wheel is able to achieve optimal solution for small size instances; however the quality of solution reduces as the size of instance increase

3.4. The Method of Crossover

Picek *et. al* [15], doing a research for making a comparison on 16 crossover method that frequently used in genetic algorithm such as: Discrete crossover, simple arithmetic crossover, single arithmetic crossover, whole arithmetic crossover, Local Crossover, SBX Crossover, BLX-Alpha Crossover, BLX-Alpha-Beta Crossover, Flat Crossover, BGA Crossover, Heuristic Crossover, Average Crossover, One Point Crossover, No Crossover, Combination Crossover, and Random Crossover. The result of their research can be seen in Table 4.

Table 4. Average Rankings of the Crossover Operators

Algorithm	Ranking
Arithmetic Whole	6.791
Arithmetic Simple	8.229
Arithmetic Single	9.145
Average	8.104
BGA	6.562
Discrete	7.895
Flat	9.229
Heuristic	9.062
Onepoint	8.354
Random	14.875
SBX	6.937
No crossover	16
Local	5.791
BLX-alpha	9.229
BLX-alpha-beta	8.229
Combination crossover	1.562

From the Table 4, we can see that the best crossover operator is combination crossover. This crossover is actually a combination of all the previous individual crossovers, where in each reproduction phase a single crossover operator is chosen uniformly at random from the pool of all available crossover operators. The reasoning behind this approach is that the evolution is able to use as many possible transitions in the search space as possible, although it may impair convergence in some cases.

3.5. Mutation

Abdoun *et. al* [16] have made a comparison between some mutation operator such as: Twors Mutation (TM), Centre Inverse Mutation (CIM), Reverse Sequence Mutation (RSM), Throas Mutation, Thrors Mutation, and Partial Shuffle Mutation (PSM). The mutation operator determines the performance of

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genetic algorithm. The result of their result can be seen in Figure 2.

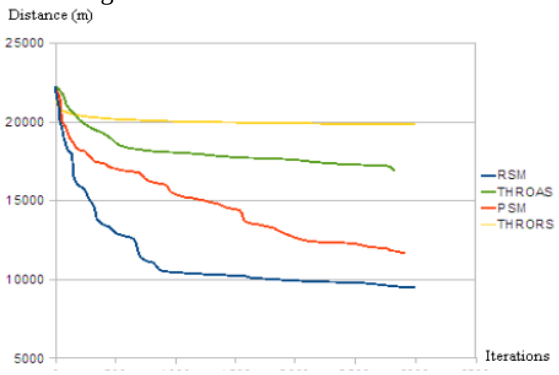

Figure 2. Comparison of the Mutation Operators

For the traveling salesman problem presented above, the operators of mutation with the best solutions are RSM and PSM.

4. CONCLUSION

Performance of the genetic algorithm depends on several aspects such as: population size, population diversity, the selection process, the method of crossover, and mutation. From all of the research about the population size, we can assume that If the population size is very less, there is a chance to have premature convergence and if is high, unnecessary executions takes place to complete the process. Convergence velocity automatically increased. Hence correct optimal population size should be identified.

The result about the population diversity give a result that the population diversity can give an impact to the performance of genetic algorithm. Population Diversity is considered as the primary reason for premature convergence. So a very homogeneous Population is found i.e. little Population Diversity is considered as the major reason for a Genetic Algorithm to premature converge. Premature convergence occurs when the population of a GA reaches such a suboptimal state that the genetic operators can no longer produce offspring that outperform their parents.

The result about the selection process give a result that GA with rank-based roulette wheel selection always gives the highest solution quality (i.e. minimum travelling distance) for all TSP instances tested. This is then followed by tournament and proportional roulette wheel. Tournament and proportional roulette wheel is able to achieve optimal solution for small size instances; however the quality of solution reduces as the size of instance increase. The best crossover method from the research is combination crossover. This crossover is actually a combination of all the previous individual crossovers, where in each reproduction phase a single crossover operator is chosen uniformly at random from the pool of all available crossover operators. The research from the mutation give a result that, if we want to get a better performance, we may think to use Reverse Sequence Mutation (RSM) .

From the overview of all of the Research we can know every aspects that will give an influence to the performance of genetic algorithm.

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ISBN 978-602-19877-3-5

FORECASTING OIL PRODUCTION USING TIME SERIES MODEL

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ABSTRACT

The decline rate in oil production is based on a single well in a closed system, generally. In reality, oil production wells in the same reservoir. If the wells are producing at the rate or pressure is not uniform, there will be a draining system that is not uniform over the boundary dominated flow conditions. Furthermore, it may happen that new wells affect the drainage area of the older wells. Therefore, we need a model of multi-well decline curve analysis which includes the interaction between wells. This study aims to forecast model of the rate of oil production on wells with multi-system interaction between wells through the approach of a predator-prey-like models. Predator-prey system of multi wells represented as VARIMA model on time series analysis. Model parameters are estimated simultaneously using Gauss Newton method. Expected production forecasting models resulting from the proposed model would be more realistic to approach by Vector Autoregressive Integrated Moving Average (VARIMA), and will contribute significantly to the methodology of petroleum production forecasts.

Index Terms— Decline curve analysis, petroleum production, time series analysis, VARIMA

1. INTRODUCTION

The national energy needs by way of an increase in oil production is an important issue. Data oil production is very useful for predicting the performance of wells and to estimate energy reserves held for the foreseeable future. A commonly used technique is the decline curve analysis method. Oil production continues to decline over time. Basic equation of this method is the equation of Arps [1]. This equation states the relationship between the rate of production and the time for oil wells in the state pseudosteady, and mathematically expressed as ordinary differential equations.

A commonly used technique is the decline curve analysis method (decline curve analysis) [2]. Basic equation of this method is the equation of Arps, expressing the relation between the rate of production and the time for oil wells in the period pseudosteady-state expressed by the equation

$$q_t = \frac{q_0}{\left(1+bDt\right)^{1/b}} \qquad (1)$$

where is the production rate at the time (kg / s), the initial production rate (kg / s), the rate of decline (decline rate) (1 / s), time (s) = 1,2,3, ..., and the exponent of hyperbolic with b between 0 and 1 is defined as:

$$D = -\frac{dq_t / dt}{q_t} \qquad (2)$$

In practice, it is not easy to determine the type of the decline curve of field data. The field data is not always follow one of a kind Arps curve is exponential, hyperbolic or harmonic (differentiated based on constant prices), it could be a combination of several types of curves. Exponential decline tend to produce lower estimates and a reduction in harmonic generally give higher estimates than expected. With discretization method Equation (2) can be expressed as a model AR (1) and the Kalman filter approach [3]. Hyperbolic curve parameter estimation can use non-linear regression bootstrap method [4]. Hyperbolic decline curve can also be represented as time varying autoregressive models [5].

In general, the rate of decline in production is based on a single well in a closed system. But in reality, a production wells together with other wells in the same reservoir. If the wells producing at the rate or pressure are not uniform, there will be a draining system that is not uniform over the boundary dominated flow conditions (boundary dominated flow). Furthermore, it may happen that new wells affect the drainage area of the older wells. Therefore, we need a model of multi-well.

decline curve analysis that includes the interaction between wells [6].

This study aims to model forecasts of the rate of oil production on wells with multi-system interaction between wells through the approach of a predator-prey-like models. Predator-prey system of multi wells represented as a model VARIMA on time series analysis. The model parameters are estimated simultaneously using Gauss Newton method. Expected production forecasting models resulting from the proposed model would be more realistic to approach the Vector Autoregressive Moving Average (VARIMA), and will contribute significantly to the methodology petroleum production forecasts.

ISBN 978-602-19877-3-5

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2. DECLINE CURVE ANALYSIS

One technique for estimating the energy reserves that is widely used is the decline curve analysis. In general, the technique is based on the Arps equation [1]. This equation is still used today because it has a simple form and does not require a lot of measurements. Nevertheless, this equation still has limitations, one of which is not yet involve sampling error, sampling error where the problem can be modeled by a stochastic process. This equation is an empirical equation that states the relationship between the production rate and time on oil wells in pseudosteady-state period. Based on the loss ratio, Arps decline curve classify three types, namely: exponential, hyperbolic, and harmonic. Loss ratio is defined as the rate of production per unit time divided by the first derivative as rate-time curve is expressed as:

$$Loss\ ratio = \frac{q_t}{dq_t / dt} \qquad (3)$$

In practice, it is not easy to determine the type of curve decrease of field data. Li and Horne (2005) states that the field data do not always follow one of the Arps type curves, it could be a combination of several types of curves. To estimate the rate of production of the future, Arps using extrapolation with a simple linear regression method. Exponential decline tends to produce lower estimates and harmonic decline generally give higher estimates than expected.

3. STATIONARITY

In other words, strictly stationary requires that the joint distribution of fixed or constant in time shift. This is a condition that is very strong and difficult to examine empirically. Said to be weakly stationary time series if the average and covariance between and constant, with random integers. Specifically, it is said weakly stationary if the basis of the analysis of time series is stationary. Time series data $\{Z_t\}$ said to be strictly stationary if the joint distribution $(Z_{t_1},....,Z_{t_k})$ is identical to $(Z_{t_{1+t}},....,Z_{t_{k+t}})$ for all *t*, where *k* is a positive integer random number and $(t_1,...,t_k)$ is a collection of *k* positive integers. In other words, strictly stationary requires that the joint distribution $(Z_{t_1},....,Z_{t_k})$ of fixed or constant in time shift. This is a condition that is very strong and difficult to examine empirically Time series data $\{Z_t\}$ said to be weakly stationaryif the average Z_t and covariance between Z_t and Z_{t-l} is constant, where l is random integer. Spesifically, $\{Z_t\}$ said to be weakly stationary if:

(a) $\mathrm{E}(Z_t) = \mu$, constant,

(b) $\mathrm{Cov}\ (Z_t, Z_{t-l}) = \gamma_l$, only depend on l.

In practice, suppose the observed data. Weak stationarity in the data plot shows that the values fluctuate with constant variance around a constant level. Covariance Cov called autokovariansi lag- of. Covariance has two important properties, namely:

In practice, suppose the observed n data $\{Z_t | t = 1,...,n\}$. Weak stationarity in the data plot shows that the values n fluctuate with constant variance around a constant level. Covariance $\gamma_l = \mathrm{Cov}(Z_t, Z_{t-l})$ called autocovariance *lag-*l of Z_t. Covariance γ_l has two important properties, namely:

(a) $\gamma_0 = \mathrm{Var}(Z_t)$

(b) $\gamma_{-l} = \gamma_l$.

The second property is $\mathrm{Cov}(Z_t, Z_{t-(-l)}) = \mathrm{Cov}(Z_{t-(-l)}, Z_t) = \mathrm{Cov}(Z_{t+l}, Z_t) = \mathrm{Cov}(Z_{t_1}, Z_{t_1-l})$, dengan $t_1 = t + l$ (Brockwell and Davis, 2002).

Stationarity condition has two properties, stationairity in variance and level (mean). To check this condition can be used time series plot between variable Z_t with time *t*. If the time series plot not stationarity in level, the data need to difference. Differencing for first order is difference between *t*-th data with *t-1*-th data :

$$\Delta Z_t = Z_t - Z_{t-1}.$$

Figure 1. shows time series plot which is stationarity in level and Figure 2 shows non stationarity time series plot

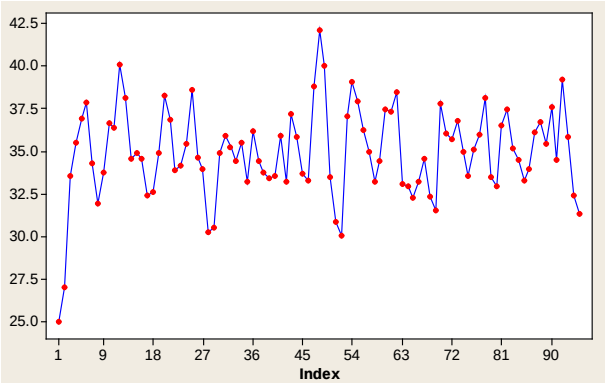

Figure 1. Stationarity time series plot in level

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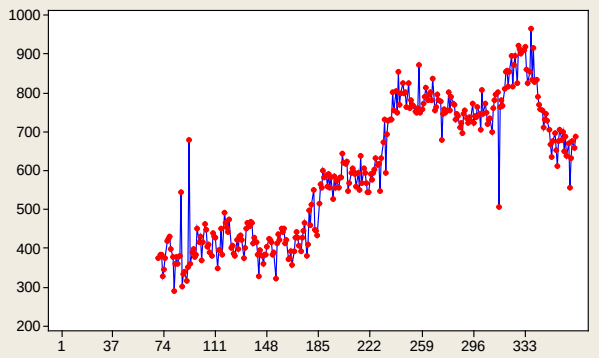

Gambar 2. Non stationairity time series plot

Key statistics in the analysis of time series is the autocorrelation coefficient (correlation time series with time series itself with the time difference (lag) 0, 1, 2 periods, or more). Autocorrelation coefficient is a function that shows the magnitude of the correlation (linear relationship) between the observations in previous times (denoted by $Z_1, Z_2, ..., Z_{t-l}$)

Tthe correlation coefficient between Z_t and Z_{t-l} can be defined as follows:

$$\rho_l = \frac{Cov(Z_t, Z_{t-l})}{\sqrt{Var(Z_t)Var(Z_{t-l})}} = \frac{Cov(Z_t, Z_{t-l})}{Var(Z_t)} = \frac{\gamma_l}{\gamma_0}$$

where $\mathrm{Var}(Z_t) = \mathrm{Var}(Z_{t-l})$ for weakly stationary series. By definition, $\rho_0 = 1$, $\rho_l = \rho_{-l}$ and $-1 \le \rho_l \le 1$. Weakly stationary series Z_t uncorrelated if and only if $\rho_l = 0$ for all $l > 0$.

Partial autocorrelation is used to measure the level of closeness (association) between Z_t and Z_{t-l}, if the effect of the time lag 1, 2, 3, …, *l*-1 are considered separately. Partial autocorrelation function (PACF) is a function that shows the magnitude of the partial correlation between observations in time to t (denoted by Z_t) with observations at earlier times (denoted by $Z_{t-1}, Z_{t-2}, ..., Z_{t-l}$).

Partial autocorrelation function formula as follows $\phi_{ll} = corr(Z_t, Z_{t-l} | Z_{t-1}, Z_{t-2}, ..., Z_{t-l+1},)$.

Value ϕ_{ll} can be determined through the Yule Walker equations as follows: $\rho_j = \phi_{l1}\rho_{j-1} + \phi_{l2}\rho_{j-2} + ... + \phi_{ll}\rho_{j-l}$, for $j = 1,2,...,l$. Regression model with the dependent variable Z_{t+l} of a stationary process with mean zero regressed on the independent variables $Z_{t+l-1}, Z_{t+l-2}, ..., Z_t$, are:

$$Z_{t+l} = \phi_{l1}Z_{t+l-1} + \phi_{l2}Z_{t+l-2} + ... + \phi_{ll}Z_t + a_{t+l}$$

where ϕ_{li} regression coefficient *i-th* and a_{t+l} is an error term which uncorrelated with Z_{t+l-j} for $j \ge 1$. By multiplying both sides of the equation by Z_{t+l-j} then calculate the expected value of both sides, is obtained:

$$\gamma_j = \phi_{l1}\gamma_{j-1} + \phi_{l2}\gamma_{j-2} + ... + \phi_{ll}\gamma_{j-l},$$

therefore,

$$\rho_j = \phi_{l1}\rho_{j-1} + \phi_{l2}\rho_{j-2} + ... + \phi_{ll}\rho_{j-l}.$$

for $j = 1,2,...,l$, the following equation applies :

$$\rho_1 = \phi_{l1}\rho_0 + \phi_{l2}\rho_1 + ... + \phi_{ll}\rho_{l-1}$$
$$\rho_2 = \phi_{l1}\rho_1 + \phi_{l2}\rho_0 + ... + \phi_{ll}\rho_{l-2}$$
$$\vdots$$
$$\rho_l = \phi_{l1}\rho_{l-1} + \phi_{l2}\rho_{l-2} + ... + \phi_{ll}\rho_0.$$

Using Cramer method, for $l = 1,2,...,$ is obtained:

$$\phi_{ll} = \frac{\begin{vmatrix} 1 & \rho_1 & \rho_2 & \cdots & \rho_{l-2} & \rho_1 \\ \rho_1 & 1 & \rho_1 & \cdots & \rho_{l-3} & \rho_2 \\ \vdots & \vdots & \vdots & & \vdots & \vdots \\ \rho_{l-1} & \rho_{l-2} & \rho_{l-3} & \cdots & \rho_1 & \rho_l \end{vmatrix}}{\begin{vmatrix} 1 & \rho_1 & \rho_2 & \cdots & \rho_{l-2} & \rho_{l-1} \\ \rho_1 & 1 & \rho_1 & \cdots & \rho_{l-3} & \rho_{l-2} \\ \vdots & \vdots & \vdots & & \vdots & \vdots \\ \rho_{l-1} & \rho_{l-2} & \rho_{l-3} & \cdots & \rho_1 & 1 \end{vmatrix}} \quad (2.13)$$

Tthe Yule Walker equations:

$$\phi_{ll} = \frac{\rho_l - \sum_{j=1}^{l-1} \phi_{l-1,j}\rho_{l-j}}{1 - \sum_{j=1}^{l-1} \phi_{l-1,j}\rho_j},$$

where, $\phi_{lj} = \phi_{l-1,j} - \phi_{ll}\phi_{l-1,l-j}$, for $j = 1,2,...,l-1$.

The residual white noise test can be written as follows:

Hypotesis

H_0 : $\rho_1 = \rho_2 = ... = \rho_L = 0$ (Residual qualified white noise)

H_1 : Minimum ther is one $\rho_i \ne 0, i = 1,2,...,L$ (Residual qualified not white noise)

Statistics test, using Portmanteau test:

$$Q^* = n\sum_{i=1}^{L} tr(c_i' c_0^{-1} c_i c_0^{-1})$$

$$c_i = \frac{1}{n}\sum_{t=i+1}^{n} e_t e_{t-i}^{'}, \; c_0 = \frac{1}{n}\sum_{t=1}^{n} e_t e_t^{'}$$

where,

n : number of observation

ISBN 978-602-19877-3-5

L : maximum *lag*

Critical region

Reject H_0 if $Q^* > \chi^2_{\alpha;df=n_p^2(l-p)}$, where n_p is number of variables, p is the order of VAR (Lutkepohl, 2005).

.

4. VECTOR AUTOREGRESSIVE (VAR)

If the data used in the analysis of time series data, the model Vector Autoregressive (VAR) offering an alternative modeling as a way out of the problem. VAR model is constructed with an approach that minimizes the theory with the aim to be able to capture good economic phenomena. VAR model is referred to as a model of non-structural or theoretical model does not (ateoritis)

Suppose there is VAR(p) model as follose :

$$Z_t = A_0 + A_1 Z_{t-1} + A_2 Z_{t-2} + ... + A_p Z_{t-p} + e_t \quad (4)$$

Where this model can be as regression model with k independent variables bebas as follows:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + ... + \beta_k X_{ik} + e_i,$$
$$i = 1,2,..,n$$

In matrix notation, this equation can be written as

$$\begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{pmatrix} = \begin{pmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1k} \\ 1 & x_{21} & x_{22} & \cdots & x_{2k} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ 1 & x_{n1} & x_{n2} & \cdots & x_{nk} \end{pmatrix} \begin{pmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_k \end{pmatrix} + \begin{pmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{pmatrix}. \quad (5)$$

Suppose that

$$Y = \begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_n \end{pmatrix}, \qquad X = \begin{pmatrix} 1 & x_{11} & x_{12} & \cdots & x_{1k} \\ 1 & x_{21} & x_{22} & \cdots & x_{2k} \\ \vdots & \vdots & \vdots & \cdots & \vdots \\ 1 & x_{n1} & x_{n2} & \cdots & x_{nk} \end{pmatrix},$$

$$\beta = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \beta_2 \\ \vdots \\ \beta_k \end{pmatrix}, \text{ and } e = \begin{pmatrix} e_1 \\ e_2 \\ \vdots \\ e_n \end{pmatrix}.$$

Therefore, Equation (2.5) can be written as

$$Y = X\beta + e \quad (6)$$

Thus, equation (6) is a common form of regression equations in the matrix. In this general form Y is a vector of responses, X represents independent variable matrix size, the size of the parameter vector and the error vector size. There are many parameters to be estimated from the data, including. These estimates will be written in the form of the equation, with a vector of estimates.

Ordinary Least Square is a method of searching for a residual value as small as possible by summing the squared residuals. For example there are following VAR model as follows:

$$Z_{1t} = a_{11} Z_{1t-1} + a_{12} Z_{2t-1} + e_{1t}$$
$$Z_{2t} = a_{21} Z_{1t-1} + a_{22} Z_{2t-1} + e_{2t}$$

The presence of shocks in period t in equation Z that changes e_{it} will immediately have an impact on one for one Z_{1t}, but have yet to have an impact on Z_{2t}. In period t + 1, the change e_{it} will impact on Z_{2t} the result through Z_{1t-1} and Z_{2t-1}.. This impact continues in period t + 2 and so on. Thus, the change e_{1t} will have a multiplier effect in period t, t + 1, t + 2, ..., t + s for all variables in the model. Multiplier effect is called the Impulse Response (Juanda and Junaidi, 2012). .

5. RESEARCH METHOD

5.1 Construct a production decline curve analysis model of multi wells

Wahyuningsih et al (2008) have proposed a Kalman filter approach to geothermal production forecasts. The model for a single well system. In this study, the model was extended to multi-well systems by using the concept of vector / matrix. [3]

5.2 Modeling the interaction between two production wells

Suppose there is an interaction between the two production wells that were located quite close, where the interaction between the two wells can be viewed as a system for predators and prey. The production wells will absorb the production of other wells so that the rate of decline is smaller. Thus the well is act as predators, of course, other wells act as prey. Based on differential equations Arps and by modifying predator-prey models will be derived mathematically models the interaction between these two production wells.

5.3 Modeling the interaction of multi wells

In mathematical concepts, this is the development of a model case of the interaction of two wells into wells

ISBN 978-602-19877-3-5

arbitrary n. The concept model of a predator - prey will still be used in the case of more than two wells interact. Estimation of reservoir parameters will be obtained by solving a system of linear equations not containing n equations with Gauss Newton method. Furthermore, there will be well simulated multi interaction model and compared with a single well system model.

5.4 Forecasting with time series analysis

Since the data is a vector and a time series data, it is feasible approaches to the analysis of time series forecasting, which in this study were selected using VARIMA. In this study, the software used is Microsoft Excel, Matlab and SPSS.

6. RESULTS AND DISCUSSION

6.1 ARIMA Approach for Petroleum Production Decline Curve Type Exponential in the Single Well System

The decline in oil production-type exponential can be expressed according to Equation (1) or can be expressed :

$$Loss\ ratio = \frac{q_t}{dq_t / dt} = -\frac{1}{D},\ \mathrm{D} > 0 \qquad (7)$$

By changing the composition of Equation (4.1) can be rewritten into

$$\frac{dq_t}{dt} = -Dq_t, \mathrm{D}>0 \qquad (8)$$

By performing discretization of the differential equation (4.2), so it can be declared to be

$$\frac{dq_t}{dt} = \frac{\Delta q_t}{\Delta t} = \frac{q_t - q_{t-1}}{\Delta t} = -Dq_t,\ \mathrm{D} > 0$$

Or it can be expressed as

$$q_t = \frac{1}{1+D\Delta t} q_{t-1} \qquad (9)$$

By adding the error ε_t in the right hand side of Equation (4.3), obtained by the model Autoregressive Integrated Moving Average (ARIMA) with $Z_t = q_t$ dan $\phi = \frac{1}{1+D\Delta t}$ which can be written as

$$q_t = \frac{1}{1+D\Delta t} q_{t-1} + \varepsilon_t \qquad (10)$$

Or can be written as time series model AR(1)

$Z_t = \phi Z_{t-1} + \varepsilon_t$, where $\varepsilon_t \sim N(0, \sigma^2)$

Equation (4.4) is guaranted stationarity since $0 < \frac{1}{1+D\Delta t} < 1$.

6.2 VARIMA Approach for Petroleum Production Decline Curve Exponential Type on Multi Wells System Assumptions There are Interaction among wells

In the case of multiple wells, Equation (4.4) can be expanded into

$$\begin{pmatrix} Z_{1,t} \\ Z_{2,t} \\ \vdots \\ Z_{i,t} \end{pmatrix} = \begin{pmatrix} \phi_{11} & \phi_{12} & \cdots & \phi_{1j} \\ \phi_{21} & \phi_{22} & \cdots & \phi_{2j} \\ \vdots & \vdots & \ddots & \vdots \\ \phi_{i1} & \phi_{i2} & \cdots & \phi_{ij} \end{pmatrix} \begin{pmatrix} Z_{1,t-1} \\ Z_{2,t-1} \\ \vdots \\ Z_{i,t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \vdots \\ \varepsilon_{i,t} \end{pmatrix} \qquad (4.5)$$

where $\begin{pmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \vdots \\ \varepsilon_{i,t} \end{pmatrix} \sim N(0, \Sigma)$.

In general, models of the interaction between petroleum wells can be written in vector form as follows:

$$\frac{d\vec{Z}_t}{dt} = -D\vec{Z}_t, \qquad (11)$$

where $D = D_0 + B$, by

$$D_0 = \begin{pmatrix} D_1 & 0 & \cdots & 0 \\ 0 & D_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & D_j \end{pmatrix}, D_i > 0, i = 1, 2, ..., n$$

$$s_{i,j} = \begin{cases} -1 \\ +1 \end{cases}$$

If $s_{i,j} = -1$, that is to say the production wells $Z_{i,t}$ as predators or absorbent than other wells, and if $s_{i,j} = 1$, that is to say the production wells $Z_{i,t}$ as prey or absorbed by other wells. By performing discretization then Equation (11) can be expressed as

$$\frac{\vec{Z}_t - \vec{Z}_{t-1}}{\Delta t} = -\vec{D}\vec{Z}_t, \qquad (12)$$

$$\vec{Z}_t = (I + \vec{D}\Delta t)^{-1} \vec{Z}_{t-1}$$

The addition of an error $\vec{\varepsilon}_t$ in Equation (4.7) will be obtained by a Vector Autoregressive model of order 1 (VAR (1)), which can be written:

$$\vec{Z}_t = \Phi \vec{Z}_{t-1} + \varepsilon_t, \varepsilon_t \sim N(0, \Sigma) \qquad (13)$$

where $\Phi = (I + \vec{D}\Delta t)^{-1}$, this parameter can be obtained using OLS (*Ordinary Least Square*).

It is assumed that the interaction occurs between two adjacent wells, where the interaction between the two wells can be viewed as a system for predators and prey. The production wells will absorb the production of other wells so that the rate of decline is smaller. Thus, these wells act as predators, of course, other wells act as prey. The basic idea of this interaction model are as follows:

Suppose the well-1 was seen as predators and prey-2 as well. The presence of well-2 will affect the production rate of the well-1, and vice versa, the presence of well-1 affects the production rate of the

ISBN 978-602-19877-3-5

well-2. Thus the mathematical model of exponential decline curve that assumes the existence of an interaction between these two wells can be expressed by the following equation:

$$\begin{cases} \frac{dZ_{1,t}}{dt} = -D_1 Z_{1,t} + \beta_{1,2} Z_{2,t} \\ \frac{dZ_{2,t}}{dt} = -D_2 Z_{2,t} + \beta_{2,1} Z_{1,t} \end{cases} \quad (14)$$

If there is an interaction between the two wells this model still can be expressed by the VAR(1) model, where :

$$\Phi = \frac{1}{(1+D_1\Delta t)(1+D_2\Delta t)+\beta_{1,2}\beta_{2,1}(\Delta t)^2}\begin{pmatrix} 1+D_2\Delta t & \beta_{1,2}\Delta t \\ -\beta_{2,1}\Delta t & 1+D_1\Delta t \end{pmatrix}$$ Es

timation of parameters can be searched simultaneously with the Gauss Newton method. Value parameters are always non-negative. If the interaction coefficient is zero, then the model back to the scalar ARIMA models that express single well system without interaction between wells.

The first simulation data generated by $D_1 = 0,06$ dan $D_2 = 0,01$, while the value of $\beta_{1,2} = 0,03$ dan $\beta_{2,1} = 0,01$ In this case the interaction coefficient is assumed between wells-1 with the well-2 or otherwise assumed to be the same. Each well consists of 20 data were divided into training data (10 data first) and validation data (10 data hereafter). In this model indicates that the well-2 as predators and as prey-1 wells. With the interaction between the two wells has resulted in forecast production rate of the well-2 well production rate approaching well-1 (Figure .1)

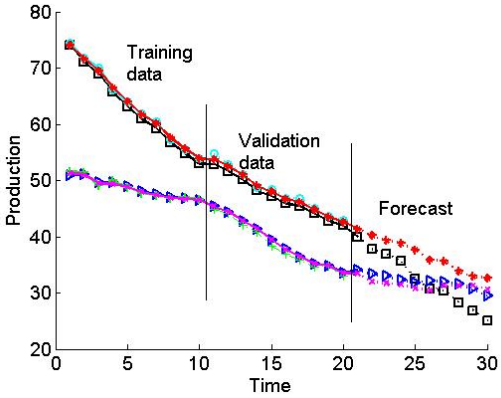

Figure 4.1. Simulation-1

The second simulated data generated by $D_1 = 0,06$ and $D_2 = 0,01$, while the value of $\beta_{1,2} = 0,151$ and $\beta_{2,1} = 0,028$.. So the value of the parameter is equal to the first simulation. The only difference being galatnya only. In this case the interaction coefficient is assumed between wells-1 with the well-2 or otherwise assumed to be the same. Each well consists of 20 data were divided into training data (10 data first) and validation data (10 data hereafter). In this model indicates that the well-2 as predators and as prey-1 wells. With the interaction between the two wells has resulted in forecast production rate of the well-2 well production rate approaching large-1 (Figure 4.2)

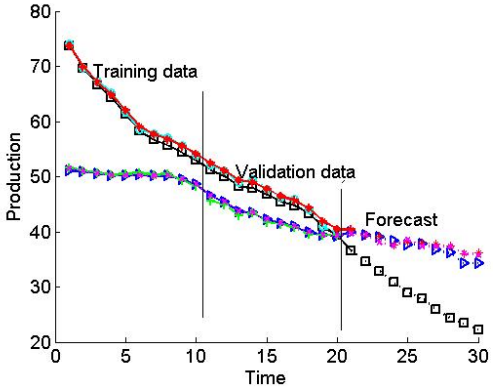

Figure 4.2. Simulation-2

7. SUMMARY

Decline curve analysis of oil production can be represented as VARIMA model. Using interaction model among wells, alternative model which is the result of this research showed more realistic, if there are interaction among production oil wells, specifically if the distance among production wells near enough. Forecasting for oil production can be applied, since VARIMA model is one of time series analysis. For future research, this model can be applied to update real data.

10. ACKNOWLEDGEMENTS

Hibah Fundamental DIKTI 2015.

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ISBN 978-602-19877-3-5

OPTIMIZATION OF PRODUCTION PLANNING USING GOAL PROGRAMMING METHOD (A CASE STUDY IN A CEMENT INDUSTRY)

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ABSTRACT

Production planning plays an important role for a manufacturing industry as it relates to the manufacturer's plan to meet product demand, profit achievement, and use of resources. An improper planning can lead to costs that are not expected. This study aimed to determined the optimal production, to estimated total profit, and to estimated processing time and raw material usage. The study conducted on one of cement industry in Indonesia. The analysis was divided into 3 stages. The first, estimating monthly demand of cement type I and II for 2015. In this case, the linear regression method was chosen based on the smallest error indices. The second, developing a model of goal programming (GP) to optimized four goals of (production volume, total profit, utilization of processing time, and raw materials usage). The GP model was solved by Lingo 10.0 software. The third, interpretation of GP solution. The results indicated the optimal production of cement type I and type II averagely reached 87.961 tons and 89.706 tons per period would be able to achieved. The average total profit of Rp. 61.290.933.000 per period producing two type of cements would be achieved. The average utilization rate of processing time capacity reached 87,2% per period. There was an excess availability of clinker averagely reached 1.28% per period. The limestone usage averagely reached 0.003% (excess) and 0.05% (shortage). The gypsum usage averagely reached 0.22% (excess) and 0.02% (shortage) per period. The pozzolan usage averagely reached 0.48% (excess) and 0.05% (shortage) per period.

Index Terms— Optimization, production planning, goal programming

1. INTRODUCTION

Production planning plays an important role for a manufacturing industry as it relates to the manufacturer's plan to meet product demand, profit achievement, and the use of resources. An improper planning can lead to costs that are not expected. The planning is done with the purpose of determining the direction of the beginning of the actions that must be done in the future, what should be done, how many were made, and when to do. Because of the planning with regard to the future, the plan drawn up on the basis of an estimate made based on past data by using several assumptions [1]. Production planning begins by analyzing product demand, making schedules, and others based on the information available and planning schemes utilization of company resources, including machines, raw materials, and labor to achieve the most economical way. Production planning is a pre-production activities to determine the needs of manufacturing includes labor, raw materials, machinery, and production process [2].

PT X is a cement manufacturer that has some plants. At one plant produces two types of cement (named type I and II). In the recent years, level of real production could not achieve the planned target and the utilization rate of processing time capacity has not yet reached the optimum level. The manufacturer wanted to make an production planning that could predicted the requirements of production in the future.

This study aimed to plan the optimal level of cement production, to estimate the total profit that could be achieved, to estimated processing time and raw materials usage. The manufacturer had several objectives to be achieved in the future period. In this case, the goal programming (GP) method used to achieved the research objectives. The GP aimed to minimize the deviation between the achievement of the objectives and the level of aspiration [3]. The GP model is flexible because it produces a solution that is a compromise of various objectives by minimizing the deviation of each objective [4].

Several past studies that used GP method for production planning, among others [5] did study on the tea industry, [6] did study on the palm fruit processing industry, [7] did study on rubber trees industry, [8] did study on the automotive industry, and [9] did study about allocation of agricultural land use. For case in the cement industry, among others [10] used the fuzzy GP for optimization of production planning, and [11] used the GP for optimization of product distribution. This study used the GP method for production planning of cement by considering four objectives (production volume

ISBN 978-602-19877-3-5

target, total profit, processing time capacity and material usage).

2. RESEARCH METHOD

The study was conducted in a cement manufacturer in Indonesia. The main data in this research was secondary data that collected from annually performance reports of PT X. The data include monthly cements demand in 2014, the profit of each type of cements, number of working days and working hours, process cycle time, cement mill, raw materials, and materials availability. The analysis was divided into 3 stages. The first, estimating demand of cement type I and II for year 2015. The second, developing the goal programming (GP) model for optimization of production planning. A commonly used generalized GP model is as follows [3] :

$$\min \sum_{i=1}^{n} |f_i(x) - g_i|,$$

Subject to :

$$x \varepsilon F,\ x \geq 0,\ g_i \geq 0, \qquad (1)$$

Where *fi (x)* is a linear function of the goal-*i*, g_i is the aspiration (priority) level of goal-*i*, and *F* is set of constraints that is defined by a linear equation or linear inequality. Let :

$$f_i(x) - g_i = d_i^+ - d_i^-$$

non-negative constraint

$$d_i^+,\ d_i^- \geq 0 \qquad (2)$$

Afterward, the equation (2) is substituted into the equation (1) so that the formulation GP becomes:

$$\min \sum_{i=1}^{n} (d_i^+ + d_i^-)$$

Constraints :

$$f_i(x) - d_i^+ + d_i^- - g_i = 0, \quad i=1, 2, ...,n,$$
$$d_i^+,\ d_i^- \geq 0, \quad i=1, 2, ...,n,$$
$$x \varepsilon F,\ x \geq 0, \qquad (3)$$

Where d_i^+, d_i^- respectively are positive and negative deviation variable from the goal-*i*. In this case, there were four goals to be optimized ; production volume (P1), total profit (P2), processing time usage (P3), and materials (clinker, limestone, gypsum and pozzolan usage (P4). The planning horizon was limited to 12 periods of year 2015. The computation is done by Lingo 10.0 software. The third, the obtained solution is interpretated..

3. RESULTS AND DISCUSSION

This section includes estimation of parameters, estimation of cements demand, developing of goal programming model, solutions, and interpretation.

3.1 Estimation of Parameters

For estimating product demand for 12 periods ahead then needed data of cement demand in 2014 as can be seen in the Table 1 below.

Table 1. Demand for Cements (2014)

Period	Demand (Tons)	
	Type I	Type II
1	90.394	78.935
2	67.100	73.461
3	88.152	82.311
4	85.102	79.361
5	88.152	82.311
6	85.102	59.000
7	88.152	64.900
8	70.150	86.706
9	86.017	84.606
10	88.152	86.706
11	85.102	83.706
12	88.152	86.706

Cement type I and II respectively have a net profit of Rp. 348,000 and Rp. 342,000 per ton. The both cements required four type of materials (clinker, limestone, gypsum and pozzolan). Material composition of cement type I respectively were 79%, 10%, 4% and 8%, meanwhile cement type II were 77%, 11%, 3% and 9%. This composition percentage values were assumption that obtained from the manufacturer. The material availability was determined based on the need of cements production. The parameter of processing time was only represented by the cement mills due to data limitation and simplification of the problem. The plant has two cement mills where their capacity and processing cycle time as can be seen in the Table 2 below.

Table 2. Processing Cycle Time of Cement Mills

Cement mill	Capacity (Tons)	Cycle time (Hours)	Cycle time per ton (Hours)
I	110	0,75	0,0068
II	150	0,75	0,0050

Each product could be manufactured in any of two cement mills. Therefore, used an average cycle time of 0.0059 hours and added by allowance 10% (for unavoidable delays) so that it would be 0.0065 hours. The cement mill capacity (in machine hours) for 12 periods of year 2015 as can be seen in Table 3 below.

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Table 3 Cement Mill Capacity (2015)

Period.	Cement mill	Working time (days)	Capacity (hours)	Total capacity (hours)
1	I	31	719	1356
	II	29	637	
2	I	28	649	1265
	II	28	615	
3	I	29	681	1398
	II	31	717	
4	I	28	628	1340
	II	30	712	
5	I	31	719	1356
	II	29	637	
6	I	30	706	1270
	II	26	564	
7	I	30	706	1313
	II	28	607	
8	I	29	618	1332
	II	31	714	
9	I	30	684	1276
	II	28	592	
10	I	31	736	1381
	II	29	645	
11	I	30	687	1340
	II	28	653	
12	I	29	618	1299
	II	31	681	

The machine hours capacity in each month were different due to day-off schedule which includes allocation of maintenance activities.

3.2 Estimation of Cement Demand

The Cements demand in 12 periods of year 2015 was determined by four types of time series forecasting methods ; moving average, weighted moving average, exponential smoothing, and linear regression. The computation is done by POM-QM 3.0 software. The results were presented in Table 4.

Table 4. Forecasting Results

Method	Error	Cement I	Cement II
Moving average	SEE	10.732	10.249
	MSE	94.241.130	87.539.780
	MAD	6.824	6.451
	MAPE	0,09	0,09
Weighted moving average	SEE	8.497	12.496
	MSE	57.758.560	124.916.400
	MAD	5.838	7.471
	MAPE	0,07	0,10
Exponential smoothing	SEE	8.757	12.179
	MSE	61.343.900	118.669.400
	MAD	6.055	7.058
	MAPE	0,07	0,10
Linear regression	SEE	7.730	8.779
	MSE	49.792.080	64.220.950
	MAD	5.093	5.971
	MAPE	0,07	0,08

In Table 4, the forecasting error values were obtained that include the standard error of estimate (SEE), the mean square error (MSE), the mean absolute deviation (MAD), and mean absolute percentage error (MAPE). The linear regression has smallest SEE, MSE, MAD and MAPE value. Therefore it is used to estimated demand of 2015. Table 5 below presented the estimated cements demand for 12 periods of year 2015.

Table 5. Estimated Cements Demand (2015)

Period	Demand (Tons)	
	Cement I	Cement II
1	86.212	84.826
2	86.530	85.714
3	86.848	86.601
4	87.166	87.488
5	87.484	88.375
6	87.802	89.263
7	88.120	90.150
8	88.438	91.037
9	88.756	91.925
10	89.074	92.812
11	89.392	93.699
12	89.711	94.586

Finally, the collected data (parameters) were presented in the Table 6 and Table 7 below.

Table 6. Availability of Materials

Period	Clinker (tons)	Limestone (tons)	Gypsum (tons)	Pozzolan (tons)
1	135.120	17.959	5.986	14.538
2	136.073	18.086	6.029	14.641
3	137.025	18.212	6.071	14.743
4	137.977	18.339	6.113	14.846
5	138.929	18.465	6.155	14.948
6	139.881	18.592	6.197	15.051
7	140.833	18.718	6.239	15.153
8	141.785	18.845	6.282	15.255
9	142.738	18.972	6.324	15.358
10	143.690	19.098	6.366	15.460
11	144.642	19.225	6.408	15.563
12	145.595	19.351	6.450	15.665

Table 7. Total Profit and Cement Mill Capacity

Period	Total profit (Rp)	Cement mill capacity (hours)
1	59.012.268.000	1.356
2	59.426.628.000	1.256
3	59.840.646.000	1.398
4	60.254.664.000	1.340
5	60.668.682.000	1.356
6	61.083.042.000	1.270
7	61.497.060.000	1.313
8	61.921.998.000	1.332
9	62.325.438.000	1.276
10	62.739.456.000	1.381
11	63.153.474.000	1.340
12	63.567.840.000	1.299
Average	61.290.933.000	1.326

ISBN 978-602-19877-3-5

3.3 Developing of Goal Programming Model

There were two decision variables on this problem, X_1 and X_2 represented production level of cement type I and II per period (in ton). There were four objectives (goals) to be achieved by the management namely production volume, total profit, processing time usage and material usage. The formulation of each goal could be explained as followed.

The first goal was production volume. The management wanted the production level of cement type I and II could fulfilled consumer's demand. The constraint functions of this goal could be formulated as followed:

$$X_1 + d_1^- - d_1^+ = Y_{1j} \quad (4)$$
$$X_2 + d_2^- - d_2^+ = Y_{2j} \quad (5)$$

Where Y_{1j} and Y_{2j} respectively represented the estimated demand for cement type I and II in period-j (in ton), d_1^-, d_1^+ and d_2^-, d_2^+ respectively were negative and positive deviation of achievement of production target of cement type I and II (in ton). The production levels were below the target would result in non-fulfillment of consumer's demand. Otherwise, overproduction would lead to inventory costs. Therefore the objective function was minimization of under or over of production that was formulated as :

$$Min\ Z = P_1 (d_1^- + d_1^+ + d_2^- + d_2^+) \quad (6)$$

The second goal was total profit. The management expected for maximum total profit by producing two types of cements. The total profit function constraint was formulated as:

$$C_1X_1 + C_2X_2 + d_3^- - d_3^+ = TP_j \quad (7)$$

Where C_1 and C_2 represented a net profit of cement type I and II per ton (in Rp), TP_j is total profit of period-j (in Rp), d_3^- and d_3^+ were negative and positive deviation of total profit achievement (in Rp). Therefore, the total profit below the target would be minimized and the objective function was formulated as:

$$Min\ Z = P_2 (d_3^-) \quad (8)$$

The third goal was processing time capacity (machine hours) usage. The management wanted cement mill capacity could optimally used, therefore the constraint function was formulated as :

$$CT_1X_1 + CT_2X_2 + d_4^- - d_4^+ = CMC_i \quad (9)$$

Where CT_1 and CT_2 represented processing cycle time of cement mill for producing cement type I and II (in hours), KWP_j was cement mill capacity on period-j (in hours), d_4^- and d_4^+ were the negative and positive deviation of the achievement of machine hours capacity (in hours). The under capacity (referred to idle time) or above capacity (referred to overtime) should be minimized. In this case the objective function could be formulated as:

$$Min\ Z = P_3 (d_4^- + d_4^+) \quad (10)$$

The fourth goal was materials usage. The management wanted material (clinker, limestone, gypsum, pozzolan) usage was fitted to their availability. This function objective function was formulated as :

$$CC_1X_1 + CC_2X_2 + d_5^- - d_5^+ = AC_j \quad (11)$$
$$CL_1X_1 + CL_2X_2 + d_6^- - d_6^+ = AL_j \quad (12)$$
$$CG_1X_1 + CG_2X_2 + d_7^- - d_7^+ = AG_j \quad (13)$$
$$CP_1X_1 + CP_2X_2 + d_8^- - d_8^+ = AP_j \quad (14)$$

Where AC_j , AL_j, AG_j, and AP_j represented availability of materials (clinker, limestone, gypsum and pozzolan) in period-j (in ton), CC_1 and CC_2 , CL_1 and CL_2, CG_1 and CG_2, CP_1 and CP_2 respectively were consumption level of clinker, limestone, gypsum, and pozzolan in producing one ton of cement type I and II (in ton), d_5^- and d_5^+, d_6^- and d_6^+ , d_7^- and d_7^+, d_8^- and d_8^+ respectively were negative and positive deviation of clinker, limestone, gypsum, and pozzolan usage that linked to their availability (in ton). The management wanted the use of materials did not exceed their availability (referred to shortage) and it should be minimized. In this case the objective function was formulated as:

$$Min\ Z = P_4(d_5^+ + d_6^+ + d_7^+ + d_8^+) \quad (15)$$

Finally, the GP model for the first period of 2015 could be compiled as followed.

The objective function :

$$Min\ Z = P_1(d_1^- + d_1^+ + d_2^- + d_2^+) + P_2\, d_3^- + P_3(d_4^- + d_4^+) + P_4(d_5^+ + d_6^+ + d_7^+ + d_8^+)$$

Subject to (goal constraints) :

$X_1 + d_1^- - d_1^+ = 86.212$
(production of cement type I)
$X_2 + d_2^- - d_2^+ = 84.826$
(production of cement type II)
$348.000\ X_1 + 342.000\ X_2 + d_3^- - d_3^+ = 59.012.268.000$ (total profit)
$0.006\ X_1 + 0.006\ X_2 + d_4^- - d_4^+ = 1356$
(machine hours)
$0{,}79\ X_1 + 0{,}77\ X_2 + d_5^- - d_5^+ = 135.120$
(*clinker*)
$0{,}10\ X_1 + 0{,}11\ X_2 + d_6^- - d_6^+ = 17.959$
(*limestone*)

ISBN 978-602-19877-3-5

$0{,}04\ X_1 + 0{,}03\ X_2 + d_7^- - d_7^+ = 5.986$ (*gypsum*)
$0{,}08\ X_1 + 0{,}09\ X_2 + d_8^- - d_8^+ = 14.538$ (*pozzolan*)

Non-negative constraints :

$X_1, X_2, d_1^-, d_1^+, d_2^-, d_2^+, d_3^-, d_3^+, d_4^-, d_4^+, d_5^-, d_5^+, d_6^-, d_6^+, d_7^-, d_7^+, d_8^-, d_8^+ \geq 0$ (16)

Due to manual calculation was time consuming, then the equation model (16) was solved by Lingo 10.0 software. The GP models of 11 other periods and their solutions were carried out in the same way.

3.4 Solutions

The solution results of GP model presented in Table 7 through Table 10. The results with regarded to achievement of production volume (1st goal) were presented in Table 8 below.

Table 8. The 1st Goal Achievement

Period	P_1			
	d_1^-	d_1^+	d_2^-	d_2^+
1	0,0	0,0	0,0	0,0
2	0,0	0,0	0,0	0,0
3	0,0	0,0	0,0	0,0
4	0,0	0,2	0,0	0,0
5	0,0	0,4	0,0	0,0
6	0,0	0,0	0,0	0,0
7	0,0	0,1	0,0	0,0
8	0,0	0,5	0,0	0,0
9	0,0	0,0	0,0	0,0
10	0,0	0,2	0,0	0,0
11	0,0	0,6	0,0	0,0
12	0,0	0,0	0,0	0,0
Average	0,0	0,2	0,0	0,0

The results with regarded to achievement of total profit (2nd goal) and usage of processing time capacity (4th goal) were presented in Table 9 below.

Table 9. The 2nd and 3th Goal Achievement

Period	P_2		P_3	
	d_3^-	d_3^+	d_4^-	d_4^+
1	0,0	0,0	244,2	0,0
2	0,0	0,0	136,4	0,0
3	0,0	0,0	270,6	0,0
4	0,0	0,0	204,7	0,0
5	0,0	0,0	212,9	0,0
6	0,0	0,0	119,1	0,0
7	0,0	0,0	154,2	0,0
8	0,0	0,0	165,4	0,0
9	0,0	0,0	101,5	0,0
10	0,0	0,0	198,7	0,0
11	0,0	0,0	149,9	0,0
12	0,0	0,0	101,1	0,0
Average	0,0	0,0	171,6	0,0

The results with regarded to achievement of materials usage (4th goal) were presented in Table 10 and Table 11 below.

Table 10. The 4th Goal Achievement

Period	P_4			
	d_5^-	d_5^+	d_6^-	d_6^+
1	1696,0	0,0	0,0	0,0
2	1714,5	0,0	4,5	0,0
3	1732,0	0,0	1,1	0,0
4	1750,0	0,0	0,0	1,3
5	1767,0	0,0	0,0	4,7
6	1784,9	0,0	0,0	7,1
7	1802,6	0,0	0,0	10,5
8	1820,1	0,0	0,0	12,9
9	1838,5	0,0	0,0	15,4
10	1856,1	0,0	0,0	18,7
11	1873,6	0,0	0,0	21,2
12	1892,0	0,0	0,0	25,6
Average	1793,9	0,0	0,5	9,8

Table 11. The 4th Goal Achievement (Continued)

Period	P_4			
	d_7^-	d_7^+	d_8^-	d_8^+
1	0,0	7,3	6,7	0,0
2	0,0	3,6	4,3	0,0
3	0,0	1,0	1,1	0,0
4	1,7	0,0	0,0	1,2
5	4,4	0,0	0,0	4,5
6	7,0	0,0	0,0	6,8
7	63,7	0,0	0,0	10,1
8	13,4	0,0	0,0	13,4
9	16,0	0,0	0,0	15,7
10	18,7	0,0	0,0	19,0
11	21,3	0,0	0,0	21,3
12	24,0	0,0	897,4	0,0
Average	14,2	1,0	75,8	7,7

3.5 Interpretation

The solution results in Table 8 with regarded to achievement of production level, where d_1^- was 0 for all periods which meant no production shortage (cement type I) occured, but d_1^+ was positive (over production) during six periods with an average of 0.2 tons. The value d_2^- and d_2^+ were 0 for all periods, which meant that production level of cement type II could be achieved.

Table 9, d_3^- and d_3^+ that regarded to achievement of total profit were 0 for all periods, these meant that planned total profit could be achieved. Next, the use of processing time capacity which d_4^- was positive on all periods with an average 171.6 hours (deviation of 12.8% of capacity level) which indicated to under capacity (idle time), this meant that the utilization rate of processing time capacity was 87.2%. The d_4^+ was 0 for all periods which meant not occured over capacity (overtime) throughout the planning periods.

ISBN 978-602-19877-3-5

Table 10 and Table 11 regared to use of materials. Value of d_5^- was positive in all periods with an average of 1793.9 tonnes per period (deviation reached 1.28% of availability level) which meant that use of clinker was under its availability, and d_5^+ was 0 in all periods which meant clinker usage did not exceed its availability. Value of d_6^- was 0 in 10 periods which indicated limestone usage was equal to its availability, meanwhile d_6^- was positive in 2 periods with an average of 0.5 tonnes or 0.003% (limestone usage under its availability). Value of d_6^+ was 0 in 3 early periods and positive in 9 periods with an average of 9.8 tons or 0.05% (limestone usage exceeded its availability). Value of d_7^- was 0 in 3 early periods and and positive in 9 last periods with an average of 14,2 tons or 0,22% (gypsum usage was under its availability). Otherwise, d_7^+ was positive in 9 early periods with an average of 1 ton or 0,02% (gypsum usage exceeded its availability) and d_7^+ was 0 in 3 last periods ton (gypsum usage was equal to its availability). Last, d_8^- was positive with an average of 75.8 tons or 0.48% (pozzolan usage was under its availability) and d_8^+ was positive with an average of 7.7 tons or 0.05% (pozzolan usage exceeded its availability).

4. CONCLUSIONS

The optimal production of cement type I and type II averagely were 87.961 tons and 89.706 tons per period and the target would be able to achieved. The average total profit Rp. 61.290.933.000 per period by producing two type of cements would be achieved. The average utilization rate of processing time capacity reached 87,2% per period. There was an excess availability of clinker averagely reached 1.28% per period. The limestone usage averagely reached 0.003% (excess) and 0.05% (shortage). The gypsum usage averagely reached 0.22% (excess) and 0.02% (shortage) per period. The pozzolan usage averagely reached 0.48% (excess) and 0.05% (shortage) per period.

This study could be developed by comparing the model solution with its actual condition. All parameter values were assumed to be deterministic so that the next research could consider uncertainty in parameter values. The study could be developed by expanding the boundaries of model system for example by considering production cost and inventory.

4. ACKNOWLEDGEMENT

The authors would like to express gratitude to PT X for data support and anonymous reviewers for constructive suggestions.

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ISBN 978-602-19877-3-5

STOCK PARTS FORECASTING USING LEAST SQUARE IN PT. DUNIA BARUSA LHOKSEUMAWE

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ABSTRACT

Analysis of demand, particularly demand for spare part stock is to measure the current and forecast demand conditions - the condition in the future. Methods least quare is a method that is most widely used to determine the equation of trend data. Least square forecasting system to capture the pattern of past data is then used to project the data that will come. Measuring demand now means analyzing the present conditions and previously as a source of information to predict the conditions that will come with the assumption that the past situation will be repeated again in the future and how to forecast the demand for spare part stocks for the future and analyze the needs of the spare parts stock in PT. Dunia Barusa. The purpose of the system can allow companies to predict shortages of spare parts and predict stock inventory of spare parts. With the ability of the forecasting system is expected will be used to measure the current demand and the predicted demand for future inventory stock inventory of spare parts in order to remain stable.

Index Terms—*forecasting, least square, spare part*

1. INTRODUCTION

Marketing is to measure and predict market demand. Good demand from domestic and external demand. As the market demand (market demand) is defined as the total number of products or services to be purchased by a group of consumers in a particular area, within a certain time, in a specific marketing environment, and in a particular marketing program.

Problems faced in conducting the analysis of demand, especially demand for the stock of spare parts is to measure the current and predicted demand conditions - the condition in the future. Measuring demand now means analyzing the present conditions and previously as a source of information to predict the conditions that will come with the assumption that the past situation will be repeated again in the future.

Quare least the method is a method that is most widely used to determine the equation of trend data. Method of least squares, divided into two cases, namely the case of the data even and odd data case. Least Square method (least squares) is most often used to predict Y, because the calculation more accurately.

Least square forecasting system to capture the pattern of past data is then used to project the data to come. In this study, the authors will perform inventory forecasting by using the least squares method based on data products in 2010 until 2014. The input variables used in this study are variable demand, while the output variables that forecasting results. With the ability of the forecasting system is expected will be used to measure the current demand and the predicted demand for future inventory stock inventory of spare parts in order to remain stable.

2. LITERATURE REVIEW

2.1. Decision Support Systems

According Kusrini (2007), Decision Support System is a system that is intended to support decision-making managerial decisions in a situation of semi-structured. DSS is intended to be a tool for decision makers to expand their capabilities, but not to substitute their judgment. DSS is intended to decisions that require judgment or on decisions that absolutely can not be supported by the algorithm.

According to Dadan Umar Daihani (2001: 54), the concept of Decision Support Systems (DSS) was first disclosed in the early 1970s by Michael S.Scott Morton explained that the decision support system is a computer-based system intended to help decision makers in particular utilize data and models to solve unstructured problems. In addition Efraim Turban suggests that the Decision Support System is a system that is intended to support decision-making managerial decisions in a situation of semi-structured.

From the definition above, it can be said that the Decision Support System is a system of specific information intended to assist management in making decisions related to issues that are semi structure and structure. This system has the facility toproduce various alternatives that can be used interactively by the user. The computer-based system designed to increase the effectiveness of decision-making in solving the problems that are semi-structured and unstructured. The word-based computer is the key word, because it is almost impossible to build DSS without utilizing the computer as a tool primarily for storing data and managing models.

ISBN 978-602-19877-3-5

2.2. Statistics

According to Suharyadi and Purwanto (2008), Statistics is the science of collecting, organizing, presenting, analyzing, and interpreting data into information to support effective decision-making. Statistics have broad utility in business and other fields. Statistics used in marketing, accounting, management, quality control, see customer satisfaction, and so on.

According to Suharyadi and Purwanto (2008), The types of data is divided into two, namely:

a. Qualitative data is data on non-numeric (numeric) such as gender, favorite color and ethnic origin. Qualitative data is used when we are interested in seeing the proportion or parts that are included in the category.
b. Quantitative data are data numbers or numeric. So, all of these measures in the form of numbers.

2.3. Forecasting

According to Hery Prasetya (2009) Forecasting is an attempt to predict the future state through testing condition in the past. The essence forecasting is an estimate of the events in the future on the basis of the patterns in the past, and the use of policy towards the projections with patterns in the past. Forecasting is an art and science to predict future events. This can be done by involving the retrieval of past data and placing it into the future with a mathematical model forms.

According Rosnani Ginting (2007) concept of forecasting is the initial part of a decision-making process. Before performing trelebih forecasting should be known in advance what exactly the problems in making that decision.

According Subagyo (2002) the purpose of forecasting is getting forecasting that minimize errors predict (forecast error) is usually measured by Mean Absolute Error (MAD), and Mean Squre Error (MSE). So with the forecast production company's management will get an overview of the state of production in the future, and will provide facilities management company in determining the policy to be made by the company. According Gaspersz (2005) the purpose of forecasting is to predict the demand of independent demand items in the future.

According Render and Heizer (2005) on the type of forecasting can be divided into several types. Judging from the planning of future operations, the forecasting is divided into three kinds:

a. Economic Forecasting (economic forecast) explains the business cycle to predict the rate of inflation, the availability of money, the funds needed to build perumahandan other planning indicator.
b. Forecasting technology (technological forecast) take into account the level of technological progress that can launch exciting new products, requiring new factories and equipment.
c. Forecasting demand (demand forecast) are projected demand for the company's products or services. Projections of demand for the products or services of a company. Forecasting is also called forecasting sales, which controls production, capacity and scheduling system and becomes an input for financial planning, marketing, and human resources.

According Rosnani (2007) good forecasting has several important criteria, such as accuracy, cost, and convenience. Explanation of the criteria is as follows:

a. Accuracy
   The accuracy of forecasting an outcome is measured by the results of habit and consistency of the forecasting. Kosisten said forecasting results when the magnitude of forecasting error is relatively small. Forecasting that is too low will result in supply shortages, forecasting that is too high will result in the accumulation of inventories. Then the accuracy of forecasting results is instrumental in menyimbangkan ideal inventory
b. Charge
   Costs required in making a forecast adlah depending on the number of items predicted, the length of the forecast period, and the forecasting method used.
c. Easiness
   The use of forecasting methods that are simple, easy to make, easy to apply and will benefit the company.

3. RESEARCH METHODOLOGY

In a study conducted by the author in PT. Dunia Barusa Lhokseumawe, the authors collected data is based on the following method:

a. Field Research (Field Research) is through direct observation of daily activities at PT. Dunia Barusa Lhokseumawe.
b. Library Research (Research Library) is through the books and other materials related to this research.
c. Interview (interview) that the authors collected data in face-to-face with managers and employees or in order to obtain the information necessary.

Data input is entered in the Least Square method (Least Squares) were as follows:

a. Data Parts
b. Data Stock Parts
c. Data needs Stock Parts

The assessment procedure in forecasting stock of spare parts using the least squares method in PT. Dunia Barusa Lhokseumawe represented in tabular form as follows:

ISBN 978-602-19877-3-5

Table 1. Data Stock Spare Part 2010 until 2014

No	Years	Stock Spare Part
1	2010	9200
2	2011	11227
3	2012	23661
4	2013	19422
5	2014	22527
	Amount	86037

4. RESULT AND DISCUSSION

Forecasting Stock Spare Part Method Using Least Square at PT. Dunia Barusa Lhokseumawe is a system that processes the data and make the process of forecasting the stock of spare parts to the forecasting system in the future, for example, the data so inputted in 2010, 2011, 2012, 2013, and 2014 will be obtained forecast the amount of the stock of spare parts until 2017. The system involves forecasting between tbsp manager, chief engineer, and data stock of spare parts. In the processing system spare part stocks assessed from data on the number TGMO, Oil Filters, Spark Plugs, Padkit, Air Filter, a year which is calculated using the least squares method.

Forecasting of the stock of spare parts at the moment still in the process of using the manual method like using handwriting and Microsoft Office programs, Word or Excel. System is running in PT. Dunia Barusa felt still less effective and efficient, it is not uncommon stock of spare parts is less than is needed, on the other hand also sometimes happens the stock of spare parts with an excessive amount. In this section will be developed a database application that has a good job, in producing a report that accurately forecast the amount of stock of spare parts. With the capability of this system, it is expected in the stock of spare parts becomes more optimized and increased.

In the process of designing computer-based systems, problem analysis plays an important role in making the details of the application to be developed, the analysis of the problem is a step in understanding the issue before taking action or decision final settlement.

Analysis of the new system will be developed to explain about the system that will be created which will be applied in determining activity forecast stoke spare part in PT. Dunia Barusa. In this system, any system users no longer have to re-create the table every new page in the process peningputan data by using the application Microsoft Office, data users enter data on the forms that have been available on the results of data processing systems forecast the stock of spare parts, so that it will directly appear on the page reports that have been made. So to create a database application forecasts the stock of spare parts need the computer for data entry facilities are made. In order to do that we need a program that can provide a better system.

At this stage of system design aims to determine measures overall system operations applications that starts from the design diagram Context and proceed with designing DFD (Data Flow Diagram), ERD (Entity Relationship Diagram), table structure and interface design. In the Data Flow Diagrams (DFD) describes how the functional processes detailed system that connects between the one with the other parts.

4.1. Context Diagram

Context diagram is a diagram related to external systems, and in this context diagram describes a general overview of forecasting stock of spare parts using the least squares method. More clearly seen in Figure 1 below.

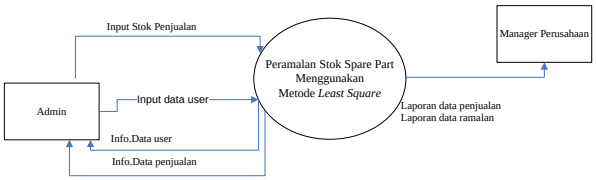

Figure 1. Context Diagram

4.2. Data Flow Diagram Level 0

In designing the data flow diagram above illustrates in detail, for example, the admin does inputting the data management process of forecasting the stock of spare parts are stored in a database that was named the fulfillment of the water and so are other processes. Can be explained more clearly in Figure 2 below.

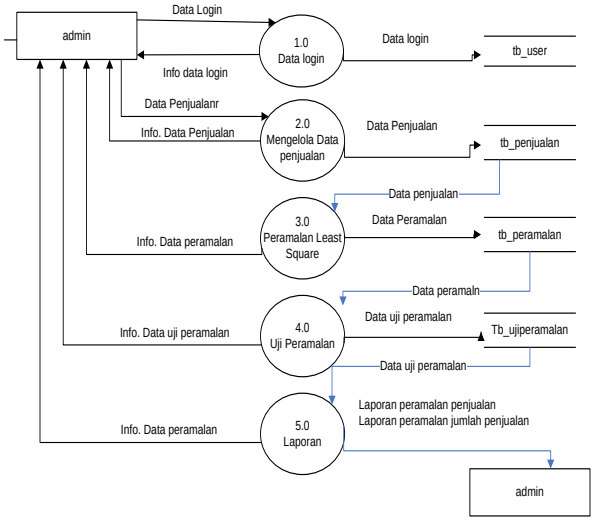

Figure 2. DFD Level 0

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4.3. DFD Level 1 Process 1 Managing Data Login

Figure 3 below DFD level 1 process 1 (Managing Data Login), described in more detail in managing data login, namely the processes needed by the system, for example the process save, edit, update and delete then the data is stored in a database that is named admin and the system is in use by admin.

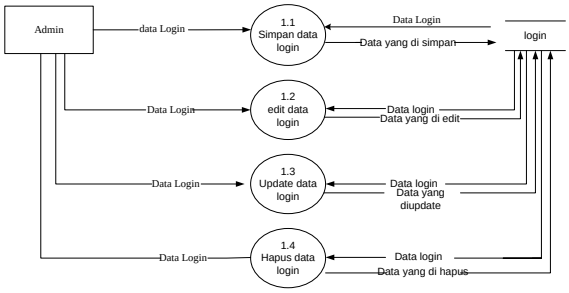

Figure 3. DFD Level 1 Process 1 Managing Data Login

4.4. DFD Level 1 Process 2 Data Sales

Figure 4 below DFD level 1 process 2 (Managing Data Sales), described in more detail in managing address data location, namely the processes needed by the system, for example, the process is stored, edited, updated and deleted then the data is stored at a given address location database and the system is in use by admin.

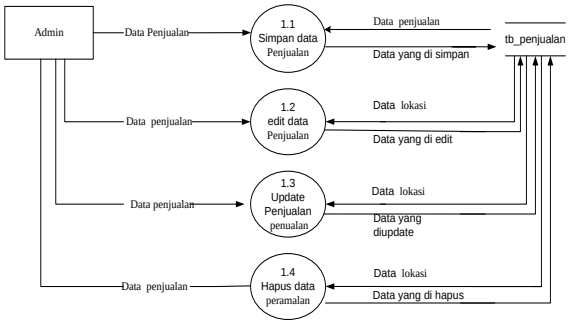

Figure 4. DFD Level 1 Process 2 Data Sales

4.5. DFD Level 1 Process 3 Forecasting Data Stock Spare Part

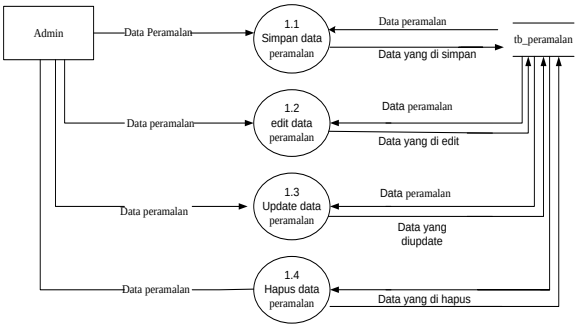

Figure 5. DFD Level 1 Process 3 Forecasting Data Stock Spare Part

Figure 5 above DFD level 1 process 3 (Managing Data Availability of stock of spare parts forecasting), described in more detail in managing the data stock of spare parts forecasting, namely the processes needed by the system, for example, the process is stored, edited , updated and deleted then the data is stored on a database that was named tb_forecasting and the system is in use by admin.

4.6. DFD Level 1 Proses 4 Test Data Forecasting

Figure 6 above DFD level 1 process 4 (Data stock spare forecasting test), described in more detail in managing test data forecasting.

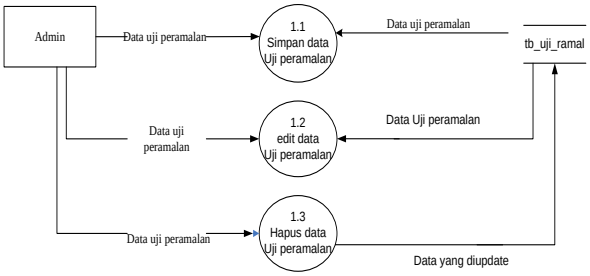

Figure 6. DFD Level 1 Proses 4 Test Data Forecasting

4.7. System Implementation

The interface is designed to have some form of which form the input file stock sales, forecasts, reports and forms printed on. Clearer will be described below as follows:

4.7.1. Form File Data Login

Form login data is the first form arises when the application is run, this form and closes automatically. Login form serves to enter the program input and reports, how the login form is a way to fill in the appropriate username and password and click login here. More clearly seen in Figure 7 below:

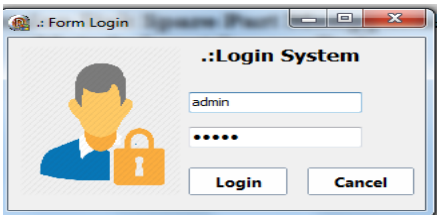

Figure 7. Form File Data Login

4.7.2. Form Main Menu

Form the main menu is the form in which the first caller from the main menu we can open all the forms, procedures, or reports desired. To more clearly seen in Figure 8 below:

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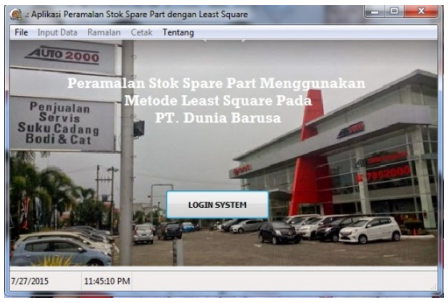


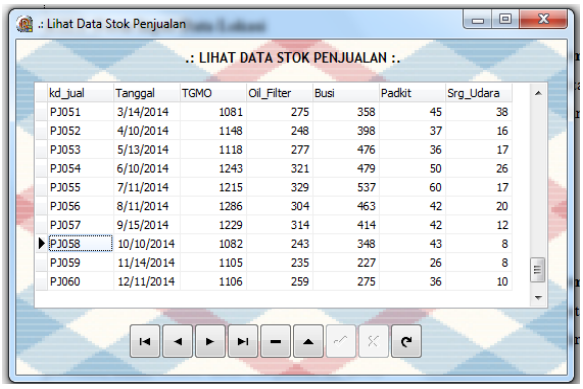
Figure 8. Form Main Menu

4.7.3. Form Input Data

nput data is designed to have some form of them form file sales data, sales data input form, form input user data, form data forecasts least square, forecasting all form data, forecasting graph form, and form the print menu. Clearer will be described below as follows:

4.7.3.1. Form File Data Penjualan

Form Input Data stock of spare parts can be displayed through the main form menu > Input Data. See file Form stock data sales. This form is used to view data files sales data, sales data can be input file, save, delete, and out of form. To more clearly could dilhat in Figure 9 below:



kd_jual	Tanggal	TGMO	Oil_Filter	Busi	Padkit	Srg_Udara
PJ051	3/14/2014	1081	275	358	45	38
PJ052	4/10/2014	1148	248	398	37	16
PJ053	5/13/2014	1118	277	476	36	17
PJ054	6/10/2014	1243	321	479	50	26
PJ055	7/11/2014	1215	329	537	60	17
PJ056	8/11/2014	1286	304	463	42	20
PJ057	9/15/2014	1229	314	414	42	12
PJ058	10/10/2014	1082	243	348	43	8
PJ059	11/14/2014	1105	235	227	26	8
PJ060	12/11/2014	1106	259	275	36	10

Figure 9. Form Input Data Location

4.7.3.2. Form Input Data Penjualan

Form Input sales data can be displayed through the main form menu > Input Data. Form Input sales data. This form is used to enter, save, delete, update and out of form. To more clearly could dilhat in figure 10 below:

Figure 10. Form Input Data Stock Sales

4.7.3.3. Form Input Data User

Form Input user data can be displayed via the main form menu > Input Data. Form user data. This form is used to enter, save, delete, update and out of form. To more clearly could dilhat in figure 11 below:

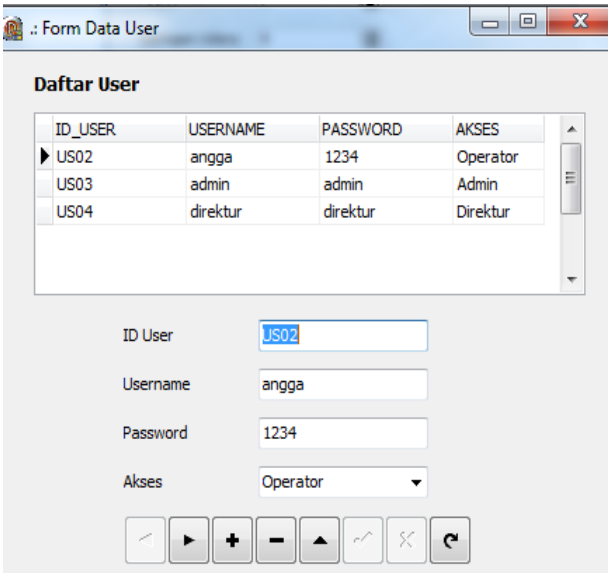


Figure 11. Form Input Data User

4.7.4. Form Data Forecasting Least Square

Form Forecasting Input data can be displayed through the main form menu > select Data Input Data forecasting. Input Form forecasts least square. To more clearly be seen in Figure 12 below:

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Figure 12. Form Data Forecasting Least Square

4.7.5. Form Data All Forecasting

Data reports forecasting the stock of spare parts consists of consists of the year, the number of spare parts, spare parts fulfillment amount, total demand and total stock of spare parts. How to call a water distribution report that is on the main Form menu > Reports, click a report forecasting all the data, it will come out form the decision of forecasting stock of spare parts. To more clearly seen in Figure 13 below:

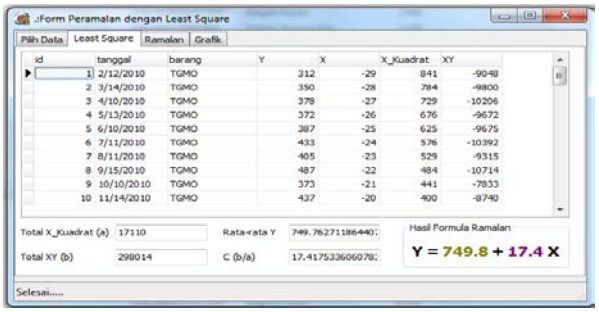


Figure 13. Form Data Forecasting Least Square

4.7.6. Form Forecasting Graphs

Form forecasting graphs can be displayed through the main form menu > Reports. Form charts forecasting. This form is used to enter, correcting, processing, and returns. This form consists of a selection of data, and a year-tellers. To more clearly could dilhat in Figure 14 below:

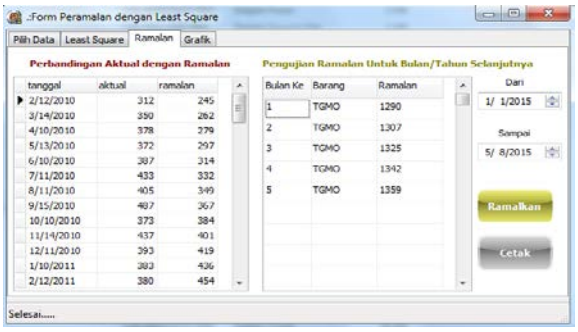


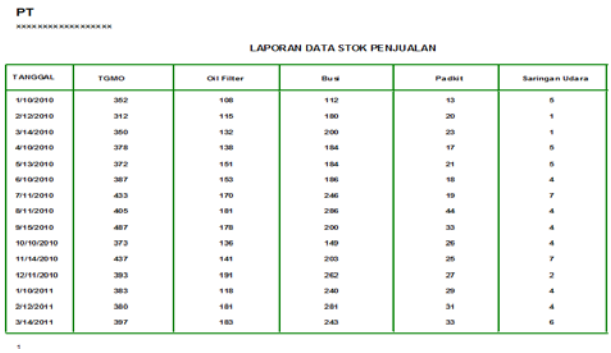
Figure14. Form Forecasting Graphs

The report consists of the forecasting graph consists of a selection of data reports, charts, and year. How to call graphs forecasting that the main form menu > Reports, click a report forecasting charts and click process, it will exit the decision graph form forecasting. To more clearly seen in Figure 15 below:

Figure 15. Form Resut of Foeracsting Graphs

4.7.7. Form Report Menu

Form a report forecasting the print menu can be displayed through the main form menu > Print. For more details on the picture may in Figure16 below:

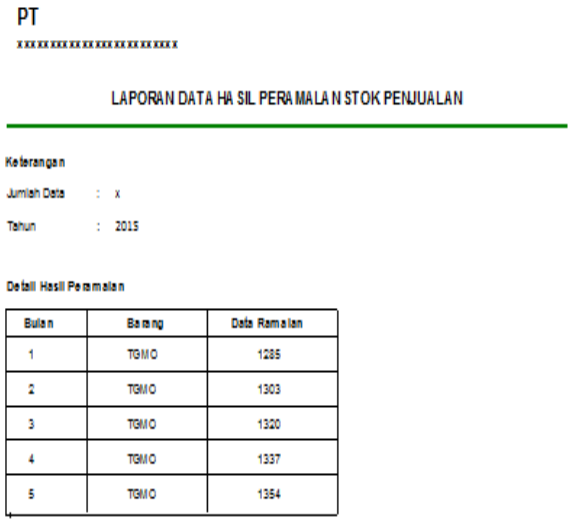

PT

LAPORAN DATA STOK PENJUALAN

TANGGAL	TGMO	Oil Filter	Busi	Padkit	Saringan Udara
1/10/2010	352	108	112	13	6
2/12/2010	312	115	100	20	1
3/14/2010	350	132	200	23	1
4/10/2010	378	138	184	17	5
5/13/2010	372	151	184	21	5
6/10/2010	387	153	186	18	4
7/11/2010	433	170	246	19	7
8/11/2010	405	181	206	44	4
9/15/2010	487	178	200	33	4
10/10/2010	373	136	149	26	4
11/14/2010	437	141	203	25	7
12/11/2010	393	191	262	27	2
1/10/2011	383	118	240	29	4
2/12/2011	380	181	281	31	4
3/14/2011	397	183	243	33	6

Figure 16. Results Report Form Data Sales

Furthermore, the report form of prediction results are used to seeing the results of the forecast. Admin to form images can be seen in Figure 17 below:


PT

LAPORAN DATA HA SIL PERA MALA N STOK PENJUALAN

Keterangan

Jumlah Data : x

Tahun : 2015

Detail Hasil Peramalan

Bulan	Barang	Data Ramalan
1	TGMO	1285
2	TGMO	1303
3	TGMO	1320
4	TGMO	1337
5	TGMO	1354

Figure 17. Form Result Forecasting

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5. CONCLUSION

From the results of the design Parts Stock Forecasting Method Using Least Square At PT. Dunia Barusa Lhokseumawe, the writer can draw conclusions:

a. The research resulted in a system application Forecasting Inventory stock spare parts that can be used to predict the amount of inventory stock based on the type of goods.
b. Forecasting given by the least squares method in the periodic data is not good, because the graph shown there is a difference that is very much to be a reference.

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ISBN 978-602-19877-3-5

THE EFFECTIVENESS OF MECHANICS HANDOUT INTEGRATED BY VOLCANIC ERUPTION MATERIAL TO CREATIVE THINKING ABILITY

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ABSTRACT

This experiment is based on the problem that student learning outcomes are still under standard. It aimed to investigate the effectiveness of mechanics handout integrated by volcanic eruption material to creative thinking ability. This type of research is a Quasi Experiment. Design of research is randomized Control Group Only Design. The population of research is all the student of grade XI in SMA N 1 Padang enrolled in the academic year 2013/2014. The sample is selected by cluster random sampling technique; the sample is consisted of XI Science 6 as experiment class and XI Science 7 as control class. The data of research is cognitive physics learning outcome. The technique of collecting data is essay. Analysis of data uses two similarity average tests. The conclusion of research is hypothesis that there is significant effectiveness of mechanics handout integrated by volcanic eruption material to the creative thinking ability can be accepted on the real level of 0.05.

Index Terms— Mechanics, Handout, Volcanic, Eruption, Creative, Thinking

1. INTRODUCTION

Physics is the most fundamental science as the basis for the development of science [1]. Physics is a science which aims to study the components of matter, energy, and their interactions [2]. So, physics is the science that studies the most fundamental matter, energy, and their interactions.

Physics can develop the ability of thinking, not only knowledge of facts, concepts or principles but also a process of discovery or problem solving [3]. To encourage the process of discovery or problem solving, creative thinking abilities is required for students to associate the concept of physics with the phenomenon of volcanic eruptions. The ability of creative thinking is intended to acquire the competence of science and cultivate scientific thinking [4].

Creative thinking is the ability to find new ideas and then reconstruct the idea to form solutions [5]. Creative thinking has certain indicators that differentiate it from other thinking skills. Indicators of creative thinking are: (1) fluency, have a lot of ideas; (2) flexibility, give the interpretation of the images; (3) originality, resolve the problem with synthesize, and (4) evaluation, giving consideration on the basis of their own perspective [6]. A person has the ability to think creatively if they have the indicators of creative thinking.

SMAN 1 Padang is one of the top schools in Padang. SMAN 1 Padang has students who have top score in final examination in junior high school, complete infrastructure, competent teachers, and a good school administration. Although it has been supported by the school, most of the students in SMAN 1 Padang could not reach minimum completeness standard as seen on the final score of physics class XI Science 2012/2013 academic year in

Table 1 Final Score Physics Grade XI Science SMAN 1 Padang Academic Year 2012/2013 Term 1

Class	$\bar{x}$	Com-plete (%)	Incom-plete (%)	Minimal Score
XI 1	75	10,71	89,29	80
XI 2	77	44,83	55,17	80
XI 3	78	28,57	71,43	80
XI 4	79	37,93	62,07	80
XI 5	81	62,07	37,93	80
XI 6	80	46,43	53,57	80
XI 7	82	74,07	25,93	80

Source: SMAN 1 Padang Administrator

Table 1 shows that only a small percentage of students who were able to achieve minimum completeness standard. Only two classes achieved complete percentage to 50%. Those were grade XI Science 5 and XI Science 7. This condition indicates that the creative thinking ability of the students were still low.

The author held survey and interview in class XI Science at SMAN 1 Padang to determine the cause of the low creative thinking ability. Based on the interviews, it was concluded that the student still have difficulty finding relationships between concepts. The habit of memorizing formulas makes the student not understand that the relation of physics and environment.

Physics is the study of natural phenomena, such as the potential of the region. The learning process set out in the curriculum should be developed based on regional potential [7] [8]. In addition, learning material must contain enrichment. Learning enriched with local potentials should be implemented in West Sumatra [9].

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One of local potential of West Sumatra is volcano such as Mount Marapi and Mount Talang. The process of learning physics in schools should be associated with volcanic eruption material to foster creative thinking ability. The lack implementation of regional potential to the learning process is caused by not integrated learning resource to volcanic eruption material. Therefore, teacher can use mechanics handout integrated by volcanic eruption material.

Handout is teaching materials that can support teaching process [10]. Handout is simpler and easier to develop so that it can be used to integrate disaster material into the learning process. Handout material integrated volcanic eruption material or elaboration contains a brief elaboration of a teaching materials and their relation to volcanic eruption material. Handout compiler structure contains three things, namely: Introduction, content, and cover [11].

The material presented in handout is the law of energy and momentum conservation integrated by volcanic eruption material. Volcanic eruption formula such [12]:

$$E = cp\ \rho\Delta T\ q\ \tau \quad (1)$$

where *E* is the thermal energy which is owned magma in the earth (joules), *cp* is the heat capacity of magma (J kg^{-1} K^{-1}), ° is the density of the magma (kg/m^3), a*T* is the temperature difference between the column of magma channels mountain erupted and outside air (K), *q* is the discharge of magma that came out of volcanoes channel column (m^3/s), and τ is an interval of eruption event (s).

The average value of heat capacity (*cp*) is $1{,}3x10^2$ $JKg^{-1}K^{-1}$ [13] and the density of magma is different for each type. The density for three types of magma can be seen in Table 2.

Table 2 Mass Magma type [14]

Type	Density (kg/m^3)
Basal Magma	2650-2800
Andesit Magma	2450-2500
Rhyolit Magma	2180-2250

The relationship between the height emission discharge of magma and the crater written as follows [12]:

$$H = 1{,}4\ q^{¼} \quad (2)$$

Which H is the height emission of magma (m), and 1.4 and ¼ are constant.

The relationship between the thermal energy and the height of the magma as follows [12]:

$$E = \frac{cp\rho\Delta TH^{5}\tau}{1{,}4} \quad (3)$$

Other physical parameters associated with volcanic eruptions are mass, speed, force, and a time interval. The relationship of parameters is expressed in impulses as follows in Equation (4):

$$dp/dt = Mv = F \quad (4)$$

Which *p* is the momentum (kg m/s), *t* is the time interval (s), *M* is the mass emission of magma average (kg), *v* is the velocity of magma through the gap, and *F* is the force received magma when it moved.

The use of mechanics Handout integrated volcano eruption material is expected to enhance the students' ability to think creatively. The purpose of this study was to investigate the effectiveness of mechanics handout integrated by volcanic eruption material to creative thinking ability. The research material is a physics material of first term class XI, the law of energy and momentum conservation.

2. RESEARCH METHODS

The type of research is a quasi experimental research. The research design is Randomized Control Group Only Design. Students are grouped into two classes. There are experimental and control class. In experimental class, the author uses the volcanic eruption material. While in the control group, the author does not use the volcanic eruption material. The research design is shown in Table 3.

Table 3 Study Design

Class	*Treatment*	Posttest
Experiment	X	T
Control	-	T

Where T is the final test on the experimental and control classes and X is the treatment given to the experimental class, namely the use of mechanics handout integrated by volcanic eruption material.

Population is a collection of all similar elements but can be differentiate from each other that are the result of calculations or measurements of the specific characteristics of all members of who wants to be learned their attitudes [15]. The study population was all first term XI Science Class at SMAN 1 Padang enrolled in the academic year 2013/2014 as shown in Table 4.

Table 4 Distribution of Grade XI Science SMAN 1 Padang

Class	Amount of Student	Average Mark
XI 1	31	72,00
XI 2	32	73,00
XI 3	32	74,00
XI 4	32	75,20
XI 5	31	77,50
XI 6	30	76,00
XI 7	30	72,00

Source: Administrative SMAN 1 Padang

The sample is representative of the population. It means all the characteristics of the population should be reflected also in samples taken [15]. Sample was

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obtained by cluster random sampling technique, which takes representative of each population. There are two samples that will be used as the experimental class (XI Science 6) and the control class (XI Science 7).

The variable is everything that becomes the object of observation [15]. The variables of this study consisted of three, such as independent variable, dependent variable, and the control variable. The independent variable is the variable that cause or influence, the factors measured, manipulated or selected by the authors to determine the relationship between the observed phenomena. In this study, the independent variable is the volcanic eruption material. The dependent variable is the factor that is observed and measured to determine the influence of independent variables, which is a factor that appears, or does not turn up, or changed according to that introduced by the researcher. Dependent variable in this research is physics students' learning outcomes. Control variables are variables that can be made to be neutralized. Control variables in this experiment are handout, a classroom condition, the number of hours of lesson, book resources, and classroom teacher.

Data is a value that describes an object or event. The research data is data result of student learning physics of class XI at SMAN 1 Padang after the treatment was given, in the form of primary data obtained directly from the sample under study.

To achieve the objectives, it is need to be developed a systematic procedure. In general, the research procedure can be divided into three phase, such as preparation, implementation and completion.

During the preparation phase, the authors prepare everything related to the implementation of the study, such as research schedule, research permission, sample, the learning set (syllabus, lesson plans, and handouts), final test plan, and final test item.

The implementation phase is the phase of doing research. The research is held in experimental and control class. The treatment is given to the experimental class is a volcano eruption material.

The activities in completion phase is holding a final test, analyzing test results to determine the validity, the item index differentiator, difficulties index, and item reliability, taking four items for the final test, doing a final test for both classes, collecting data of student learning outcomes through written tests and observation sheets, and analyzing the student learning outcomes through statistical tests.

The instrument is a data collection tool in the research. It was a written test for cognitive aspects.

Before performing the test, the instrument should be analyzed statistically. Statistical analysis has been done will provide information about the feasibility of which has been designed. Analysis of item test aims to hold the identification of item [16].

Analysis was conducted on the instrument validity, reliability, power is different, and the level of the difficulties index instrument. Instrument can be valid if the instrument can measure what is to be measured [16]. In this study, the type of study is a content validity (content validity).

Techniques that can be used to determine the correlation is the product moment correlation technique with rough numbers. The formula product moment correlation with rough numbers according to Pearson [16], namely:

$$r_{xy}=\frac{N\Sigma XY-(\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2-(\Sigma X)^2][N\Sigma Y^2-(\Sigma Y)^2]}} \quad (5)$$

Which r_{xy} is the correlation coefficient between the variables *x* and *y* variables, the two variables are correlated, X is the score of the items, and Y is the total score. If $r_{xy} > r_{table}$, so the item is valid.

Reliability is the level of consistency of a test, as far as the item is reliable, relatively unchanged even if used in different situations shown in the level of provision and accuracy.

To determine the reliability of the test form can use the description about Alpha formula.

$$r = \left(\frac{n}{n-1}\right)\left(1-\frac{\Sigma\sigma b^2}{\sigma^2 t}\right) \quad (6)$$

Which

$$\sigma^2 = \frac{\Sigma x^2-\frac{(\Sigma x)^2}{N}}{N} \quad (7)$$

Which *r* is the overall reliability of the test, n is the number of items, $\Sigma\sigma b^2$ is the amount of variance item, $\sigma^2 t$ is the total variance, Σx is the number of participants test scores, $(\Sigma x)^2$ is the sum of squared scores of learners, and N is the number of test-takers.

The item index differentiator is ability of the item to differentiate smart and less intelligent students. It can be determined by the following steps.

First, sort the data from highest to lowest. Second, take 27% of the group receiving the highest score and 27% of the group that received the lowest score. Third, calculate degrees of freedom (df) with Equation (8).

$$df = (n_t - 1) + (n_r - 1) \quad (8)$$

Where

$$n_t = n_r = 27\% \times N = n \quad (9)$$

To search the item index differentiator, use Equation (10).

$$Ip = \frac{Mt-Mr}{\sqrt{\frac{\Sigma x_t^2+\Sigma x_r^2}{n(n-1)}}} \quad (10)$$

with *Ip* is a item index differentiator, *Mt* is the average score of the higher group, *Mr* is the average score of the lower group, Σx_t^2 is the sum of the squares score of the higher group, Σx_r^2 is the square scores of the lower group, *n* is 27% x N, and N is the number of participants test.

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The item has significant index differentiator when $Ip \geq Ip_{table}$ at a predetermined df [17]. The difficulty index is used to determine the difficulty of the item. The formula is [17]:

$$Ik = \frac{D_t + D_r}{2mn} \times 100\% \quad (11)$$

Which *Ik* is the difficulty index, *Dt* is the total score of the high group, *Dr* is the total score of the lower group, *m* is the true answer score, *n* is 27% x *N*, and *N* is the number of participants test.

Analyses of the research aim to test the truth of the hypothesis proposed in the study. Data analysis techniques in the cognitive domain consist of normality test, homogeneity, and hypothesis testing. Normality test aims to determine the contribution of the sample. It is used to test Lilliefors using the following steps. First, sort the data from smallest to largest and then make it as the raw numbers using Equation (12).

$$Z_i = \frac{X_i - \bar{X}}{S} \quad (12)$$

Where X_i is the score obtained by the students of I, $\bar{X}$ is the average score, *S* is the standard deviation. Second, calculate the possibility of F (Zi) = P (Z <Zi) using the standard normal distribution list. Third, the proportion is expressed by Equation (13)

$$S(Z_i) = \frac{\text{The amount of } Z_1, Z_2, Z_3 \ldots Z_n \text{ yang} \leq Z_i}{n} = \frac{fk}{n} \quad (13)$$

Fourth, by calculating the difference F (Zi) - S (Zi) uses the largest value among the absolute value of the difference called L_0. If L_0<Lt, then the samples are normally distributed. Homogeneity test is a test that aims to determine whether the samples are homogeneous or not. To test homogeneity, use F test through Equation (14).

$$F = \frac{S_1^2}{S_2^2} \quad (14)$$

Which S^2 is the variance of data, f_i is the frequency of the data, x_i is the students' grades, *F* is the variance of the data group, S_1^2 is the largest variance of learning outcomes, S_2^2 is the smallest variance of learning outcomes. If $F_{table} > F$ in 5% significant level and $dk_{numerator} = n_1 - 1$ and $dk_{denominator} = n_2 - 1$, it means both classes have a homogenous variance.

Hypothesis testing is a procedure to make decision, received or accepted. Hypothesis test uses Equation (15).

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \quad (15)$$

Where:

$$S^2 = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} \quad (16)$$

with $\bar{X}_1$ is the value of the experimental class, $\bar{X}_2$ is the value of the control class, S^2 is the variance, S_1 is the standard deviation of the experimental class, S_2 is the standard deviation of the control class, *S* is the standard deviation of the combined, n_1 is the number of students experimental class, and n_2 is the number of students control class. Criteria testing are Ho accepted if $t < t_{1-\alpha}$ and Ho rejected if *t* has another value.

3. RESULTS AND DISCUSSION

The results were obtained after collecting data from the date of October 14, 2013 until December 16, 2013 at SMAN 1 Padang. Learning is done 14 times face to face in the experimental class and control class. The data obtained in this study is a student cognitive learning outcomes. A result of this study was obtained through the assessment carried out during the learning process.

Data assessment physics cognitive learning outcomes obtained from the final test. The technique used is the technique of the written test in the form of essays by 4 pieces of matter. This matter was given to the sample at the end of the research process.

Results of calculation average value ($\bar{X}$), standard deviation (S) which is the level of data dissemination, and variance (S2) stating dissemination of data on experimental and control classes are shown in Table 5.

Table 5 Average Value, Standard Deviation, and Variance class Domains Cognitive Samples

Class	N	$\bar{X}$	S^2	S
Experiment	30	84,00	54,262	7,366
Control	30	80,00	61,029	7,812

Normality test results conducted found Lo and L_{table} prices on the real level of 0.05 as shown in Table 6.

Table 6 Normality Test Results of Both Classes

Class	α	N	L_o	L_t	Note
Experiment	0,0	30	0,134	0,161	Normal
Control	5	30	0,145	0,161	Normal

Table 6 shows that both samples have a value class Lo <Lt on the real level of 0.05. This means the end of the second test result data are normally distributed sample class for the cognitive.

After the normality test, homogeneity test was done to see if the second sample has a class of homogeneous variance. At the homogeneity test used F. After calculation test on samples obtained both classes of cognitive homogeneity test results such as Table 7.

Table 7 Homogeneity Test Results of Both Classes

Class	S^2	F_h	F_t	Note
Experiment	54,262	1,125	1,84	Homogeny
Control	61,029			

Test of normality and homogeneity, obtained a sample class normally distributed and homogeneous. Therefore, the t test was used to determine significant differences in the two classes of samples.

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Table 8 Results of the t test Cognitive Domains

Class	N	Mean	S^2	t_h	t_t
Experiment	30	84	54,26	2,26	1,67
Control	30	80	61,03		

Table 16, Table 17 and Table 18 shows that $t_h > t_{table}$, Ho accepted if $t_h < t_{(1-\alpha)}$ and rejected Ho if it has another price at significant level of 0.05 with degrees of freedom df = (n1 + n2) -2. This means that the price of t is not in the reception area so that Hi is received the real level of 0.05. Comparison of the two figures shows that there are significant influence of Mechanics Handout integrated volcanic eruption material. It means that mechanics handout can be effective to increase the creative thinking ability.

4. CONCLUSIONS AND SUGGESTIONS

Based on the research that has been held, the conclusion of this study is that Mechanics Handout integrated volcanic eruption material is effective to increase the creative thinking ability on the real level of 0.05. The indicator is a significant difference of average cognitive learning outcomes between experimental class and control class.

The author has some problems during the study. Therefore, the author gives some suggestions for overcoming researcher. First, the use of mechanics Handout integrated volcanic eruption material can't be maximized because the time was not enough. The use of mechanics Handouts can be maximized, if it has enough time. Secondly, this research is still for mechanics concept. Therefore, it is expected to continue the research for a broader scope, not only mechanics. Third, there should be the development of this research, the expansion of the scope of the mechanics Handout integrated volcanic eruption material.

5. NOTE

This paper was prepared with support provided by a contract from the U.S. Department of Energy through the National Petroleum Technology Office in Tulsa, Oklahoma, DE-AC26- 98BC15135, "Calibration of Seismic Attributes for Reservoir Characterization," under project manager Purna Halder.

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ISBN 978-602-19877-3-5

LEARNING ORIENTED CONTENT AND COGNITIVE PROCESS COMPLEXITY FOR PHYSICS LEARNING IN HIGH SCHOOL OF PADANG

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ABSTRACT

Learning physics in high school, mandates that students have a comprehensive knowledge, through cognitive processes adequately, which refers to the scientific approach, thus developing competence optimally. Based on that, it is developing physics learning model oriented on the content complexity and cognitive processes such as those developed by Anderson & Krathwohl, to improve the students competence for physics in high school. The process of developing instructional model using ADDIE model begins with a preliminary study in descriptive evaluative for 2 months (March to April 2015) at 4 high schools in Padang that implement the curriculum of 2013. Instrument for students cognitive competence is based on four dimensions of knowledge and 6 level cognitive processes, which amounted to 24 items. Competency tests were done to 12 students of class X in the category rank 1, 2, and 3. Collecting data on the learning process of teachers conducted by questionnaire, interview and observation. The results of preliminary studies conclude that the quality of the students competence achievement in physics learning on high schools in Padang is still low, in terms of the content complexity and the level of cognitive processes still in the level of 1, 2, and 3, while for level 4, 5, and 6 are still very few and almost not appear. The study results recommend to develop learning model-oriented on the content complexity and the level of cognitive processes for high school in physics learning on Padang.

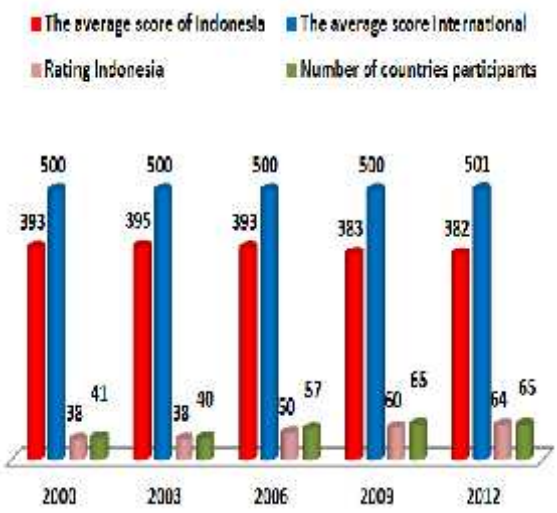
Index Term: physics learning content, cognitive processes, scientific approach, competences

1. INTRODUCTION

Content or subject matter is a curriculum component [1] concerning the answer to the question: "What is taught?". In the implementation of the learning in the field, the content is often left alone on the teacher decisions or taken from the textbook, without hooking the purposes of education, curriculum objectives and instructional goals.

The curriculum content learning traditionally has emphasized more in the presentation of the content as much as possible in the form of data, information, facts, postulate, formulas, etc. The result is a verbal learning happened, and almost all the content being taught is quickly forgotten, because of limitations memory. This situation is undesirable because not many curriculum provide sufficient understanding, so that low achievement of students competencies as a result of less qualified learning.

The low-quality learning is also happened in science. The results study that conducted by "The Programme for International Student Assessment"(PISA), which is held once in 3 years, showing the trends of Indonesia's ranking in scientific literacy in 2000-2012 was stated by the graph in Figure 1.



Source: Balitbang Kemdikbud RI, 2012 (Once in 3 Years Data) & (www.oecd.org)

Figure 1. Graphic tendency of Indonesia Position in Scientific Literacy Study Results of PISA 2000 to 2012.

The graph shows that the ability of Indonesian students' scientific literacy, which in 2000 was ranked 38th of 41 countries, the decline continued to ranks 64th of 65 countries in 2012. Furthermore, based on the study Balitbang RI (2012), if associated with the cognitive level of students, 20.3% of Indonesia students is still below the level 1, 41.3% at the level 1, 27.5% at the level 2, 9.5% at the level 3, and 1,4% at

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the level 4. There is no Indonesian students on level 5 and level 6. This shows that the majority of Indonesian students have limited scientific knowledge. The PISA results show that the achievement of learning outcomes in science of 15 years old Indonesia students (class IX junior high school and class X senior high school) was below International standard average [2]. This limitation is an indicator of the poor quality of science education itself, including physics learning.

Science Literacy can be defined as the ability to use scientific knowledge, or the capacity to use scientific knowledge. Scientific literacy is important to the student to understand their environment as well as solving the problems encountered in science and technology. Therefore, science learning in school is expected to equip students and to take advantage of science in their's needs. It depends on the content (subject matter) and the learning process that teached by the teachers in schools. Namely the learning process in accordance with the characteristics of science itself, which is based on facts, and developed through a scientific process.

Weak of scientific literacy students in Indonesia, was responded by the government with implementating the curriculum of 2013 that sue contextual learning with a scientific approach. In 2015, in Padang, there are 8 schools that implementing curriculum of 2013, i.e. SMAN 1, SMAN 2, SMAN 3, SMAN 4, SMAN 7, SMAN 10, SMA Don Bosco, and SMA Semen Padang [3]. Accordingly, questionables: a) how the student achievement should be connected with the completeness of the content dimensions and levels of students' cognitive processes in physics at the high school in Padang?. b) how teachers implement the curriculum of 2013 to achieve a quality of physics learning?. c) How model of physics learning that content oriented and cognitive processes complexity for learning physics in high school in Padang? d) How effective of physics learning model that developed could achieve a holistic student competencies?

Content of knowledge can be divided into four dimensions: (1) factual knowledge, (2) conceptual knowledge, (3) prosedual knowledge, and (4) metacognitive knowledge [4].

Factual knowledge, is "knowledge of what". Including of basic elements that should be known to the learners if they will be introduced to a knowledge and the use of experts in delivering, understanding, and managing a knowledge systematically. Anderson & Krathwohl, distinguish between factual knowledge of two kinds, i.e.: a) terminology knowledge that includes the names and symbols of verbal and non-verbal certain form of words, numbers, signs, and images, which has a certain reference, used by the experts in communicating to reveal what they known. b) detailed knowledge in the form of findings and events, which illustrate the important knowledge about the subject of science [4]. In physics, examples of the material facts, such as event that can be seen, heard, read, touch, or observed. Examples of facts: rubber is elastic and clay is plastic, the ice can melt and the water can evaporate, small and light pebbles sink in the ocean floor, while the large and heavy ships float on water.

Conceptual knowledge is a knowledge that is as a link between the facts that are interconnected. Conceptual knowledge can be divided into several types, i.e.: classification and category knowledge, principles and generalizations knowledge, and models, theories, and structures knowledge. Classifications and categories knowledge, such as sharing, grouping and specific preparing used. Principles and generalizations knowledge are the form of certain abstractions which summarize observations phenomenon that has the most benefit in describing, predicting, explaining, or determining an action or the most appropriate and relevant guidances to be taken. Theory, Models and Structures of knowledge, are covering the knowledge about relationship between the principles and generalizations, together presenting systematic and clear opinion of the phenomenon, or the complex issue. Sub type of knowledge includes the different paradigms, epistemology ep[illegible]ology, theories, and models different principles t[illegible]sed of knowledge to describing, understanding, explaining and predicting the phenomena [4]. Examples of conceptual knowledge are: 1) elastic materials category is the material that is given a force, so that shape and size are changing, and if the force lose, the shape and will be back to the beginning. Plastic materials are the opposite to the elastic materials, that is after the force lose material will not return to its original shape. 2) acceleration generated by a force, which is working on a large object is proportional to the force and inversely proportional to the mass of the object (2nd Newton's Laws). In Physics, in addition to meaning, and rules on something, include of conceptual knowledge are: concepts, principles, laws, theories, principles and models.

Procedural knowledge, is "Knowledge about the process of how to do something". The form is a series of steps that will be followed, including knowledge of skills, algorithms, techniques, and collectively methods are referred to procedures [5]. Examples of procedural knowledge are the steps of the scientific method, verification and translation of a formula that uses the logic of thinking, as well as the steps in solving other problems. In physics, scientific work step is an integration of any subject matter such measures determine the relationship style experiment with the length of the spring, the experiment determines the specific heat of solids, and so forth.

Metacognitive knowledge, is knowledge about consciousness and awareness of someone that is more emphasis on the responsibility of their own thoughts, when they act in resolving the problems wisely [6].

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Metacognitive knowledge, is covering knowledge of general strategies for learning, thinking, and diverse problem solving through owned mapping-related of knowledge (factual, conceptual and procedural knowledge), thus obtained appropriate problems troubleshooting strategies (problem solving) is. If three previous knowledges are related to the not controlled problem, then the learners are not able to resolve his problems better. Description dimensions of knowledge generally is presented in Figure 2.

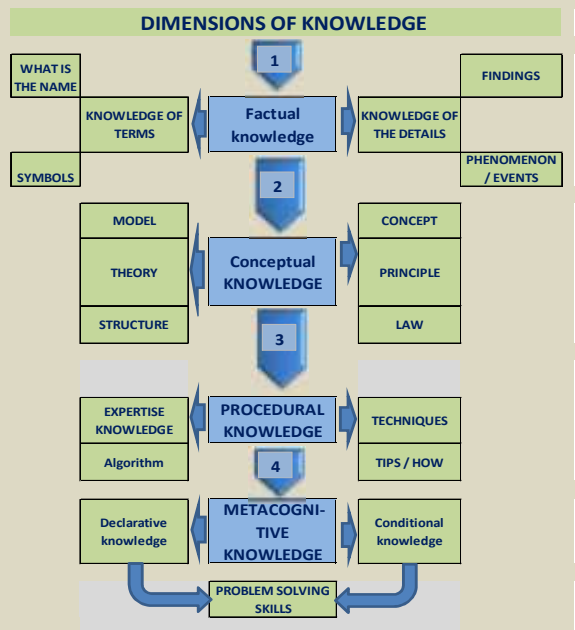

Figure 2. Dimensions of Knowledge

Anderson & Krathwohl, describe the educational goals into six categories of processes, i.e.: *Remembering*; *understanding*, *Appling*, *analyzing*, *Evaluating* and *createing. Remembering* is a process that is closely connected with the process of memory and the category in which the activity occurs retract relevant knowledge from student long-term memory. The fifth category of other processes is more related to the transfer process, i.e. the category process of understanding, Applying, Analyzing, Evaluating and creating [4]. Cognitive processes in the achievement of every knowledge dimension are contained in learning physics content, in the formulation of indicators and learning objectives as known as Operational Work Activity (KKO).

According to the guidelines of syllabus and lesson plans preparation based on the curriculum of 2013, Operational Work Activity (KKO) is a verb that can be measured the achivement, can observed changes in behavior or actions, can tested**,** and used to formulate the learning objectives that are used in making the learning evaluation instrument. General Operations Work Activity can be used in the relationship between the dimensions of knowledge according to Bloom's taxonomy revision with occur cognitive processes dimensions that as stated in Table 1

Table 1. Operational Work Activity Based on Knowledge Dimension & Cognitive Processes

THE KNOWLEDGE DIMENSION		THE COGNITIVE PROCESS DIMENSIONS AND VERB OPERATION					
		REMEMBER	UNDERSTAND	APPLY	ANALYZE	EVALUATE	CREATE
1	Factual KNOWLEDGE	LIST	SUMMMARIZE	CALASSIFY	ORDER	RANK	COMBINE
2	Conceptual KNOWLEDGE	DESCRIBE	INTERPRET	EXPERIMENT	EXPLAIN	ASSESS	PLAN
3	Procedural KNOWLEDGE	TABULATE	PREDICT	CALCULATE	DIFFERENTIETE	CONCLUDE	COMPOSE
4	Metacognitive KNOWLEDGE	APPROPRIETE USE	EXECUTE	CONSTRUCT	ACHIEVE	ACTION	ACTUALIZE

Adopted from Forehand, M. (2005). Bloom's Taxonomy: Original and revised. In M. Orey (Ed.), Emerging perspectives on learning, teaching, and technology. Website: http://www.coe.uga.edu/epltt/bloom.htm.

The right content, the learning process that comes with the good and appropriate evaluation procedures, will produce the desired experience. In the selection, development and determination of the content of learning, educators should pay attention to the content dimensions complexity and the level of the students' cognitive processes which can ensure the achievement of student competency as a whole in terms of knowledge, processes and values that must be owned by the students, includes instructional cognitive, affective, and psychomotor.

The integration of learning content, as mandated in curriculum of 2013, starting with the analysis of core competencies (KI) and the Basic Competency (KD) associated with the KI. KI-1 with respect to the religious attitude, KI-2 with regard to social attitudes, KI-3 with respect to knowledge, and KI-4 with respect to skills (*Psychomotor*) that be achieved through learning [7].

In finding four dimensions of knowledge on the content (subject matter) of learning, as well as 6-level cognitive processes can be carried out through the following steps:

1) Doing linearized KD contained in KI-3 and KI-4. For example: KD 3.6 in KI-3 linear with KD 4.6 the KI-4, as follows:

KD 3.6	Analyzing the nature of elasticity of the material in their daily lives
KD 4.6	Processing and analyzing the results of experiments on the properties of elasticity of a material

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Thus obtained the subject matter that is "**Elasticity and force in spring**"

2) Arrange sub subject matter are distinguished four dimensions of knowledge (factual, conceptual, procedural, and metacognitive) as the expected knowledge that obtained by students through learning designed by the teacher.
3) Arrange learning design that accommodates the achievement of four dimensions of knowledge through 6 levels of Bloom's taxonomy revision of cognitive processes according to Anderson and Krathwohl.
4) Arrange an evaluation instrument that refers on Operational Work Activity (KKO) complex which describes the achievement of 4 dimensions of knowledge and 6 level cognitive processes.

The proficiency level of the 4 steps can be illustrated as disclosed in Figure 3.

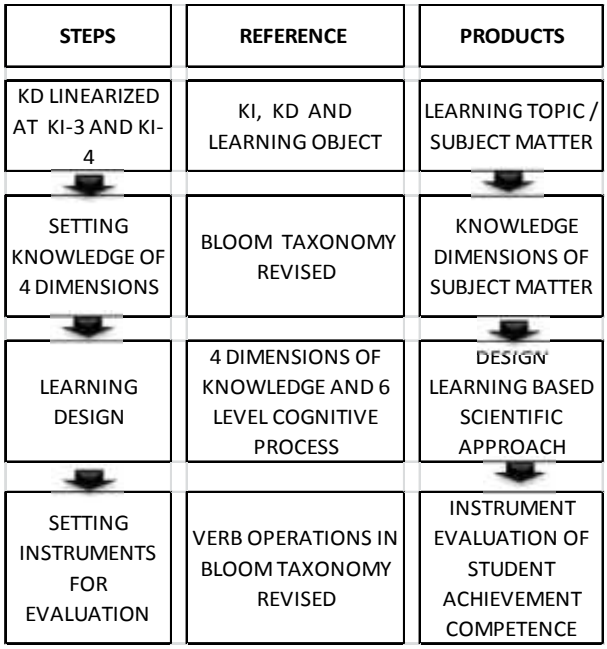

Figure 2.Step-by-step preparation Content And Cognitive Processes in Planning Learning

2. RESEARCH METHODS

This study includes research and development, Using the acronym ADDIE models to *Analyze, Design,* Develop, *Implement, Evaluate* in 5 steps, e.i. a) requirement analysis; b) model design; c) model development; d). model implementation, and e) the model evaluation [8] will be done for 3 months.

Requirement analysis (*needs assessment*) conducted through a preliminary study that aims to encompass: a) data about the complexity of mastering the content and cognitive processes of students in high school of physics learning through the competency test. b) data implementation of teacher learning in implementing curriculum of 2013 through questionnaires, interviews and observations, and models related learning approach in applied physics. This step runs in March 30 to 30 April 2015.

Model design, is based on data obtained from the analysis of the requirment and refers to the relevant concepts and theories, in the form of model design draft in the form of a matrix, to match between model components. This step has going since the beginning of May 2015 until now.

Model development, is carried out within a couple of activities: 1) Validity/Expert Test, competent to draft model was developed, consisting of experts in physics, experts learning, and expert evaluations, using the instrument assessment. 2) Revision 1 of the draft design of the model, which is done by watching and analyzing the obtained inputs based on assessment and related expert commentary. Especially with respect to language, coverage models, and compatibility between the components of the model associated with the relevant theory. 3) Focus Group Discussion (FGD), carried out in limited group, the participants consist of relevant elements and capable. FGD participant contribution is very important and meaningful as consideration for finalizing the draft model into the model. 4) revision 2. It is the process of finalizing a model based on contribution and ideas that are relevant and meaningful from the FGD.

Model implementation, is the step of research to find out the practicalities and effectivities learning model developed. Implementation is done by two steps, through limited trial and expanded trial. Limited trial is a beginning of a qualitative evaluation (an initial qualitative evaluation) of the product to be produced (Borg & Gall, 1983: 790), in the form of experimental study design model shoot one case study

Model evaluation is the step to obtain empirical evidence of the implementation results of the learning model that was developed for the using to the students in physics and diagnosis and revised according to the results of diagnosis.

Learning model developed is applied to a class X to the material elasticity and force In the spring, as well as properties of Fluid Static. As the trial subject, which is one of the high school curriculum of 2013 in Padang, SMA 7 Padang trials involving 4 Physics teachers, and 1 grade students, in class X. At the time of product trials conducted observations using instruments that have been developed, and the final research classroom, to the students who made the posttest object of the research. The average posttest results used as materials to test the hypothesis that has been set, compared with the average grade student before applying the developed learning model of physics.

This research data in the form of quantitative and qualitative data. Quantitative data is applying learning model, the ability of teachers to manage learning, student activity in learning, students response to the implementation of learning, and student competency scores. The qualitative data is the result of interviews

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with teachers and students to design feasibility study, student activities and student responses to the learning implementation. The data is analyzed to determine the validities, practicalities and effectiveness of developed instructional design.

The used Instruments is gouping into: (1) instrument validation, (2) instrument practicalities and (3) effectiveness of the instrument. **Instrument validation,** concerning: a) Model and completeness of the content dimension of learning and cognitive processes; b) Orientation of scientific learning approach; and c) Model and completeness of coverage levels instrument evaluation achivement of student competence. **Instruments practicalities** as sheet of observation and questionnaire that consist of: (1) the observation sheet of learning feasibility design; (2) the observation sheet of teachers ability to manage the learning; (3) The observation sheet of students in learning activities; (4) The student questionnaire responses to the learning implementation; and (5) the competence of student achievement tests. **Instruments Effectiveness** as regard to achieve of students scientific competence to aspects of students concepts mastery. Assessment instrument mastery of students concepts**,** arranged for 4 dimensions of knowledge on physics materials, as well as the complexity of the cognitive processes aspects for C1 to C6 aspects of a sheet that contains a set of questions that will be used to determine the level of student mastery of the subject matter. The arranging procedure of achievement test begins by arranging lattice test with multiple choice questions with five possible answers, accompanied by the reasons of the students answers. This instrument is used after fill validity and reliability.

In testing the validity, practicalities and effectiveness of the learning model developed using descriptive statistics, which count the total score of the assessment conducted by the validator and the respondent, then calculating the mean of the design assessment. In respect of these researchers can make grating instrument validity, practicalities and effectiveness of the design, and then translating the grid into the instrument observations in the form of sheet checklist, in which researchers assess the implementation process of the design, conduct checks on some sections that have been appropriate and not appropriate for completing. This way will be able to be known some weaknesses (inefficiency) from the developed model.

3. RESULTS AND DISCUSSION

At this portion will be presented preliminary research data as an ingredient to formulate *needs assessment* in the development of physics learning model applied in Padang.

3.1 Data complexity mastery of content and cognitive processes of students.

The obtained data is presented in graphical form the percentage of students in terms of 4 dimensions of knowledge and 6 levels of cognitive processes such as presented in Figure 3, 4, 5, and 6.

Figure 3. Percentage Graph of Students According Level Cognitive Process For Factual Knowledge

Figure 4. Percentage Graph of Students According to Level of Cognitive Processes For Conceptual Knowledge

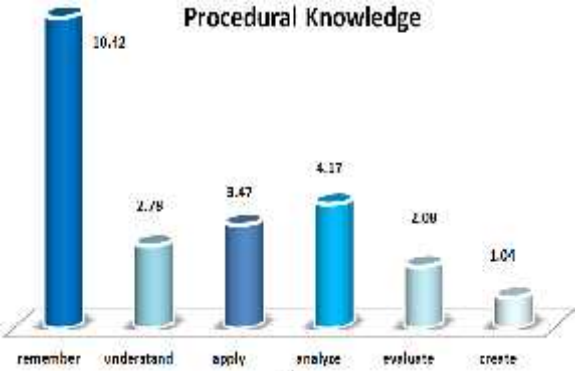

Figure 5. Percentage graph of Students According to Level of Cognitive Processes For Procedural Knowledge

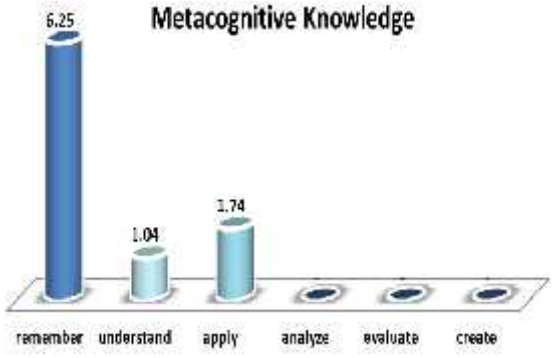

Figure 6. Percentage graph of Students According to Level of Cognitive Processes For Metacognitive Knowledge

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In Figure 3-5 and the obtained accumulated data, the total obtained information that the majority of student achievement of competence at the level of cognitive processing is in level 1 (remember) 54%, accompanied by level 2 and 3 (understand and apply), respectively 12% and 13%, and followed by level 4 (analyze), 10%. The least level 5 and 6 (evaluate and create), respectively 3% and 2%. The result amounted 94%. It means that there are 6% more students who did not answer the question or below level 1. Summary of overall data presented by the graph in Figure 7.

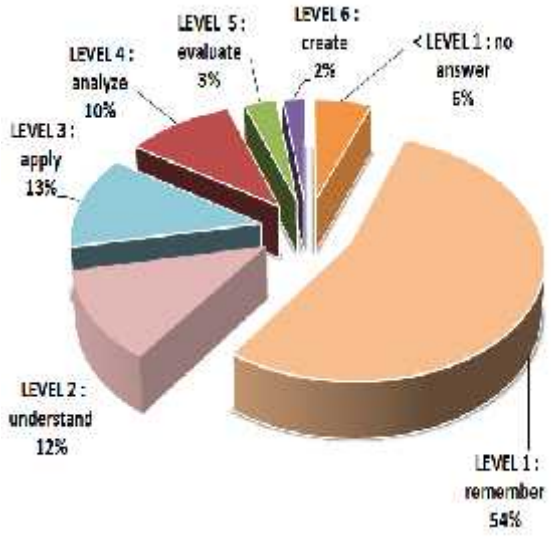

Figure 7. graph of percentage Proportion 6 Level Students Based on Cognitive Processes

3.2 Data Implementation of Learning Teacher

This data is using a questionnaire as well as observation and interview techniques. The obtained data by questionnaire is regard to the trend of the learning implementation process, are presented in graphical form in Figure 8a and 8b

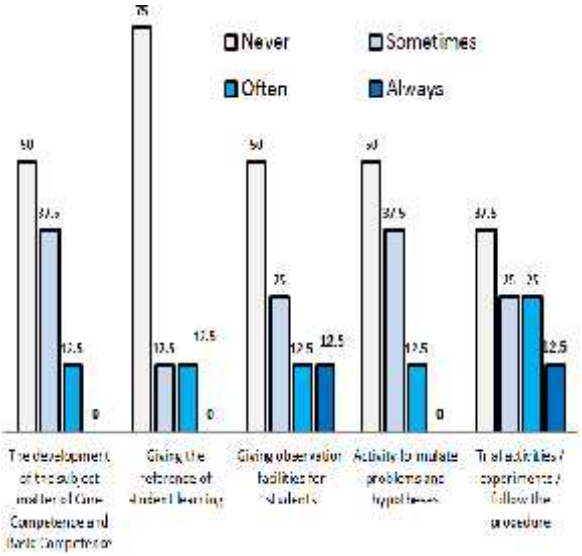

Figure 8a.

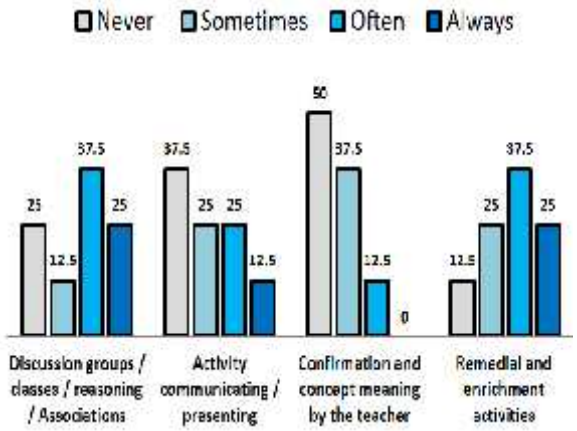

Figure 8b.

From the graph obtained the information, that almost all components showed weak point especially with respect to the activities: a) developing the subject matter of learning by KI and KD, b) the benchmark study, confirmation and planting concept by the teacher, and c) feasibility components scientific approach.

Observations and interviews with physics teachers, with regard to the completeness of the dimensions of knowledge and levels of cognitive processes in learning device, presented by the graph in Figure 9 and Figure 10.

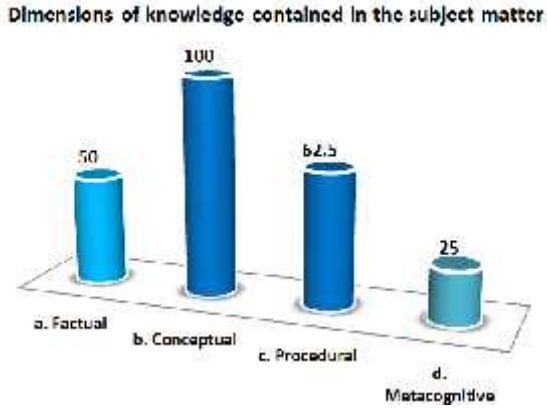

Figure 9. Graph of Proportion Percentage Completed Knowledge Dimension In Teacher Learning Tool

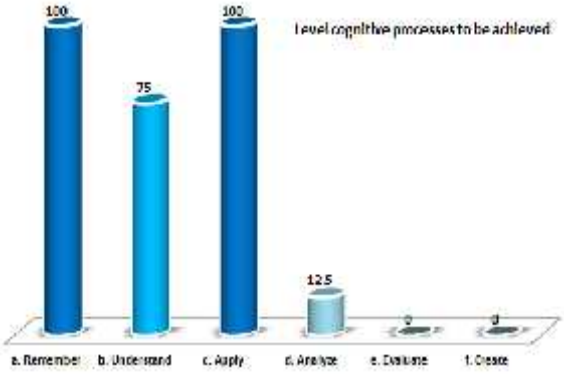

Figure 10 graph of Proportion Completion Percentage Level of Cognitive Processes in Teacher Learning Process

ISBN 978-602-19877-3-5

From the two graphs obtained information that the proportion of dimensions of knowledge is still dominated by conceptual and procedural knowledge, while the level of cognitive processes contained in teacher learning device, still dominated at level 1, 2 and 3.

4. CONCLUSION, ARGUMENTS AND RECOMMENDATIONS

Based on the results of competency test result data triangulation students with the data implementation of teachers learning, the results of the preliminary study conclude:

4.1 The low quality of student competence achievement comparable to the low quality of teacher learning implementation.

4.2 The components of learning should be improved especially with respect to: 1) develop learning subject matter by KI and KD, 2) the provision of reference for learning, confirmation and planting concept by teachers, and 3) adherence to the components of the scientific approach.

The development of the subject matter on 4 dimensions of knowledge, intended for teachers conducted lessons contain the complexity of knowledge required by the students to develop the skills and attitudes aspects in accordance with the demands of the curriculum. The provision of adequate learning reference before the students learn, meant that students have sufficient basic knowledge to be implemented in learning. Confirming and planting concept to current students before the end of learning is so that students get enough of the abiding lessons learned content. While the components scientific approach implemented in the learning intended for students accustomed to scientific activities and developing students' cognitive processes from level 1 to level 6.

Based on the results of research and discussion that has been conducted, the results of the preliminary study recommends development of physics-oriented learning model on the complexity of the content and cognitive processes that can be applied in teaching physics in high school in Padang.

5. ACKNOWLEDGEMENTS

With the completion of this preliminary study, we would like to thank profusely to the principals and teachers of physics in the high school of Padang, which provided facilities, information, and participation in providing the necessary data in this preliminary study.

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ISBN 978-602-19877-3-5

DEVELOPMENT OF AUTHENTIC ASSESSMENT FOR SUPPORTING THE INQUIRY LEARNING MODEL IN BASIC ELECTRONICS 1 COURSE

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ABSTRACT

Implementation of authentic assessment gives potency and benefit in learning process. This assessment type is conducted comprehensively both process and outcome. For this reason, the integration authentic assessment is important in a learning model. The objective of this research is to develop authentic assessment that suitable with inquiry learning model and determine its validity, practicality, and effectiveness. This research uses research and development (R&D). R&D is a research method which is used to produce certain product and to test effectiveness of that product. Stages of development model consist of primarily study, development model, and model testing. There are four products in this research, those are: writing assessment of initial task, performance assessment, scientific attitude assessment, and written report assessment. Quality criteria of authentic assessment including validity, practicality, and effectiveness. The instrument which is used to measure quality criteria consist of validation sheet experts, practicality sheet by lecturers and assistants, and achievement test sheet**.** As the result of this research shows that: 1). the validity of authentic assessment for supporting inquiry learning model is high with average value of validity is 81.42 and 2). the use of authentic assessment is practice and effective in inquiry learning model.

Index Terms : Authentic assessment, Inquiry learning model, Quality criteria, Basic Electronics

1. INTRODUCTION

Education plays an important role in improving the quality of human resources. In every learner is stored some various of potency such as intellectual, spiritual, emotional, social, and so on. Education gives some opportunities to develop various of learner potency become competency is use in their lives. High competence is required by learner in solving various problems of life.

Graduates of an education should have a good competence. In general there are three competency standards, those are: knowledge, attitudes, and skills. Knowledge relates to facts, concepts, laws, models, and theories. The attitude consist of behavioral attitudes, values, and norms. On the other hand, the skills is associated with the performance of graduates. Education should be able to develop all three of these competences in a balanced manner.

Learning is an effort to develop the some potencies of students. In the learning process of students must be involved actively. They are involved actively in reading, finding information, writing, investigating, solving problems, and so on. Learning like this is known as a student-centered learning. The role of teacher in learning is as a motivator, facilitator, mentor, and assessor.

In the learning process, teachers can activate students through authentic tasks. Authentic tasks consist of student-centered activities that focus on content and real-world skills. Authentic tasks often involve the acquisition of knowledge and skills, their main focus is related to practical application of this knowledge and skills. Authentic tasks require students to demonstrate a process or procedure of a product, these tasks serve simultaneously both learning and assessment. Therefore, authentic tasks provide a direct connection between learning and assessment.

Authentic assessment is a comprehensive assessment conducted to assess input, process and output of learning. This assessment consist of attitudes, knowledge, and skills. Authentic assessment requires that efficiency, reliability, and comparability of measures be carefully planned and delivered (Cy L, 2009). The orientation of authentic assessment includes the learning process and the learning outcomes. Competences of students which is assessed consists of knowledge, attitudes, and skills. Measurement of learning aspect includes process, performance, and product. On the other hand, the characteristics of authentic assessment are integrated in learning, related to the real world, have several methods, and conducted comprehensively.

Implementation of authentic assessment of learning can be done through authentic tasks. Authentic task consist of student-centered activities that focus on real-world and skills (Mark B, 1995). Authentic tasks encourage students to demonstrate a process or procedure of a product. This task serves simultaneously learning and assessment. For this reason, authentic tasks provide a direct connection between learning and assessment.

Making a rubric in authentic assessment is very important. A Rubric is an established set of criteria used for evaluating or rating student products and performances (Diane R, 2009). Authentic assessments

ISBN 978-602-19877-3-5

use rubrics to provide clear scoring criteria to learners enabling them to conduct self assessment or peer-assessment before submitting. The effectiveness of a rubric is dependent on its validity and reliability (Paul M, 2012). Several benefits of using scoring rubrics in performance assessments have been proposed, such as increased consistency of scoring, the possibility to facilitate valid judgment of complex competencies, and promotion of learning (Anders J, 2007).

The use of authentic assessment in learning provide some benefit to the students. First, the students are able to understand the learning material comprehensively. Second, students have some capabilities such as collecting information, using sources of information, mastering the technology, applying a systematic thinking, and so on. Third, students are able to connect the lessons with their experience, real world, and life in society. Fourth, authentic assessment can improve high-level thinking skills such as analyzing, synthesizing, identifying the problems, solving the problems, and following the cause and effect relationship. Fifth, students receive response and develop some alternatives. Finally, students are able to connect the lesson with other subjects and collaborate activities with those tasks.

Teachers should apply the authentic assessment in the learning process. The fact shows that here are some problems in implementing the authentic assessment. First, the teacher states that authentic assessment is difficult to be applied in learning process. Second, the teacher states that authentic assessment is complex because it includes many assessments which conducted during the learning process. Third, authentic assessment cause teacher is tired in performing their duties. Another problem is the authentic assessment incompatible with learning model which is implemented.

One solution to solve this problem is to develop authentic assessment on the context and the suitable learning situation. In other words, authentic assessment must be suitable with learning model which is selected. Authentic assessment has strong relevance to the scientific approach in learning. An alternative suitable learning with the scientific approach in science process is inquiry learning.

Inquiry is the process of defining and investigating problems, formulating hypotheses, designing experiments, gathering data, and drawing conclusion about problem (Trowbridge in Atilla C, 2007). A potential result in inquiry-based teaching enables students to gain insights into the nature of scientific inquiry. Inquiry activities provide a valuable context for learners to acquire, clarify, and apply an understanding of science concepts (Josef T, 2012).

Inquiry learning model is a model of learning which practice students to learn to find the problem, to collect, to organize, and to solve the problems (DD Kristianingsih, 2010). The general aim of inquiry is to help students develop the skills necessary to raise the question that arises from their curiosity and effort to find the its answer. Inquiry learning encourages and facilitates students in asking questions, trying to collect the data and process them, and finding the answers of these questions.

In general, Inquiry learning model has six stages. The first stage is the orientation, teacher make condition so that students are ready to follow the learning process with stimulating and encouraging students to think and to solve the problem. The second stage is to formulate the problem, the teacher directs and guides the students to formulate the problem. The third stage is to formulate the hypothesis, teacher guides students to formulate the hypothesis of the problem. The fourth stage is to collect the data, teacher directs and guides the students to collect data based on problem. The fifth stage is to test the hypothesis that is a process to determine the tentative answer which appropriate with data or information obtained. The last stage is to formulate the conclusion that is a process describes the findings obtained based on the results of hypothesis testing (Widhar D, 2013).

Authentic tasks are used in inquiry learning model to activate students in learning process. These task will connect directly between the learning model and assessment. Assessment which is produced by authentic tasks are authentic assessment.

The use rubric on authentic assessment gives effect on learning outcomes. There are several research results that show the effect of the use of authentic assessment and rubric in learning. First, the use of rubric for assessment was found to be very effective in determining a pathway for both the teachers and the students to look for and get to the desirable results (Sher Azim, 2012). Second, authentic learning environment that engage students in real-world inquiry problems involving higher order thinking skills with an authentic audience beyond the classroom (Audrey C R, 2006). Third, authentic assessment is inseparable from and integrated to instructional activity, and contributes to students' achievement. Authentic assessment improves thinking skill because its principles develop meta-cognitive awareness (Yuni P, 2013).

Quality criteria of development result of authentic assessment and its rubric need to be determined. There are three quality criteria used. The first criteria is validity of initial product based on rational thinking of experts. The second criteria is practicality that is easiness and implementation of authentic assessment in learning. The third criterion is effectiveness of application the product in learning (Tjeerd P, 2013).

Based on the background of the problem can be formulated problem in this study. As the formulation of the research problem, namely: 1). What is the validity of authentic assessment instrument and its rubric ?, 2). What is the practicality of authentic assessment instrument and its rubric in inquiry

ISBN 978-602-19877-3-5

learning model ?, and 3). What is the effectiveness of authentic assessment instrument in inquiry learning model ?.

Based on this reason, the researcher is interested to develop authentic assessment to support the inquiry learning model. The general objective of this research is to develop authentic assessment which connected to inquiry learning model and to test its effectiveness. The specific objective of the research is : 1). to determine the validity of authentic assessment instrument and its rubric, 2). determine the practicality of authentic assessment instrument and its rubric in inquiry learning model, and 3). determine the effectiveness of authentic assessment instrument in inquiry learning model.

2. RESEARCH METHOD

Type of this research is research and development (R & D). R & D is a method of research to develop a specific product and to test the effectiveness of that product. As a product of this research is an authentic assessment which is adapted by inquiry learning model. Authentic assessment in this research consist of two parts, those are authentic instrument and its rubric.

To develop and to test the effectiveness of a product is used a particular development model. The stages of Borg and Gall development model is modified by Sukmadinata and colleagues. In general, stages of research and development which is developed by Sukmadinata and his colleagues consists of three stages, those are preliminary study, development model, and model testing (Nana S 2006).

First stage is preliminary study. This stage is conducted to investigate the needs of students and lecturers. There are three activities in this study, those are to do the literature study, to conduct the survey field, and to make the initial product draft. Observation result on electronics experiment activities showed that: 1). lecturers only use experiment method in electronics laboratory, 2). authentic task doesn't used yet in learning, 3). assessment is not connected to learning model, and 4). authentic assessment instruments and their rubric don't applied yet in experiment activities. Based on result analysis of students questionnaire can be stated that: 1). I can't make the problem formulation is 67.44, 2), 2). I can't make the formulation of hypotheses in experimental activity is 72.09%, 3). I can't test the hypothesis is 48.84, and 4). I can't make finding summary on the results of hypothesis testing is 27.91%.

The second stage is development model. Authentic assessment is developed based on inquiry learning model. In this case, authentic tasks are used to connect between learning model and assessment. Development stage includes developing products, testing validity, and revising the product. Product development produces writing assessment instrument and its rubric, performance assessment instrument and its rubric, scientific attitude assessment instrument and its rubric, and written report instrument of experiment activities. Validation of product development is conducted by six experts. Weaknesses and mistakes of product are revised based on suggestion from experts.

The third phase is model testing. In this research, limited try-out is applied to test inquiry learning model by integrating authentic assessment. The purpose of testing is to determine the practicality and the effectiveness of authentic assessment in inquiry learning model. Testing uses before and after experimental method design. Effectiveness of the authentic assessment is determined based on posttest and pretest. This testing is conducted for three meetings.

In try-out activities, inquiry learning model by integrating authentic assessment is implemented. In this case, tray-out is conducted to determined practicality and effectiveness of authentic assessment. Generally, the learning process can be divided into three part, those are introduction activities, body activities, and conclusion activities.

Introduction activity is activity to prepare students to follow the learning process. This activity is conducted based on the preliminary task. The lecturer asks students to review the last lesson, to explain the next learning material, to explain the purpose of learning, to explain the benefit of studying the learning material, and to explain the scope of learning material.

Body activity is main process of learning to achieve competence. In this activity is used experimental task to activate students in learning process. Lecturer directs and guides students to conduct experiments based on task experiment. In learning process, students formulate the problem, formulate the hypotheses, and collect the data. Performance and scientific attitude of students in experimental activities are assessed by assistants.

Conclusion activity is activity of lecturer to close the learning process. The lecturer asks the students to conclude the lesson, to check student understanding, to direct the task report, and to inform the learning material for next meeting.

Authentic tasks consist of preliminary task, experimental task, and report task. Preliminary task is used to encourage students to review the last lesson and to learn the learning material now. Experimental task is used to guide and to direct students to conduct experiment activity in laboratory. Meanwhile, report task is used to direct students to make a written report of experiment activity.

Authentic instrument is conducted based on authentic tasks. Writing assessment instrument is used to assess the preliminary task. Performance assessment instrument and scientific attitude assessment instrument are used to assess the experimental task. On the other hand, written report

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instrument is used to assess the written report of experiment activity.

Validity sheet of experts is used to assess the validity of four types of products. Practicality sheet of lecturers and assistants are used to determine the practicality of use of the product in inquiry learning model. On the other hand, pretest and posttest sheet are used to determine the effectiveness of the use of product in inquiry learning model on RLC circuit, characteristics of diode, and wave rectifier circuit of learning material.

Writing skills assessment instrument on initial task consists of six indicators, namely writing word or letter, sentence structure, use of punctuation, paragraph structure, writing tidiness and writing consistency. Every indicator can be assessed based on certain level on its rubric. Various level and its value of rubric is advanced = 4, proficient =3, basic = 2, and novice = 1.

Performance assessment of students conducted in experimental activities. Instrument performance assessment includes six indicators, namely: making the electronic circuit, arranging the equipment, connecting the circuit with equipment, using the electronics instrument, varying the independent variables, and getting the measurement data.

Scientific attitudes of students are observed when experiment activity in laboratory. Indicators of scientific attitude consist of curious, honest, strong, objective, discipline, and responsibility. The assessment criteria to include scientific attitude is very good, good, fair, and less.

Written report is made by the students based on the results of experiments to follow the stages of inquiry learning model. Indicator assessment of written report consist of formulation of problem, formulation of hypotheses, working procedures, truth of measurement data, testing hypotheses, and drawing conclusions. The sixth indicator is assessed using assessment sheet of written report.

Data from the validity result of expert and assessment the practicality of use the product of lecturers and assistants are analyzed by using graph method. Effectiveness data of the use of product in inquiry learning model is analyzed by using comparative mean test. A product is said to be effective is if there is a significant difference between student learning outcomes after and before intervention.

3. RESULT AND DISCUSSION

Results of this research consists of three parts. The first result is validity value of authentic instrument and its rubric scoring of experts. The second result is practicality value of application of authentic assessment instruments and their rubric scoring of lecturers and assistants. The third result is effectiveness value of application of authentic assessment instruments in inquiry learning model.

3.1. Validity of Authentic Assessment

Validation is assessment of a product design by experts based on rational thinking. There are four products authentic assessment and their rubric which is assessed by experts. First, writing skills assessment instruments and its rubric. Second, performance assessment instrument and its rubric. Third, scientific attitude assessment instrument and its rubric. Finally, assessment instrument of written report of experiment activities and its rubric.

Writing assessment indicators of initial task includes writing words or letters, sentence structure, use of punctuation, paragraph structure, writing tidiness, and writing consistency. The average value of writing assessment instrument and its scoring rubric of experts varies from 76.7 to 83.3 with an average value of 79.4. The average value of validity is categorized into good category.

The average value of writing skills assessment, performance assessment, scientific attitude assessment, and written report assessment can be seen in Figure 1

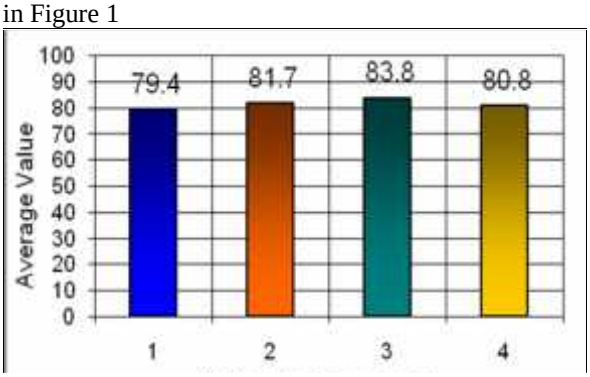

Fig 1. Validity Value of Authentic Assessment

Number 1 in Figure 1 is assessment instrument of writing skills. The average value of writing assessment instrument and its rubric is 79.4. Number 2 is instrument of performance assessment and its rubric. The average value of performance assessment instrument and its rubric is 81.7. Number 3 is scientific attitude assessment instrument and its rubric with average value is 83. 8. Meanwhile, number 4 is assessment instrument of written report of experiment activities with experiment with average value is 80.8. The minimum value, maximum value and average value of authentic assessment respectively 79.4, 83.8, and 81.4. The average value of authentic assessment is included in very good category.

3.2. Practicality of Authentic Assessment

Practicality relates to the ease of application of a product in learning. Authentic assessment instruments and their rubrics are used in inquiry learning model. These instruments and their rubric used by two lecturer and five assistants to assess the writing skills of initial task, the performance of students, the

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scientific attitude of students, and written report of experiment activities.

The first practical testing is the use of writing skills assessment instrument and its rubric. Indicator practicality testing of use writing assessment instrument and its rubric consists of: 1). Indicator on writing skills is easy to use, 2). The language which is used in writing skills instrument is easy to understand, 3). Writing skills Instrument is easy to apply, 4). The criteria in rubric of writing skills instrument is easy to understand, 5). Language on rubric of writing instrument is easy to understand, and 6). The assessment criteria on rubric of writing skills is easy to implement. Practicality value of writing skills indicator varies from 75.0 to 92.5. The average value of writing skills instrument is 87.1.

The second practicality testing is the use of performance assessment and its rubric. Practicality testing indicators of the performance assessment instrument and its rubric include: 1). Indicator on performance assessment instrument of experiment is easy to understand, 2). Language in the performance assessment instrument is easy to understand, 3). Performance assessment instrument of experiment is easy to implement, 4). Criteria in rubric of performance assessment of experiment is easy to understand, 5). Language which is used in rubric of performance assessment of experiment is easy to understand, and 6). Criteria in the rubric of performance assessment of experiment is easy to apply. Practicality value of performance assessment instrument varies 77.5 to 92.5. The practicality average value of the use of performance assessment instrument and its rubric is 86.3.

The third practicality testing is the use of scientific attitude assessment instrument and its rubric. Indicator of practicality testing consists of: 1). Indicator on scientific attitude assessment instruments in the science process is easy to understand, 2). Language in scientific attitude assessment instrument is easy to understand, 3). Scientific attitude assessment instrument in the science process is easy to apply, 4). Criteria in rubric of scientific attitude assessment in science is easy to understand, 5). Language which is used in rubric of scientific attitude assessment in the science process is easy to understand, and 6). Criteria in rubric of scientific attitude assessment in the science process is easy to apply. Practicality value of the use of scientific attitude assessment varies from 80.0 to 92.5. The practicality average value of the use of scientific attitude assessment instrument in the science process is 87.1.

The fourth practicality testing is the use of written report assessment instrument and its rubric. As practicality indicator of the use of written report assessment consists of 1). Language in written report assessment instrument of experimental activities based on inquiry is easy to understand, 2). Instrument of written report assessment of experiment activities based on inquiry is easy to implement, 3). Instrument of written report of experiment activities based on inquiry is easy to apply, 4). Criteria in rubric of written report assessment of experiment activities based inquiry is easy to understand, 5). The language used experimental activities assessment rubric based inquiry reports easy to understand, 6). Criteria in rubric of written report assessment of experiment activities based on inquiry is easy to implement, 7). Inquiry process which is conducted can be understood easily through the report, and 8). Inquiry process which is conducted can be assessed easily through the report. Practicality value of the use of written report assessment instrument of experiment activities varies from 85.0 to 95.0. The practicality average value of the use of written report assessment instrument is 90.3.

Value of practicality of authentic assessment of lecturer and assistant were shown in Figure 2

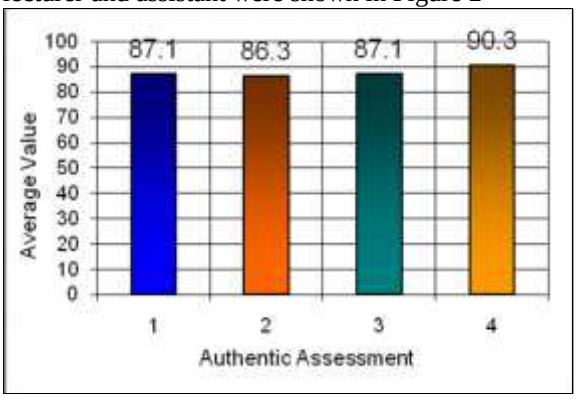

Fig 2. Practicality of Authentic Assessment

Figure 2 respectively practicality of writing skills assessment, performance assessment, scientific attitude assessment, and assessment of written report. The practicality average value of writing assessment instrument application and its rubric is 87.4. The practicality average value of performance assessment instrument application and its rubric is 86.3. The practicality average value of scientific attitude assessment instrument application and its rubric is 87.1. On the other hand, the practicality average value of written report assessment instrument and its rubric is 90.3. The practicality maximum value, minimum value, and average value of authentic assessment instrument application and its rubric respectively 86.3, 90.3, and 87.7. The average value of test results practicality of authentic assessment instrument application and its rubric included in excellent category.

3.3. Effectiveness of Authentic Assessment

The effectiveness of the use of authentic assessment in inquiry learning model is determined by comparing learning outcomes of students between after and before intervention. Descriptive statistical parameters both pretest and posttest are determined.

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The parameter The average value standard deviation, and variance of pretest of 43 students respectively 31.16, 9.56, and 91.47. On the other hand, the average value, standard deviation and variance of posttest respectively 66.16, 10.46, and 109.33.

Difference of students learning outcomes between after and before intervention can be determined of compare mean test. T value is obtained from the calculation is 14.42. On the other hand, the t value which obtained from a table for 43 students and 90 % confidence level is 1. 69. From the comparison of two values of t can be stated that the null hypothesis is rejected. This means that learning outcomes of students after the use of authentic assessment in inquiry learning model is significant difference from the learning outcomes of students before the use of authentic assessment. Therefore, the use of authentic assessment is effective in inquiry learning model.

4. CONCLUSION

Based on the objectives of research and discussion of research results can be stated three conclusions from this research. First, validity value of writing assessment, performance assessment, scientific attitude assessment, and written report respectively 79.4; 81.7; 83.8; and 80.8. These values can be categorized into high level. Average value of authentic assessment validity is 81.4. This value is very high. Second, the use authentic assessment is practice in inquiry learning model. Practicality value of writing skill assessment, performance assessment, scientific attitude assessment, and written report respectively 87.1; 86.3; 87.1; and 80.8. The average value of practicality is 87.3. Finally, Integration the authentic assessment including writing skill, performance, scientific attitude, and written report instrument is effective in inquiry learning model.

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ISBN 978-602-19877-3-5

DEVELOPMENT OF TEACHING MATERIALS BASED ON SCIENTIFIC APPROACH FOR PHYSICS SUBJECT ON CLASS X OF SENIOR HIGH SCHOOL

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ABSTRACT

This research was conducted to develop teaching materials based on scientific approach for high schools. One of the goals for development of teaching materials was to improve the quality of education and learning physics in high school. In its implementation, research was started with identification of problems at school, and then designed teaching materials based on scientific approach which contained competences to be achieved, supporting information, learning materials, instructional video, animation, student worksheets and evaluation. In order to test the validity of teaching materials based on Scientific Approach, researcher developed 4-D model in four steps which were define, design, development, and dissemination. Based on validation and practicality result, teaching materials that being constructed in this research is generally fall under very good category. These teaching materials can already be used in senior high school.

Index Terms— Curriculum 2013, scientific approach, teaching materials

1. INTRODUCTION

To improve the quality of education in Indonesia, one of fundamental changes in the field of education in Indonesia is the ratification of Law of Indonesian Republic Num. 20 of 2003 about national education system. National education has a function to develop abilities and to build characters as well as the civilization with prestige in context of national intellectual life that aimed to develop students' potentials to become religious and devoted to God Almighty, noble, healthy, knowledgeable, capable, creative, independent and become democratic and responsible [1].

In fact, the government's efforts to improve education system in Indonesia are still facing many problems. One of the problems is low quality of graduation in Indonesia at level of elementary school, junior high school, secondary school and even university. It is characterized by low achievement from learner after they complete learning activities.

Other efforts to improve the quality of education by the government are not limited to change the education system, but also attempt to adapt the curriculum according to the demands of time. One of the efforts is to change curriculum of 2006 to curriculum of 2013 which have been prepared based on opinions of future challenges in 21st century which is marked by centuries of science, knowledge-based society and future competences [2]. The foundation of formulation for curriculum of 2013 is the issues contained in SBC which are [3]:

- ✓ Competences are holistically not describing attitude skills and knowledge domains
- ✓ Curriculum contents are too dense which is shown by lot of extended materials and level of distress beyond the level of children development
- ✓ Curriculum has not been fully competency-based which according to demands of national education's function and purpose
- ✓ Some of competencies that required in accordance to the needs (e.g. character education, active learning methodology, the balance of soft skills and hard skills, entrepreneurship) have not been accommodated in the curriculum
- ✓ The curriculum has not been sensitive and responsive to social change at local, national, and global
- ✓ Standards of learning process are not describing detailed learning sequences so that the opportunities give diverse interpretations and resulted in teacher-centered learning
- ✓ Standards of assessment have not led to a competency-based assessment (process and results) and have not explicitly requires periodic remediation

Based on above issues, Curriculum 2013 is expected to produce productive, creative, affective and innovative civilization, through structuring ways of thinking and governance, deepen and expansion of material, as well as strengthening the process and burden adjustment.

To produce productive, creative, innovative, and affective civilization in line with the turn of curriculum of 2013, the term of scientific approach

ISBN 978-602-19877-3-5

in learning implementation becomes discussion that attracted the attention of educators lately, because primary and secondary education have not produce graduates that capable to think critically as children from other nations [4].

Scientific approach is intended to provide insight to learners in recognizing and understanding various materials using a scientific approach; information could have come from anywhere, at any time, and not relying on direction of teachers. Therefore, learning conditions are expected to encourage students to discover various sources through observation, and not only giving directions.

The application of scientific approach in the learning process involves skills such as observing, asking questions, gathering information, measuring, predicting, explaining, and concluding. In implementation of these processes, teacher's assistance is needed. Bruner (in Carin & Sund, 1975) emphasize four things in conformity with the required cognitive processes in learning using scientific method. First, individuals only learn and develop his mind when he uses his mind. Second, by performing the cognitive processes in the discovery process, students will gain sensation and intellectual satisfaction which is an intrinsic reward. Third, the only way for someone to learn the techniques in performing inventions is that he/she has a chance to discover. Fourth, discovery will strengthen memory retention [5]. Based on this discovery learning theory, it can be assumed that students can develop ways of thinking based on the discovery process, because the discovery would strengthen memory retention.

Kemendikbud (2013) reveals some learning goals with scientific approach, that are: 1) to improve the ability of intellectual, especially high-level thinking skills of students; 2) to form a student's ability to solve a problem in a systematic way; 3) to create conditions of learning in which students feel that learning is necessary; 4) to obtain good learning outcomes; 5) to train students in communicating ideas, especially in writing a scientific article; and 6) to develop the character of students [6].

Expectation of this scientific approach is very rational where learning with scientific approach should be done systematically so that student's competences can be increased. To support high completeness of student's competences, the government provided some textbooks in accordance to the demands of the curriculum of 2013. Especially for high school level, in first half of new academic year 2013/2014 only three subjects that already have textbooks, which are mathematics, Indonesian language and Indonesian history. This is resulting in poor implementation of curriculum of 2013 in the first half of 2013/2014. For physics subject, the book that used by teachers in curriculum is textbook of 2006, so that the learning in classroom is still oriented to KTSP. In the second semester of academic year 2013/2014 there is additional textbooks for other subjects including physics. Based on observations, physics textbook that has been accepted by schools is basically not different from books that used in previous curriculum. It is supposedly that the designed book is accordance to scientific approach as mandated in the curriculum of 2013, which is learning approach in curriculum of 2013 is scientific approach. Therefore, to furnish existing textbooks, the author wants to design textbooks that support the adherence to curriculum of 2013 that is textbook-based scientific approach for physics subject in class X of high school.

2. RESEARCH METHODOLOGY

This research is research & development type. R & D model that is used in developing teaching materials based on this scientific approach is 4-D model. According to Thiagarajan (1974), phases of research development are definition, design, development and dissemination [7]. In this research, there are only describing third phases that are: the definition, design, and development.

2.1 Define phase

In defining phase, there is conducting analysis on three aspects that are analysis of curriculum, analysis of learners, and analysis of concept. Analysis of curriculum aims to bring basic problem in school's teaching that mainly concerns an understanding to essential concepts in physics. Understanding and mastery of this concept is very important where students are able to resolve physics' problems.

So far, completion of high school physics' problem is done by teachers, but this is not optimal because it has not supported by teaching materials that lead to solve the problem. Therefore, teaching materials are prepared with scientific-based approach where students will be trained to work with scientific measures to find concepts in physics both in classroom and outside the classroom. Preparing teaching materials is limited to I and II semesters of tenth grade/class X.

2. 2 Design phase

At design phase, there is an attempt to arrange teaching materials of Physics on scientific-based approach which contains various basic aspects that must be present in the materials, components of learning materials, training and evaluation questions, and steps in understanding of physics concepts. Instructional materials are systematically designed and attractive in order to achieve competences and objectives.

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2.3 Develop phase

Development phase is conducted in several stages, starting from the initial validation and revision based on suggestions from validator and practitioners (users), limited testing, analytical testing, second revision based on the analysis of valid, practical, and effective learning trials. In this research, the resulting instructional materials are made until validation phase from experts.

2.4 Disseminate phase

The deployment phase is conducted when stage one to three already meet the criteria of good teaching materials from product development. Based on dissemination results, there is other revision to teaching materials that being developed in order to be duplicated.

3. RESULT AND DISCUSSION

3.1. Result

This research was conducted until the third phase of R & D stages, which was development phase of scientific-based teaching materials. In this stage was validation from team of experts. Teaching materials that produced were in the form of textbook-based scientific approach for class X senior high school that consisted of 9 chapters in accordance with basic competencies in the curriculum of 2013.

The instrument to validate teaching materials consisted of five indicators, which are: 1) the feasibility of textbook contents; 2) language utilization; 3) presentation of physics teaching materials textbook, 4) graphic, and 5) scientific measures. The number of experts who validate the textbook was five experts from fields that involved.

The instrument to practicality teaching materials consisted of so five indicators, which are: 1) content of textbooks, 2) textbook dish, 3) dish online textbooks, 4) textbooks for teachers benefits, and 5) opportunities for implementation of the textbook.

3.1.1 Result of validation of all indicator

Results of validation of all indicators were derived from scores of average value of each statement that contained in each indicator. The average validity values for each indicator are plotted in Figure 1.

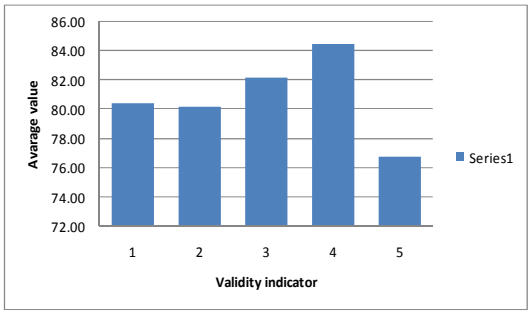

Figure 1. Average Value Of Each Validity Statement

Based on Figure 1 above, the average value of validation results from five indicators is 80.80. This can be stated that all indicators for the textbook are in good category (valid).

3.1.2 Result of Practicality of all indicator

Results of validation of all indicators were derived from scores of average value of each statement that contained in each indicator. The average practicality values for each indicator are plotted in Figure 2.

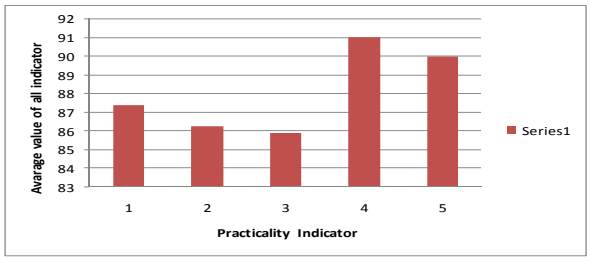

Figure 2. Average Value Of Each PracticalityStatement

Based on Figure 2 above, the average value of practicality results from five indicators is 88.10. This can be stated that all indicators for the textbook are in Very good category.

3.2 Discussiom

Based on results that obtained from each indicator, it can be described as follows: validity value of indicators are still low for indicators of content feasibility for the statement: truth of material substance, suitability of material with everyday life, benefits for additional knowledge, fitness to training and evaluation with material where each of them are valued less than 80. This is due to textbook's material is not suitable enough with everyday life so that the learning is not broaden student's knowledge. In addition, training and evaluation in each textbook is less and do not meet the criteria for good evaluation tool.

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Validity value of language utilization indicator is still low for the statement: density of ideas, construction of sentences, construction of paragraphs, writing title of tables and figures, and effective and efficient language. This is due to textbook writing still using an old style, just like previous textbooks. Another reason is it is not writing in a good format such as enhancing spelling, construct a sentence, paragraph, effective use of language, etc.

Validity value of textbook presentation indicator is still low for the statement: providing motivation and interactivity (stimulus and respond). This is due to textbooks designed is still lack of examples in everyday life which is not gaining student's interest to solve problems. In addition, interactive discussion is not widely used.

Validity value of graphic indicator is still low for the statement: textbook display. This is due to textbook design is too dense, especially at the top. It should be not too colorful, so that it will be easier to read.

Validity value of scientific steps indicator is still low for the statement: observation, asking question, digging through experimentation/discussion/ demonstration, analyzing/associating, and communicating. This is due to textbook is still not structured scientifically. Sentences statements are still not appropriate scientifically and not systematically arranged.

Based on the results of validation and suggestions from validator, there is a need to revise the design of textbook, especially regarding to the depth of materials, formatting, display, and more importantly more scientific steps on its content, not only on the section. In general, it can be said that this scientific-based textbook has good description as a physics textbook because it complies with the concept design of a textbook on the theory and research that existed previously. This scientific-based textbook can be used for curriculum of 1st half and 2nd half of class X high school.

Results achieved to test the practicality of textbooks by teachers as practitioners earned an average score of 88.10. The data show that the practical textbook used by teachers as practitioners in learning. The value of each indicator textbook on physics teacher assessment sheet that includes: the content of textbooks, textbook dish, dish online textbooks, textbooks for teachers benefits, and opportunities for implementation of textbooks in general assessed by teachers as an excellent practitioner. This means that the average value of 88.10 is a pretty good value seen from the value of practicality. This value indicates that the textbook is designed is quite practical.

In practice there are still some limitations textbook. First, the material contained in the textbook is a new material for students; Second, students are limited in obtaining textbooks used, third, test the effectiveness of the implemented new terms of differences in learning outcomes of students of Physics and practicality test only seen from keterlaksanaan an aspect that is seen and observed regardless of the timing of implementation.

Limitations of the effectiveness test can be resolved by looking at the completeness of student learning to meet the KKM has been determined. Test effectiveness can also be seen from the activities of the students and can be obtained using other instruments such as the questionnaire responses of students. Follow-up limitations of practicality test is to include the allocation of time in the test sheet practicality, so that the desired practicality will be clearly defined

4. SUMMARY AND SUGGESTION

4.1 Summary

Based on results and discussion, it can be concluded that:

1) The validity of scientific-based textbook is in medium category.
2) The practicality of scientific-based textbook is in very high category.
3) This textbook can already used for learning in curriculum of 2013 for class X senior high school

4.2 Suggestion

In preparation for prevailing national curriculum, scientific-based textbook is expected to be developed for the high school class XI and XII, and it is possible for other subjects

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ISBN 978-602-19877-3-5

MODIFICATION OF COLORADO LEARNING ATTITUDES ABOUT SCIENCE SURVEY (CLASS)

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ABSTRACT

The aimed of this study is to modify and validate The Colorado Learning Attitudes about Science Survey (CLASS) to assess students' beliefs about physics and learning physics. For the purpose of this study, CLASS was translated into Bahasa Indonesia and was examined by physics education and Indonesian language experts to avoid ambiguity in the process of translation. Originally, CLASS has eight categories, namely (1) real world connection, (2) personal interest, (3) sense making /effort, (4) conceptual connections, (5) applied conceptual understanding, (6) problem solving general, (7) problem solving confidence, (8) problem solving sophistication. After administering to 530 senior high school students, an exploratory factor analysis (EFA) produced 25 items with factor loadings greater than 0.40 which support three categories, namely (1) sense making/effort, (2) conceptual understanding, and (3) problem solving.

Index Terms— students' beliefs, exploratory factor analysis

1. INTRODUCTION

Science literacy is an important part of the education system in order to face the challenges of the 21st century. The organization for Economic Co-Operation and Development's (OECD) Programme for International Students Assessment (PISA) define scientific literacy as: "the capacity to use scientific knowledge, to identify questions and to draw evidence, based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity" [1]. In other words, scientific literacy describe as individual's ability to understand scientific laws, theories and phenomena. Intensive debate about scientific literacy emerged at 1990s inspired by concern about the educational demands of 21st century. Duit and Treagust [2] give four arguments the importance of improving science literacy:

> "The economic argument – modern societies need scientifically and technologically literate work-forces to maintain their competencies; (2) The utility argument – individuals need some basic understanding of science and technology to function effectively as individuals and consumers; (3) The cultural argument – science is a great human achievement and it is a major contributor to our culture; (4) The democratic argument – citizens need to be able to reach an informed view on matters of science –related public policies in order to participate in discussions and decision-making".

The fact that scientific literacy is an important part in order to face of the 21st century is not consistent with reality. Based on result of TIMSS (Third International Mathematics and Science Studies) and PISA (Programme for International Students Assessment) showed that student' performance in many countries was less than expected. Similar condition also occurred in Indonesia. In the last PISA at 2012, Indonesia ranked 64 among 65 participant's countries, whereas in the last TIMSS 2011, Indonesia ranked 36 of 40 countries. From these result, it can be seen that Indonesian students have poor result for both study and have low conceptual understanding, problem solving and reasoning skills in science and mathematics.

Students at secondary and tertiary levels are expected to have a good conceptual understanding of basic science, including physics. But there are a lot of evidence show that physics is the least popular subject compare with biology and chemistry. A large scale research survey conducted in the UK for the Institute of Electrical Engineers with 1552 student aged 14-16, found that students saw physics as uninteresting subject compare with other science subject such as biology and chemistry as we can see at table 1 [3].

Table 1. Data Showing 15-years-old pupils' view about science

Subject	Sample Size		Interesting	
	Boys	Girls	Boys (%)	Girls (%)
Physics	3551	1433	48	46
Chemistry	2224	1767	53	49
Biology	1329	4617	73	72

Similar condition also happen in Indonesia. Most students in Indonesia view physics as difficult and boring subject. They have low motivation in

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learning physics and their goal in studying only to pass the exam. As stated above, these beliefs will give effect to the students' learning achievement and the mastery of the physics concept. Nationally, students' conceptual understanding is measured through National Examination (UN). Among the three subjects that are tested in National Examination, physics is the subject with the lowest average score compared to other subjects such as Biology and Chemistry. In 2012 the average value for the UN high school physics is 7.0, while in 2011 the average score of the final examination of physics for senior high school in Indonesia was 7.0, whereas, in 2011 the average score was 8,17 [4]. Similarly, the average yield of the UN on the subjects of physics of high school students in Jambi province also relatively lower than the average value of other UN science. In 2011, the average value of the UN physics was 7.63 while in 2012 the average value of the UN physics was 7.45.

Research has shown that students come to class not only bring their prior knowledge about physics, but also bring their beliefs, attitudes and assumptions about what they will learn, what skills will be required, and what they will be expected to do [5-7]. A lot of evidence suggests that beliefs play an important role in student learning [6, 8, 9] . These beliefs will influence students' conceptual understanding, appreciation of the physics taught to them, learning strategies, their approaches to physics learning, the used of learning strategy and how they appreciate the physics contents (Voltaire, 2007; David Hammer, 1994). Students have beliefs about physics and learning physics very different with experts. Experts see physics as a single coherent system [10]. Novices see physics as isolated pieces of information which have a little relation with the real world. Students who emphasize science as a collection of facts fail to see the integrity and coherence of the whole structure (Redish, 1998; Voltaire Mallari, 2007).

In recent years, there have been several studies conducted in order to investigate students' belief about physics and learning pysics. Among them were study done by Redish, Saul [7] to probe students' expectation in University Physics using Maryland Physics Expectations Survey (MPEX) and study on students' beliefs about Physics and learning Physics using The Colorado Learning Attitudes about Science Survey (CLASS) by [10]. Although students' beliefs and attitude toward science and physics have been popular subject research education for so many years in Western countries, but less has been done in non-Western countries, especially in Indonesia. Thus, this study is initiated with the aim to modify and validate The Colorado Learning Attitudes About Science Survey (CLASS) Questionnaire in Indonesian version that are conceptually equivalent and produce a suitable questionnaire used to measure Indonesian students' beliefs.

2. BELIEFS ABOUT PHYSICS AND LEARNING PHYSICS

Epistemological beliefs are defined as the systems of implicit assumptions and beliefs possessed by students about the nature of knowledge and how to obtain the knowledge [11]. Different epistemology beliefs can lead to very different understanding of the same scenario [12]. Research has shown that most students have beliefs about physics and physics learning that are very different from expert. As Hammer (1994) reports, some students consider physics as weakly connected pieces of information to bel learned separately, whereas others see physics as a coherent set of ideas

Adams, Perkins [10] from Colorado University has developed the Colorado Learning Attitudes about Science Survey (CLASS) which consisting of 42 statements to probe students' beliefs about physics and learning physics and to distinguish between experts beliefs and novices beliefs [10]. CLASS survey are consist in either negative or the positive statements which made clear and concise, and respondents rate the statements on Likert scale from 1 (strongly disagree) to 5 (strongly agree). CLASS is built and development based on existing surveys such as the Maryland Physics Expectation Survey [7], the Views About Science Survey [13], and the Epistemological Beliefs Assessment about Physical Science [14].

Some designs that distinguish between CLASS with other surveys are (1) Categories in CLASS is designed to cover issues that educator consider as important aspects in learning physics, (2) the words are arranged clear, concise and meaningful, so it is easy to understand even on students who had never studied physics, (3) Scoring of the responses was easy and clear, (4) survey statements is limited or no more than 50 items so it does not take a long time to complete the survey, (5) "the grouping of statements into categories of student beliefs was subject to rigorous statistical analysis and only statistically robust categories were accepted" [10].

As explained by [15], the following categories of learning are probed by the CLASS :

> "*(1)Real World Connection Categories*. In the real world connections category, the student are asked if they believe that ideas learned in a Physics class are relevant and useful in a wide variety of real-world contexts, (2) *Personal Interest Categories*. This categories probes whether the respondents see a "connection" with the study of physics, (3) *Sense Making/Effort*. This category probes whether the learner make the effort to use available information and make sense out of the information in learning physics, (4) *Conceptual Connections* and *Applied Conceptual Understanding Cluster, (5) Problem Solving Cluster*. This cluster is divided into three sections, namely problem solving (general) - the

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students are asked how they view the role mathematical formulas in expressing relationship between physical quantities, problem solving (confidence) – probes if students are able to figure out a way to solve physics problems especially if they get stuck on their first attempt, problem solving (sophistication) – determine if students are able to apply a method used to solve one physics problem to another related problem / situation."

3. METHODS

3.1. Process of Translation and Adaptation CLASS Questionnaire

Step One : Translation Process. The aimed of this process is to achieve Indonesian language version of the Colorado Learning Attitudes About Science Survey (CLASS) questionnaire to assess Indonesian students' beliefs about physics and learning physics. The initial version of CLASS consisted of 42 items which measures students' beliefs about physics and learning physics in eight categories: personal interest, real world connections, conceptual connections, sense making/effort, problem solving (sophistication), problem solving (confidence), problem solving (general), and applied conceptual understanding.

For the purpose of this study, the original CLASS instrument was translated into Bahasa Indonesia. In order to avoid ambiguity process translation was examined by two professional education practice who bilingual in English and Indonesian. Author did cross-cultural adaptation during this translation process rather than on linguistic equivalence. For example, items #20 : " I do not spend more than five minutes stuck on physics problem before giving up or seeking help for someone else". This statement does not match with the students' condition in Indonesia. Most of students in Indonesia need quite a long time to start solve and find physics formulas which accordance with a given problem. So the author revised this statement: if I have difficulty in solving physics problems, I immediately asked friends for help.

Step Two: Back – Translation and Pre-Testing. Using the same approach as stated above, the CLASS questionnaire in Indonesian version translated again back to English by an independent translator, who has no knowledge about the questionnaire. The goal of this process is to keep both versions of the questionnaire still has the same meaning. After the back-translation process finished and both original and Indonesian version of CLASS questionnaire has same meaning, the next step is pre-testing. Ten senior high school students' consisted of five males and five females were asked to response the Indonesian version of CLASS. They are asked to response each statements and highlighted statements which were ambiguous and could be interpreted in more than one way. Based students' respond, several statements in survey was revised and asked to be review again in terms of content by the education researcher.

Step 3 - Exploratory factor analysis (EFA). The final translated version of CLASS questionnaire in Bahasa Indonesia was administered to 530 senior high school students (225 males; 305 females) in Jambi Province, the sample consisted of students from grades X, XI and XII with participants ages ranging from 15 to 17 years old. The data obtained was analyzed using exploratory factor analysis (EFA) on SPSS version 19. **).** Exploratory factor analysis (EFA) is a widely used and broadly applied statistical technique in the education, psychology, and health-related professions [16].

The flow diagram in figure 1 presents the steps in factor analysis:

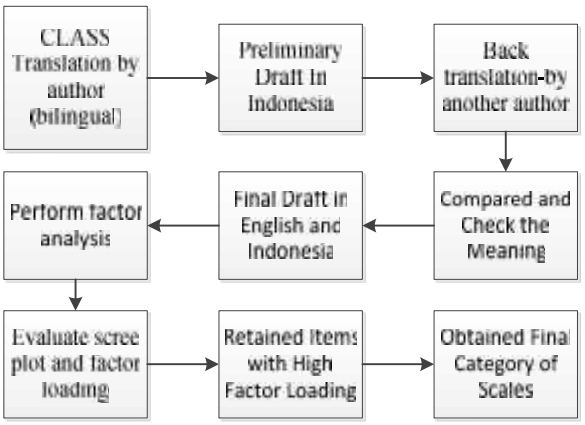

Figure 1. Flow chart summary of the category validation method

4. RESULT and DISCUSSION

Original version of CLASS consist of eight categories : real world connection, personal interest, sense making/effort, conceptual connection, applied conceptual understanding, problem solving general, and problem solving confidence. Each category consists of four to eight statements that describe students' beliefs about physics and learning physics. Totally, these categories include 27 of the 42 statements. In the current version there are nine additional statements that do not fit into eight categories of CLASS and six statements do not yet have an expert response, author decided to still include the nine's statement, but not include six statements do not yet have an expert response. Totally 36 statements of CLASS will be process in these analysis.

Principal component analysis with orthogonal rotation (example varimax) was performed on the score of the 27-items CLASS to identify factors related to students' beliefs about physics and learning physics using SPSS 19.0. There are two common rotation techniques in exploratory factor analysis

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(EFA): orthogonal rotation and oblique rotation. Author choose orthogonal rotation techniques (varimax method) because it is the most common rotational technique used in factor analysis, which produce factor structure that are uncorrelated and result solution from orthogonal rotation is easier to interpret and to report [17].

The Kaiser-Mayer-Oklin value was .810, indicated sampling adequacy appropriate for factor analysis and Bartlett's Test of Sphericity (Bratlett 1954) reached statistical significance, supporting the factorability of the correlation matrix (Table 1). Principal component analysis revealed the presence of nine components with eigenvalue exceeding 1. These nine-component explained a total of 48.24% of the variance. An inspection of the screeplot revealed a break after the third component (figure 1). From this plot, author would recommend extracting only third components. Another consideration for this decision is based on rotated component matrix. This matrix show the items loadings in eight factors with six items loading above .3 on Component 1, six items loading on Component 2, five items loading on Component 3, five items loading on Component 4, three items loadings on Component 5, component 6, component 7, component 8, and two items loading on component 9. Ideally, we would like three or more items loading on each component, so this result is not optimal. Based on Catell's (1966) the scree test and rotated component matrix, it was decided to retain only third component.

The third-factor solution explained a total of 27.90% of the variance, with Component 1 contributing 15.52%, Component 2 contributing 7.54%, Component 3 contributing 4.74% Following varimax rotation showed relatively clear three-factor solution. 8 items with factor loading less than 0.4 and 1 item which have two factor loadings (item 36 : "There are a times I solve a physics problem more than one way to help my understanding") were removed resulting in 27 item. These factor and the corresponding Cronbach's alpha values are as follows: sense making/effort consisted of 13 items (α =0.771), conceptual understanding consisted of 8 items (α = 0.632) and problem solving-general consisted of 6 items (α = 0.564) (see table 2).

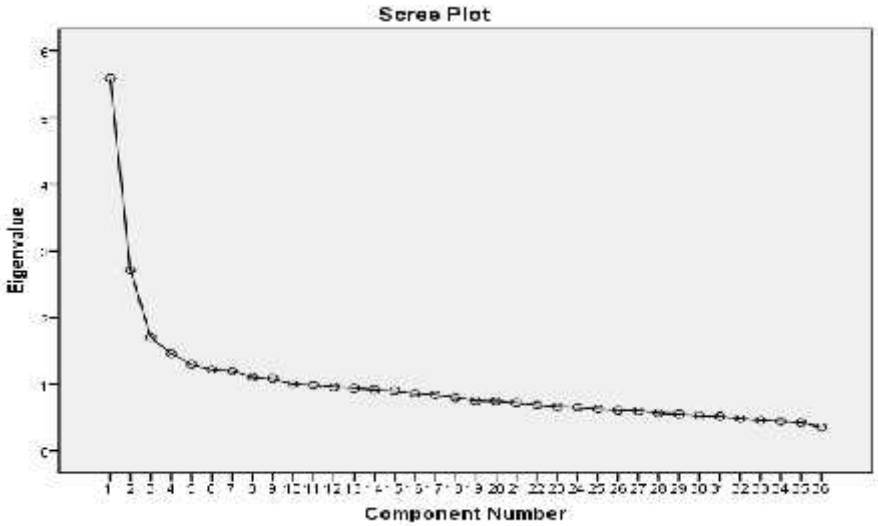

Figure 2 : Scree Plot Data

Table 2. Summary of Exploratory Factor Analysis and the Reliability of the *CLASS Questionnaire* for 3 Categories (N = 530)

Items	Component		
	Sense Making/Effort	Problem Solving	Conceptual Understanding
Item 19	0.585		
Item 17	0.573		
Item 30	0.573		
Item 24	0.567		
Item 20	0.513		
Item 14	0.499		

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Item 16	0.491		
Item 26	0.482		
Item 25	0.481		
Item 2	0.477		
Item 28	0.446		
Item 1	0.405		
Item 10		0.622	
Item 6		0.592	
Item23		0.575	
Item40		0.556	
Item32		0.516	
Item21		0.498	
Item22		0.428	
Item29		0.404	
Item37			.685
Item13			.535
Item38			.524
Item15			.462
Item3			.438
Item42			.401
Eigenvalue	5.114	2.689	1.682
% Variance	15.042	7.908	4.947
Cumulative % Variance	15.042	22.950	37.897
Reliablity	0.771	0.632	0.564

5. CONCLUSION

The result of this study indicated that the Indonesian version of Colorado Learning Attitudes About Science Survey (CLASS) to measure students' beliefs about physics and learning physics have satisfactory validity and reliability. Indonesian version of CLASS consist of three categories. The validated categories are effort/sense making, problem solving and conceptual connection. There are many useful ways to analyze and use CLASS data. CLASS can be used at the pre result and their correlation with student learning, course selection, retention, gender, age, major and also look at the shift in beliefs over a semester to determine correlations between various teaching practices and students' beliefs.

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ISBN 978-602-19877-3-5

OPTIMITION OF LEAST SQUARES METHODS SMOOTH CONSTRAIN USING OCCAM'S INVERSION GEOELECTRIC RESISTIVITY DIPOLE-DIPOLE CONSFIGURATION FOR ESTIMATION SLIP SURFACE

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ABSTRACT

The volumes of the landslide depend on the depth of the slide surface. The depth of the slide surface can be predicted by using the least squares inversion methods of data geoelectrical. Method of Least Squares Inversion of the data Geoelectrical cannot get smooth results. Based on the above, the aims was optimalitation least-squares smooth constrain inversion methods with Occam's inversion for geoelectrical data and to determine the depth and tilt angle of the slide surface in in Bukit Lantiak Padang . This exploratory study was use the method Geoelectrical resistivity Dipole-Dipole configuration. The depth and tilt angle of the slide surface in Bukit Lantiak Padang was interpretated by combined Occam's inversion with least-squares smooth constrain inversion methods. The type of slip surface is translation slip with 33.450 tilt angle and 19.3 meters in depth. Research show that the result interpretation by used combined Occam inversion with least-squares smooth constrain inversion methods more sharpness than least-squares smooth constrain inversion.

Index Terms: Least- Squares, Smooth-Constrain, Occam's Inversion, Geoelectric data

1. INTRODUCTION

Landslides is a natural phenomenon that is often take place on undulating topography. Landslide caused much loss of life and infrastructure [1], however usually pasca incident community are rebuild damaged infrastructure such as houses. The quantity of damage on landslide are depend on the volume and speed of the landslide. Volume landslide depends on the depth of sliding plane, while the landslide speed depends on the angle of the field of landslide. These problems need attention and scientific study about quantity of next landslide. This study is importent as the initial assessment of landslide disaster mitigation. Boundaries between rock wheathering or soil that was eroded with the impermeable rocks (the hard rock beneath which acts as a foundation) is called slip surface.

In the resistivity methods, slip surface are identified with of two layers of rock that have contrast resistivity [1],[2],[3],[4]. Slip surface usually consisting of a hard coating with a layer of soft and groundwater [5]. Slip surface usually consisting of rock that is low permeability that weathering rock (soil) is move on it. Structure of rock as the slip surface can be seen from the value of resistivity of rock. Resistivity of rock as the slip surface around (200-100) Ωm [6], [7].

Resistivity contrast between two types of rocks adjacent to the slip surface is influenced by rainfall and slope of hill or mountain [2],[7]. Landsilide surface on the hill or mountain that have a slope angle greater than 25^0 is divided into two types, namely the rotation slip and the translation slip (slip surface parallel to the surface of the slope)[8]. The rotation slip surface is the sliding plane that the landslide material a rotation movement above this plane. Translation slip surface is the surface that landslide material moves translational and moves in block form.

The estimation of true resistivity distribution against depth from the apparent resistivity data essentially lead to solving the inverse problem. Further, relation between the observed "apparent resistivity" and the model parameters ("true resistivity" and "layer thickness") is non-linear. Forward mathematical models are generally used to relate the measured data (here apparent resistivity) to desired model parameters (true resistivity and layer thickness). Essentially, the forward modeling is a process of predicting results of measurements on the basis of some general principle or model and specific conditions relevant to the problem. Inverse modeling, in contrast starts with the data and a general principle or a model, in which the model parameters are estimated by minimizing the error set up between the data and model parameters [9]. During the past decades researchers have made several attempts to solve the resistivity inverse problems [10],[11],[12]. These algorithms critically depend on the initial parameter chosen for it. These methods are also computationally expensive and sometimes found unfeasible for processing voluminous amount of data. Thus it is imperative to search for solving non-linear resistivity inverse problems.

2. RESISTIVITY METHODS

In the resistivity method, current is induced directly into the ground through a pair of current electrodes and resulting voltage difference is measured between a pair of potential electrodes. The

ISBN 978-602-19877-3-5

method provides the apparent resistivity distribution against depth. The depth of penetration of electrical signal is generally found to be approximately one-third of the distance between the electrode separations. The layered structures in and around the region have impacted on the near surface distribution pattern of electrical properties. In this method, current is induced directly into the ground through a pair of current electrodes and resulting voltage difference is measured between a pair of potential electrodes. The method provides the apparent resistivity distribution against depth. The depth of penetration of electrical signal is generally found to be approximately one-fitth of the distance between the electrode separations.

The subsurface geology is usually complex, subtle and multi-scale such that spatial variations can change rapidly both laterally along the survey profiles and vertically with depths. Thus, a closely spaced grid of observation points is required for the accurate characterization, high spatial resolution and good target definition of such highly heterogeneous subsurface. Survey design must take into account the capabilities of the data acquisition system, heterogeneity of the subsurface electrical conductivity and the required resolution. Other factors to be considered are the areal extent of the site to be investigated, the cost of the survey and the time required to complete the survey[13],[14],[15].

If the point electrode delivering current (I amperes) is located at the surface of the homogeneous isotropic medium, all the current now flows through a hemispherical surface in the lower medium because and the air above earth has zero conductivity. The flow of electric current in the earth as Figure 2 [14],[15].

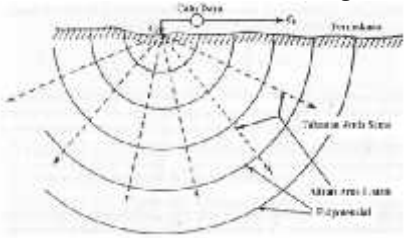

Figure 2. Point source of current at the surface a homogeneous medium

If the current source and potential are located on surface, the horizontal boundary separating two media (e.g., the upper resistivity ρ_1, the lower ρ_2), the electrical potential V(x) on the surface (z = 0) of a layered earth at a distance s from a grounded electrode carrying a current I, at point distand x from current electrodes [16],[14],[35] can be write the equation as follows

$$V(x) = \frac{1}{2\pi}\int_0^\infty T_1(\lambda) J_0(\lambda x) d\lambda \qquad (1)$$

where $J_0(\lambda x)$ is the zeroeth order Bessel function of the first kind, $T_1(\lambda)$ is the electrical impedance at the surface that is the resistivity transform function of layer resistivities and thicknesses[17], and λ denotes the integral variable [18] (specifically for dipole-dipole configuration is half of the positive current electrode spacing of the electrode potential [19]). The resistivity transform function to extract the resistivity kernel function $K_1(\lambda)$ representing the deviations in response of the layered earth from that of a homogeneous half-space.

Irregularities on the response of the layered earth homogeneous half-space can be represented by the function of the resistivity transformation into Kernel function $K_1(\lambda)$ of resistivity [17]. Recurrence relationship of the resistivity transform function impendasi electrical resistivity T(λ) can be written as follow

$$T_i(\lambda) = \frac{T_{i+1}(\lambda) + \rho_i \tanh(\lambda_i h_i)}{\left[1 + T_{i+1}(\lambda)\tanh(\lambda h_i / \rho_i\right]}, i = n-1...1 \qquad (2)$$

while n denotes the number of layers, ρi denotes the true resistivity and thickness of the i-th layer, respectively. Electrical impedance at the earth surface (the air-earth interface) can be formulated by

$$T_1(\lambda) = \rho_1\left[1 + 2K_1(\lambda)\right], \qquad (3)$$

while electrical impedance at the top of the ith layer [18] can be write as follows

$$T_i(\lambda) = \rho_i\left[1 + 2K_i(\lambda)\right] \qquad (4)$$

Earth is not homogenous in resistivity, so the relationship between the apparent resistivity (ρ and the layer parameters (e.g. layer thickness, layer true resistivity) can be expressed by an integral equation considering an earth model consisting of homogeneous and isotropic layers can be write the equation as follows [12],[37].

$$\rho_a(x) = x^2\int_0^\infty T(\lambda) J_1(\lambda x)\lambda d\lambda \qquad (5)$$

where ρa denotes an apparent resistivity.

To Calculate Equation (5) can be under taken with a linear filter method is generally expressed as following equation.

$$\rho_a(x) = \sum_k T_k(\lambda) f_k \qquad (6)$$

while fk denotes a linear filter coefficient derived by Ghosh [20]. Equation (6) shows the relationship between the apparent resistivity (ρ_a) with the parameters of the model resistivity and thickness of the layer (ρ_k,h_k) is very linear [21], so to estimate the apparent resistivity to true resistivity inversion required non-linear solution. Next, base on the equation (6) can be obtained the simple expression apparent resistivity that measured by symmetrical dipole-dipole configurations in discrete Green's function as follows [18]

$$\rho_a(x) = \sum_{j=0}^{\infty} T_{1j}\left(\frac{m}{m-1}\frac{x}{\sqrt{(\varepsilon_j^2 + x^2)}} - \frac{1}{m-1}\frac{mx}{\sqrt{(\varepsilon_j^2 + (mx)^2)}}\right) \qquad (7)$$

which is the Green's function of a point source, ε_j being a real constant and m denotes specific electrode configurations.

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3. OCCAM'S INVERSION IN LEAST-SQUARE SMOOTH CONSTRAIN

The behavior of the electrical properties of the earth's subsurface (resistivity and thickness) were studied based on the electrical parameters of the structure below the earth's surface [22]. Layer of earth is modeled in the form of a series of horizontal layers with constant resistivity. The real resistivity distribution estimation (true resistivity) to a depth based on the apparent resistivity data (apparent resistivity) can be solved by mathematical and statistical techniques to obtain information about the physical properties of the subsurface of the earth [23]. Inversion method Least-Square 2-D can be use to interpret of the subsurface resistivity structure [24,[25], but the results of inversion have not shown results in a smooth response [13] .

The earth is not a homogeneous medium due to subsurface resistivity is changes continuously with depth. The local layer parameters characterizing the model are frequently estimated by using apparent resistivity data (sounding curves) determined at relatively sparse stations. In order to ensure the fulfillment of a 1-D assumption as much as possible, the measurement electrode arrays are deployed in the strike direction of the geological structure [19],[20]. By the method all observation data (measured with an electrode array) from each VES station along the survey profile are integrated into one inversion procedure [36]. The lateral change of the model parameters (the dependence of layer resistivities and thicknesses on the lateral coordinates) are approximated by series expansion. The main problem in the inversion approach is the result of inversion does not produce a unique solution [9],[22]. Such inversion displays the same response from three or more different models. This can lead to errors in the interpretation of the parameters. In order to give better approximation for geological models with slow lateral variations a new inversion algorithm, such as Robust inversion, Occam's inversion and joint inversion [9],[26].

An alternative approach can be used to parameterize the amount of geoelectric earth layers horizontally with a continuous resistivity profiles around sounding using electromagnetic data which is linear [9],[11],[27]. The relationship between the observation data (apparent resistivity) and model parameters (true resistivity and layer thickness) is not linear [37]. Standard linear inverse approach to solving the problems of non-linear inversion in Geophysics in general are developed based on the iteration process. In inversion process, the number of iterations and error interpretation results generally depend on the value of the initial guess [11],[27].

The Levenberg-Marquardt algorithm adaptively varies the parameter updates between the gradient descent update and the Gauss-Newton update [28].

$$\left[J^T W J + \alpha I\right]\Delta m_k = J^T W d \qquad (8)$$

where I is the identity matrix and μ is Marquardt factor or damping factor. The parameter λ is initialized to be large. If an iteration happens to result in a worse approximation, λ is increased. As the solution approaches the minimum, λ is decreased, the Levenberg-Marquardt method approaches the Gauss-Newton method, and the solution typically converges rapidly to the local minimum [23].

If data measured in geoelectrical modeling the Marquardt inversion was expressed as d = such as s apparent resistivity with i = 1,2, ..., n and n is the number of data. Model resistivity and thickness of the subsurface is $\Delta m_k = [\rho_k, h_k]$, while k = 1,2, ..., n and n is the number of layers. Marquardt inversion method of applying iterative methods as well as the Gauss-Newton method, the difference lies in the addition of damping factor μ scalar multiplication with the identity matrix I[29],[30]. The term damping or attenuation to estimate model parameters as stated in Equation (8) relates to dampen the instability that might arise due to limited data on inversion including underdetermined [31] .

To obtain a unique solution inversion various constraints must be added. To reduce the non-uniqueness problem and to achieve a faster computer code, several authors have combined the use of 2-D and 1-D calculations serving 1-D grid laterally with inversion procedure requiring too much numbers iterations [27]. Numbers iterations process was reduced by modifying the Occam's inversion with cutting singuler value, however this inversion method can not find out a conductive thin layer and a conductive layer which was covered by resistive layers [32]. This information indicates that this method can not use to investigated landslide. If this method will use to data interpretation, it is necessary to improve. Another problem is the result of inversion of resistivity sounding a little change in the value of the model parameters lead to large changes in the results of inversion [12]. This condition will be overcome by using Occam inversion that is inserted into the equation linear least-squares inversion as a regulator of the process of calculating a damping factor. Damping factor for the linear least-squares inversion damped [30] as follows

$$m = [\, G^T G + \varepsilon^2 W]^{-1} G^T d \qquad (9)$$

where m is the vector correction parameter, d is the vector difference data G Jacobian matrix containing the partial diffrensial data to the model parameters and ε is called the damping factor. The damping factor is used to control the convergence and the obtained solution[16]. In cases of resistivity data inversion, partial differential price is expected to model parameters are not too large so that the price difference inversion model parameters can be minimized. W_m matrix is a square matrix (M x M) with the same size as the model

$$\underline{W} = \text{diag}\ \{ \circ_1, \circ_2, \ldots\ldots \circ_M \} \qquad (10)$$

Minimization of errors on a regular linear inversion expanded to minimization of the prediction

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error data and error solutions. If the damping factor used is very small or close to zero, the prediction error will be minimized [20],[29]. That is, the addition of damping factor in the inversion process can stabilize the inversion process on the matrix inversion[16].

Non-uniqueness problem inversion results are minimized by using the minimum norm as constrain models and minimize the objective function related to geological conditions desired. Results inversion models will thus provide information in accordance with the desired geological conditions. Constraints in this case are anomalous resistivity on the slick field using electrode configuration dipole-dipole. Parameters of model modified iteratively by using the equation as follow

$$\Delta m^k = \underline{W}_k^{-1}\underline{G}^T[\underline{G}\underline{W}_k^{-1}\underline{G}^T + \mathrm{a}\underline{I}]^{-1}(x - \underline{G}m^k) \qquad (11)$$

For a 2-D model the earth is parameterized by means of a grid of rectangular prisms, each having a uniform conductivity [27]. The grid is terminated laterally by uniform layers and below by prisms elongated with depth. This grid is referred to as the regularization mesh. The individual blocks are made smaller than the data resolution length so that the locations of the block boundaries do not affect the final model [33]. To perform the forward calculations required by the inversion scheme a finite-element [30].

However, the regularization mesh contains a much larger number of conductivity regions than is normally used for 2-D models based on assumed geologic structures, and so using several nodes for each conductivity element would be computationally expensive. The smooth inversion scheme will prevent large conductivity contrasts from appearing in the model, and several inversions have been conducted using no more nodes than defined by the regularization mesh. However, it is usually desirable to insert more nodes within the regularization mesh to maintain accuracy in the forward code, especially at the edges of the grid [19]. To suppress model structure not required by the data, the model roughness must be minimized. For a 2-D structure with x in the direction of the strike axis a measure of the model roughness may be given by

$$R_1 = \left\|\partial_y m\right\|^2 + \left\|\partial_z\right\|^2 \qquad (12)$$

where m is the vector of model parameters, ∂y is a roughening matrix which differences the model parameters of laterally adjacent prisms, and ∂z is a roughening matrix which differences the model parameters of vertically adjacent prisms [19],[33],[34],[35]. This is the expression for a first derivative roughness penalty. The penalty for the second derivative roughness is given by

$$R_2 = \left\|\partial_y^2 m\right\|^2 + \left\|\partial_z^2 m\right\|^2 \qquad (13)$$

Since the model grid is terminated by uniform layers at the sides and uniform blocks below, first derivative smoothing best matches the boundary conditions imposed by the forward code. Therefore only the R_1, roughness penalty will be discussed. The vertical scale of the prisms is exponentially increased as a function of depth in order to coincide with the loss of resolving power, so that this is equivalent to increasing the penalty for roughness as a function of depth. The horizontal block boundaries and node spacing in the forward code extend to depth and are constrained by the requirement of having a fine mesh near the surface. Since the block widths remain constant, the horizontal damping factors in the roughening matrix are adjusted to ensure that resolved features are not elongated in the vertical direction. That is, as the vertical scale of the prisms increases, a greater penalty must be given to differences in model parameters between laterally adjacent blocks [19], [33], [35]. In order to quickly reach the converging and inversion results reflect the expected geological conditions Equation (13) can be modified into

$$\Delta m_{i+1}^k = \left[\left(\underline{\partial}_y^T\underline{\partial}_y + \underline{\partial}_z^T\underline{\partial}_z\right) + \underline{W}_k^{-1}\underline{G}^T(\underline{G}\underline{W}_k^{-1}\underline{G}^T + \mathrm{a}\underline{I})^{-1}(x - \underline{G}m_i^k)\right] \qquad (14)$$

An unvaried search is conducted along model on each iteration in order to find a model that minimizes the misfit to the data until the desired ttolerance is obtained.

4. METHODS

Model inversion obtained verified by resistivity data measurement in Lantiak Bukit Padang. Data was collected using a multi-electrode system resistymeter (ARES). The use of multi-electrode systems for data acquisition in Geoelectric resistivity surveys has led to a dramatic increase in field productivity as well as increased quality and reliability of subsurface resistivity information obtained. Multi-electrode systems were used computer-controlled multi-electrode systems with automatic measurements and data quality control, which has tremendous impact on the quality of the data and the speed with which they are collected. Multi-channel transmitter and receiver systems are now being used in simultaneously carrying out series of measurements. This research has three parameters, which was parameter which was measured in survey (electric current, electric potential, and spaced electrodes), calculated parameter I which was the apparent resistivity and interpretation parameter (true resistivity and the thickness of the subsurface).

This study was divided into three stages first, do the preparation phase assessment literature on theories that support. Survey is under taken to determine the trajectory measurements and determine the geological measurement area. Second, the planning phase is to design the measurement to be performed. Third, the implementation phase is to do measurements or data acquisition measurements in accordance with the design that has made as many as three tracks. Measurements carried out by Dipole-dipole configuration, because this configuration has a current penetration is deep enough that 1/5 of current electrode spacing that used and sensitive to vertical

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resolution. The arrangement of the electrodes on Dipole-dipole configuration shown in Figure 1

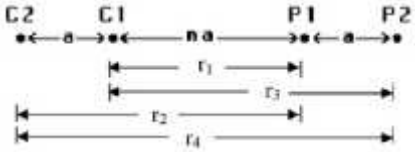

Figure 1. Structure of Dipole-dipole electrode configuration.

Apparent resistivity measurement results calculated

$$\rho_a = \pi n(n+1)(n+2)a\frac{\Delta V}{I} \quad (15)$$

Where a denotes distance between the two nearest electrodes, n denotes integer number (e.g. n = 1...6) and na denotes space the positive current electrode and the negative potential electrode. Apparent resistivity was interpreted by the Least-Square inversion method that was optimized with Occam's inversion. Occam's inversion is used to get the value of damping for Least-Squares smooth constraint inversion. Based on 2D cross sections was obtained true resistivity of the earth's subsurface. Based on the true resistivity that obtained, geological structure, and table references were estimated resistivity of rock in Bukitlantiak Padang. Based on 2D cross-sectional, we can estimate type, depth and tilt angle of slip surface. All interpretation of data was under taken by Matlab software version 7.01 and the RES2DINV with Dogle of Sri Gutomo USM Malaysia [38]

5. RESULTS AND DISCUSSION

To determine whether the inversion method developed to function properly, it has conducted trials use this method in some survey data geoelectric resistivity. First, the method is tested to interpret the data on the measurement of strike 1 (00^0 58 '16" S and 100^0 22' 8"E to 00^0 58'05.4"S and 100^0 22' 14.5" E). This strike has an altitude at (79-125) meters above sea level. The 2D model cross-sectional data on strike 1 is shown in Figure 2.

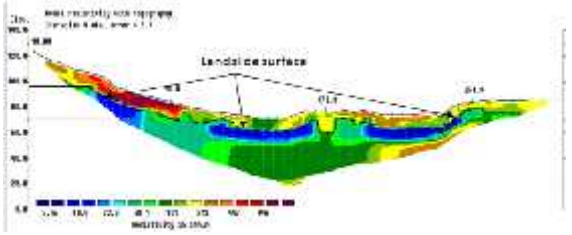

Figure 2a. Cross-section 2D resistivity model by least-squares smooth constrain inversion methods

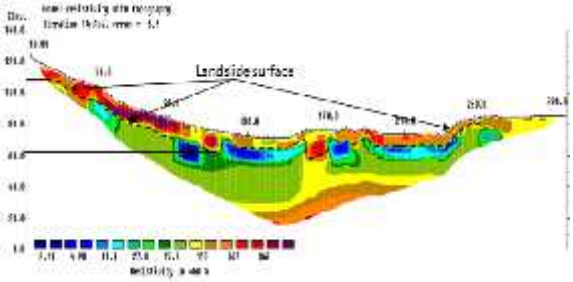

Figure 2b. Cross-section 2D resistivity model by combined Occam's inversion and least-squares smooth constrain inversion methods

Cross-section 2D resistivity model show that structural model of 2-D resistivity was interrelated by Occam's inversion method that combined with smooth constrained least-squares inversion (Figure 2.b) more sharpness than structural model of 2-D resistivity was interrelated by Least-squares constrain smooth inversion methods (Figure 2.a). The tilt angle obtained by Occam's inversion method that combined with smooth constrained least-squares inversion (Figure 2.b) greater than tilt angle obtained by Least-squares constrain smooth inversion methods (Figure 2.a). Resistivity at strike 1 is around 1.21 ohm.m to 2005.76 ohm.m. Cross-section that is green in color (resistivity is 19.52 ohm.m to 27.81 ohm.m) was estimated as clay. Thin layer which greener color (a dashed black line) is estimated as slip surface. Slip surface on the strike has an altitude (78-100) meters above sea level and the tilt angle is 33.980. Type of slip surface on strike 1 is translation slip.

Next, this method was used to interpret data on strike 2 ($00^0$58'16"S and $100^0$22'8"E to $00^0$58'05.4" S and $100^0$22'14.5"E). This strike has an altitude 71-115 meters above sea level. The 2D model cross-sectional data on strike 2 is shown in Figure 3.

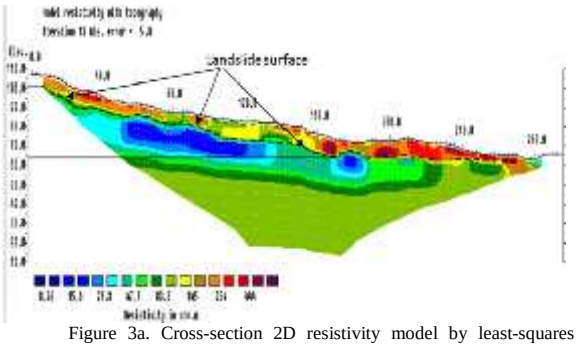

Figure 3a. Cross-section 2D resistivity model by least-squares smooth constrain inversion methods

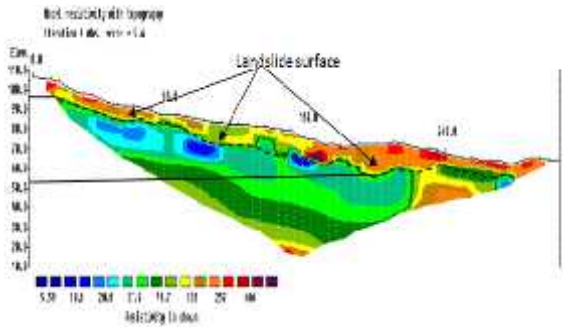

Figure 3b Cross-section 2D resistivity model by combined Occam inversion with least-squares smooth constrain inversion methods

Cross-section 2D resistivity model show that structural model of 2-D resistivity was interrelated by Occam's inversion method that combined with smooth constrained least-squares inversion (Figure 3.b) more sharpness than structural model of 2-D resistivity was interrelated by Least-squares constrain smooth inversion methods (Figure 3.a). The tilt angle obtained by Occam's inversion method that combined with smooth constrained least-squares inversion (Figure 3.b) greater than tilt angle obtained

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by Least-squares constrain smooth inversion methods (Figure 3.a). Resistivity of strike 2 around (1.43 Ohm.m – 1879.54 Ohm.m). Cross-section that is green in color (resistivity is 25.5 ohm.m – 37.9 ohm.m) was estimated as clay. Thin layer which greener color (dashed black line) is estimated as slip surface. Slip surface on the strike 2 has an altitude 62 - 106 meters above sea level and the tilt angle is 32.680. Type of slip surface on strike 2 is translation slip. The percentage of errors interpretation by Occam's inversion method that combined with smooth constrained least-squares inversion on 14th iteration is around 5.6% - 6.7%.

The overall study results showed that the cross-section 2D resistivity model show that structural model of 2-D resistivity was interrelated by Occam's inversion method that combined with smooth constrained least-squares inversion more sharpness than structural model of 2-D resistivity was interrelated by Least-squares constrain smooth inversion methods. Results obtained by using methods developed sharper than the results obtained by using the least-squares inversion smooth constrains methods which has been widely used [35] . Type of sliding plane obtained is the type of translation. It is located above the sliding plane parallel to the hard rock slope. The characteristics are geoelectric sliding plane is the presence of a layer that has a value large enough resistivity between two adjacent layers. Layer with low resistivity flanked by two layers which have a high resistivity. Usually the rock that serves as a sliding plane is the clay because the clay absorbs water during the rainy season but the slow passing of water so that the load of rocks increases. Water that accumulates on clay which is above the hard rock lead becomes hard rock slippery. Slippery clay formed acts as a field of experience weathering material above it moves. Material moving on a slippery field is called as the landslide material. The boundary between materials that is stationary with a moving material called sliding plane. Therefore the need for anticipatory action to prevent landslides

6. CONCLUSION

Study results showed that the cross-section 2D resistivity model show that structural model of 2-D resistivity was interpretive by Occam's inversion method that combined with smooth constrained least-squares inversion more sharpness than structural model of 2-D resistivity was interpretive by Least-squares constrain smooth inversion methods. Type of sliding plane obtained is the type of translation. The percentage of errors interpretation by Occam's inversion method that combined with smooth constrained least-squares inversion on 14th iteration is around 5.6% - 6.7%.

7. ACKNOWLEDGEMENTS

My thanks go to students from the Department of Physics, Faculty of Mathematics and Sciences Padang State University who helped carry out the survey with the resistivity method in Bukitlantik. Survey data collection was funded by the Directorate General of Higher Education through Student Creativity Week that guided the first author. Thanks also to the Ministry of Energy and Mineral Resources of West Sumatra who allowed us to use the land to carry out a survey.

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ISBN 978-602-19877-3-5

DETERMINATION OF SYSTEM DYNAMIC CHARACTERISTICS BASED ON A SERIAL RC CIRCUIT MODEL

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ABSTRACT

An inverse calculation method has been developed in order to get values of resistance *R* and capacitance *C* which could be change with time, based on time series data of voltage sources ε and charges of capacitor *Q* (or electric current *dQ/dt*), from a simple serial RC circuit model (RSRC model)

$$\frac{dQ}{dt} = -\frac{1}{RC}\ Q - c\varepsilon$$

by using several values of *C* resulting from extreme conditions of *Q* and applying the continues cyclic boundary condition to the function representing the change of *C* above. Resulting calculation of the method for three samples of "The C-function" and the periodic voltage sources

$$\varepsilon\ t\ = \epsilon_A + \varepsilon_B\ sin\omega t;\ 0 \le\ \omega t \le\ \pi \text{ and} \varepsilon\ t\ =\ \varepsilon_A;\ \pi \le\ \omega t \le\ 2\pi$$

where ϵ_A, ε_B, and ω are constants, gave pair values of R and C which are similar to the ones obtained from the identical standard problem using the standard solution of the RSRC model. Applications of the above model and method for the study of atmospheric and surface heating (cooling) processes related to the atmosphere-surface thermal interaction are complement to the discussion in this paper.

***Index Terms*:** Serial RC circuit model (RSRC model), continues cyclic boundary condition, standard problem, standard solution, inverse calculation method.

1. INTRODUCTION

1.1. RSRC Model: Problems and Solutions

Model Serial RC circuit (RSRCModel), [1], [2], is not a strange thing for the students because he had been introduced since the first year of lectures in various departments with physics as the basis for the field of science. Although intrinsically specifically linked to electrical circuit problem but the application of this model can cover wider aspects of life. RSRC model mathematically can be formulated in the form of a differential equation :

$$\frac{dQ}{dt} = -\frac{1}{RC}\ Q - C\varepsilon \qquad (1)$$

Where Q is the electric charge in capacitor, *dQ/dt* is the electric current, *R* is the resistance, C is the capacitance, ε is the battery voltage and *t* is time

If we look at it from the standpoint of system, R and C are parameters that express the characteristics while ε states treatments (outside) and Q (or dQ/dt) is the response of the system.

As differential-equation problems or problems of the system in general, standard dissuesassociated with equation(1) I show to determine the solution, Q(t), armed with predetermined data of R, C, andε[3]. Further investigation of the equation(1) shows that Q(t) is not determined by the values of R, C, and εalone but by the values of combined RC and Cε(or ε/R).

This means that for every Q(t) there will be many sets of values of R, C, and ε that can be associated with it. So the more specific question is how to get the true values of R, C, and ε of a system dynamics as expressed by equation (1).

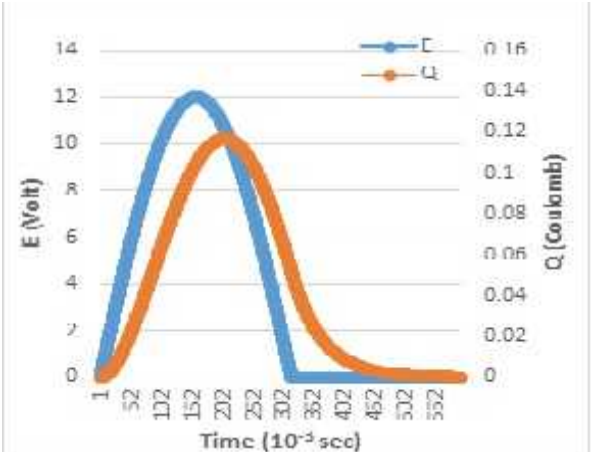

Figure1.The patternQ(t) associated withε(t) in the form ofa halfsinewave. According to the natureof equation (1) the form Q(t) is only affected by Cε, not by RC.

Figure 1 shows the Q(t) associated with ε(t) in the form of a half sine wave. A typical visible form of Q(t) is 'similar' but always delayed compared toε(t). Deeply examination showed the fact that the form Q(t) is determined only by Cε, not by RC, in

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accordance with their physical meaning only determines the rate of the process or the dynamics of the system in question.

The problem in this paper is an inverse problem, namely how to get the true values of Rand C from the time series data of Q(t) (or dQ/dt) and ε(t). Noting that Rand Care parameters which express the characteristics of a system, then the information about variations of both values on time is a sign of the dynamic behavior of the system in question.

The fact that Q(t), which is a solution of equation(1), associated with many probable options of R, C, and εvalues that may require the need for a different approach in order to be able to determine each value respectively. In terms when time series data ofε (t) is known then it still needs a way to determine the values of R and C more specific.

1.2. Inverse Calculation Method

The purpose of the whole of this study was to get information about the characteristics of the system associated with the RSRC Model, while this paper aims to introduce and test the performance of inverse calculation method, MPT, in order to obtain the true values of Rand C, which are parameters related to the characteristics of the model. An explanation of the background of the design, formulation used, and the steps of method implementation will be discussed in Chapter 2, while the results and explanation of its meaning will be revealed in Chapter 3.

By considering the specific purpose that is more focused on the introduction and testing of MPT, the discussion in this paper will be limited to the aspects of computation and simulation test of the computing program, with emphasis on the accuracy of calculation results compared with the value of the test data which has been available.

2. METHODOLOGY

The principle in understanding the characteristics of a natural system is the fact that under normal conditions the pattern of the dynamics of a system of life will form a continuous cycle. Based on this basic assumption, then all dynamic variables consisting of parameters that express the characteristics of the system (R and C), the outside driving factor (ε) and the system response is (Q or dQ/dt) should have a pattern, at least on average, forming periodic and continuous functions.

2.1. Model and Data

As equation (1), the data for this study are simulation data of RSRC Model concerning with variable/parameter values of Q (or dQ/dt), ε, R, C, and t. The values were determined rationally related data while the amount of data was estimated according to the need to produce enough accurate computing calculations, as presented in Table 1.

2.2. Design and Step of Calculation

2.2.1. *Determination of Battery Voltage*

Battery voltageε(t) is settotakeshape of

$$\varepsilon\ t\ = \epsilon_A + \varepsilon_B\ sin\omega t;\ 0 \le\ \omega t \le\ \pi \quad (2a)$$

and

$$\varepsilon\ t\ = \varepsilon_A;\ \pi \le\ \omega t \le\ 2\pi \quad (2b)$$

This form is selected in accordance with the requirements of continuous periodic, and also the consideration of its application to the study of the process of heating/cooling that will be discussed at the end of the paper.

2.2.2**.** *Test Data and Sample Data of Functions-C Test*

Test data of R and C are designed as the true values of R and C, as well as used to calculate the value of Q(t) by equation (1) or in accordance with the solution "standard problem". The three data will then be used as test data for the calculation of the MPT.

In particular for test data C, they not only must meet the requirements of periodic and continuous but also their patterns and values that will be used according to the function-C test sample selected from three functions with a pattern that is proportional to the function that: (a) linear with respect to time; (b) linear with respect to Q(t); and (c) linear against ε(t).

2.2.3. *Determination of R and C with MPT*

Inverse calculation method (MPT) is designed to take advantage of the presence of extreme conditionsQ_{ext}, i.e. when the case where dQ/dt = 0, corresponding to equation (1) will produce

$$C_{ext} = \frac{Q_{ext}}{\varepsilon} \quad (3)$$

Table 1. Variable/Parameter setting

Variable/Parameter	Symbol	Unit	Typical Values
Charge in Capacitor	Q	Coulomb	0.001-0.12
Battery Voltage	ε	Volt	0.01-12.01
Resistance	R	Ohm	8 - 13
Capacitance	C	Farad	0.01
Time interval	Δt	Second	0.002

In accordance with the typical form of Q(t) as in Figure 1, at least there will be two Q_{ext} values, each associated with maximum and minimum values. Furthermore, the value of C between two mutually sequential C_{ext} values is determined by assuming the form of the function C(t) in accordance with the selected test sample as in point 2.2.2. While the values of R(t), which arepair of associated values C(t), obtained through another form of equation (1)

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$$R\ t\ = -\frac{Q(t)-C(t)\varepsilon(t)}{c(t)\frac{dQ}{dt}} \quad (4)$$

2.2.4. *Performance Test Results of MPT Calculation*

The performance of MPT is determined by the deviation values of Rand C obtained from the calculations of the values of Rand C corresponding test data(see point 2.2.2.)

3. RESULTS AND DISCUSSION

3.1. Applications of Functions-C Test Sample

In accordance with the discussion on the methodology, three function-C test samples have been applied to calculate R and C with MPT. At least 36 periodic and continuous functions of R and C(see Table 2) included in the above test sample, have been under going trials, but there are more than 36 variations of cases that can be built and tested more results.

Table 2 illustrates the results of calculation of MPT to various cases in the test sample categories "Function-C". More detailed categorization, with more number oftest cases, was carried out with variations C, linear with respect to time t. With attention focused on the Maximum Relative Error (MRE) we can immediately see the value of MRE for the calculation of C is generally lower(or better) compared with the same thing for R.It is reason able, in accordance with the accounting procedures for C which would take precedence, while the calculation of R has been brought as a result of a calculation error C.

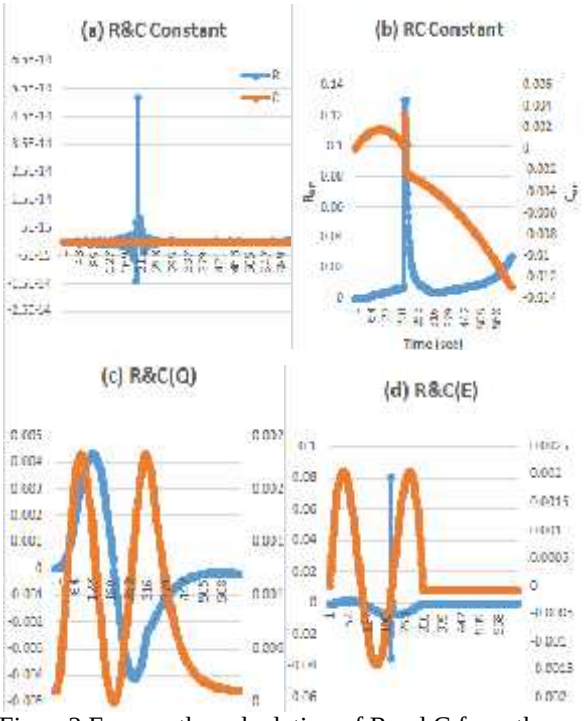

Figure2.Erroron the calculation of Rand C from the MPT to the case: (a) R&C Constant, (b) RC=Constant, (c) ClinearQ, and(d) Clinearε.

Table2.Calculation Resultsof MPT

Cases	Number of Cases	Max. Relative Error	
		R	C
1. Varies C linear to t:			
(a) R & C are constant	1	10^{-14}	10^{-16}
(b) RC = Constant	4	0.13	$7.1x10^{-3}$
(c) R or C is constant	16	0.14	$4.9x10^{-7}$
(d) R & C are changing	5	0.14	0.01
2. Varies C linear to Q	5	0.06	10^{-3}
3. Varies C linear toε	5	1.54	$2.0x10^{-3}$

Figure 2 shows the relative error of MPT results for each case 1(a), 1(b), case 2 and case 3 in Table 2. In all cases R is much larger error than the C error and the biggest deviation from the R error occurred the conditions (time) close to Q_{max}. As in Table 2, except for the case of 1(a) almost all calculations R MRE fairly high yield (more than 1%). This occurs as the maximum condition Q (in which case dQ/dt = 0), and in accordance with equation (4) The calculation result R in these conditions will deviate quite far from what it should be.

Table 2 also shows the calculation results for MRE of R which is good enough for case 2, while for the case of 3, the result is much worse than the other two groups of cases. This picture gives an indication that the use of Cfunction approach in a form of Q linear is the performance of MPT.

So far, from the investigations it can be concluded that as far as the pattern of test data in accordance with the function-C test sample are used, the MPT has been able to calculate (back) R and C at a fairly high level of accuracy. Additional corrections in the area around the extreme conditions Q are expected to lower MRE of R to be below the value of 1%, a fairly good accuracy limits for various studies in the field of environment.

In fact the main problem is that we do not have C and R test data mentioned above, thus we cannot test accuracy the results of MPT sample calculations. The only indicator that can be used is a parameter that can express the degree of similarity between calculation results of MPT with test samples of Function-C used. Discrepancy between the two suggests that we may develop moretest samplesof function-C.

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3.2. Implementation RSRC Model in Atmospheric and Surface Heating/Cooling Processes

Figure 3 displays the pattern of solar radiation, atmospheric temperature, and surface temperature, all day and night, observation data every 5 minutes during 2014 from Mauna Loa Observatory (MLO) Hawaii, USA, [4]. Note the pattern of the graph in Figure 3 are similar to the chart patterns for RSRC Model in Figure 1, the solar global radiation (Ig) replace battery voltage (ε), while the atmospheric temperature (Ta) or the surface temperature (Ts) replace the role of charges in capacitors (Q). In the perspective of simple thermal interaction (with only involves aspects of radiation) heating/cooling process in the atmosphere and the surface (which is identical to the process of charging/discharging the charge on the capacitor) mathematical model is identical to equation (1) is expressed, respectively, by [5], [6], [7] as

For atmospheric (a):

$$\frac{dT_a}{dt} = -\frac{1}{\tau_a} T_a - T_s - Y_a I_a \quad (5a)$$

andforthe surface (s):

$$\frac{dT_s}{dt} = -\frac{1}{\tau_s} T_s - T_s - Y_s I_s \quad (5b)$$

with $\tau_x = R_x C_x = \frac{c_x}{4\epsilon'\sigma T_y^3}$ is time constant, R_x and C_x are equivalent resistance and capacitance respectively, c'_x is specific heat (per unit area); $Y_x = \frac{1}{4\epsilon'\sigma T_y^3}$,, where the index x and y respectively declared for a (atmosphere) and s (surface) or the exchanges between them; $\epsilon' = \frac{\epsilon_a T_a^4 - \epsilon_s T_s^4}{T_a^4 - T_s^4}$ iscombined atmosphere-surface emissivity and ± = 5.6704x10^{-8} W/m^{2}K^4 is Stefan-Boltzmann constant.

If short-wave atmospheric absorption coefficient is noted as β, atmospheric albedo~$_a$ and surface albedo α_s then solar radiation absorbed by the atmosphere is $I_a = \frac{\beta\ 1-\alpha_a}{1-\beta\ 1-\alpha_a} I_g$ and solar radiation absorbed by the surface is $I_s = 1 - \alpha_s\ I_g$.

By looking at the similarity of the form of equation (1) with equation (5) and relationships over the formula for the equivalent resistance and equivalent capacitance can be expressed as

$$R_a = c'_a \frac{1-\beta\ 1-\alpha_a\ I_g}{4\epsilon'\sigma T_a^4\ 1-\beta\ 1-\alpha_a\ -\beta\ 1-\alpha_a\ I_g} \quad (6a)$$

and

$$C_a = \frac{T_s}{I_g} - \frac{\beta\ 1-\alpha_a}{4\epsilon'\sigma T_a^3\ 1-\beta\ 1-\alpha_a} \quad (6b)$$

for the atmosphere, also

$$R_s = c'_s \frac{I_g}{4\epsilon'\sigma T_a^4 - 1-\alpha_s\ I_g} \quad (7a)$$

and

$$C_s = \frac{T_a}{I_g} - \frac{1-\alpha_s}{4\epsilon'\sigma T_a^3} \quad (7b)$$

For the surface.

Equation (6a), (6b), (7a) and(7b) clearly shows how the resistance and capacitance that is equivalent to the heating/cooling processes of the atmosphere and the surface is expressed towards its associated physical parameters. Specialequation (6b) and(7b) are expected to assist in the determination of the test sample related to "Function-C" for the application of MPT on this issue.

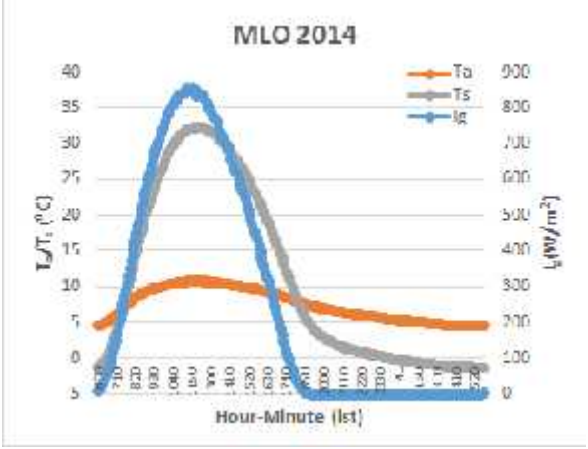

Figure3. The pattern of global solar radiation, atmospheric temperature, and surface temperature throughout the day and night, observation data Mauna Loa Observatory in 2014.

4. CONCLUSIONS

The basic design of Inverse Calculation Method (MPT) is on the assumption of periodicity, continuity and smooth changes in functions that declare the variable treatment, variable responses, as well as the dynamic characteristics of a system parameter. Special Serial RC circuit Model (RSRC Model), and other relevant models, information relating to the condition of the system response extreme utilized to predict more specific test sample patterns function parameters you want examined.

As far as the use of "function-C" test samples corresponding simulation calculation using the MPT at RSRC Model, the values of the parameters R and C can be obtained (returned back) as stated on test data related parameters, however, a bit of a correction to the deviation of R is needed for the extreme conditions of Q.

In reality and its application to the broader system, because R and C (equivalent) test data in general do not possess, sample test "function-C" needs to be developed further and more complete especially by exploiting the relationship between R and C parameters with other analogous physical equivalent parameters.

ISBN 978-602-19877-3-5

5. ACKNOWLEDGEMENTS

This study and paper can be realized on the support of Prime Competitive Research granted by Sriwijaya University of Fiscal Year 2015, by the Decree of the Rector of the Sriwijaya University,No. 0066/UN9/KP/2015.

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ISBN 978-602-19877-3-5

MAGNETIC PROPERTIES AND HEAVY METAL CONTENT OF LEACHATE SLUDGE IN WASTE LANDFILL, AIR DINGIN PADANG, INDONESIA

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ABSTRACT

Magnetic parameters can be used as a proxy for environmental pollution, including pollution by leachate sludge. This study aims to determine the value of magnetic susceptibility, type of magnetic minerals and heavy metals content of the leachate sludge in waste landfill Air Dingin Padang as indicators of environmental pollution. Leachate sludge samples taken from some of the leachate pond, and conducted a series of measurement using magnetic susceptibility, IRM and XRF methods. The results showed that the sludge leachate samples have significant susceptibility values ranged from 122.7 to 901.8 (10^{-8} m^3/kg), with an average value of 429.1 (10^{-8} m^3/kg). The susceptibility values indicate the presence of heavy metals in the sludge leachate. The dominant magnetic minerals of sample is magnetite. XRF results obtained from the content of heavy metals in sludge samples of leachate is Ti, V, Cr, Mn, Fe, Co, Zn, Zr, Nd, Yb, Rh and Eu. Heavy metal is the dominant iron (Fe) with a composition range of 14% - 56% and averaged 39.2%.

Index Terms— magnetic susceptibility, magnetic mineral, heavy metals, sludge leachate

1. INTRODUCTION

Padang waste landfill located in Air Dingin village which is about 18 km from center of Padang with about 33 Ha in area. Landfill waste management in the Air Dingin is still using open dumping system; is a system to let garbage pile up in a place that is open, and potentially pollute the environment. Soil and groundwater around the landfill is very easily contaminated by leachate is the liquid waste that contains a lot of toxic or hazardous materials, including heavy metals. It is very dangerous to the health of people around the landfill that uses soil and groundwater for agricultural land and sources of drinking water.T

Landfill site located on hilly ground with an altitude ranging from 38-99 m above sea level. There are the river near 8 leachate pond located in the northwest of the buildup of waste in the landfill site. Leachate liquid on the last leachate pond, flowed directly into the river which is in landfill sites. The river continues to flow towards the settlements outside the landfill. In landfill sites there is also a ditch / sewer, which is on the cliff looks pile of garbage mixed with the soil that had been overgrown with shrubs. Water and sludge in the trenches appear blackish color because it has been contaminated leachate liquid.

Soil and water contaminated leachate can contaminate agricultural crops residents near landfill sites. Contaminants originating from a pile of garbage in the form of heavy metals will be absorbed by plant roots. Accumulation of heavy metals in agricultural land can result not only in environmental contamination but worse is causing increased levels of heavy metals in agricultural products harvested, and will enter the food chain cycle. [13]

Heavy metals contens in wells water in the landfill Air Dingin Padang been investigated previously by chemical analysis. Samples of water taken from the soil 6 shallow wells in the landfill and 1 control wells. The results showed 6 wells are located at a distance less than 330 meters are not suitable for consumption because they do not meet quality standards [9]. But not yet known heavy metal content in the leachate sludge related pollution that may occur in rivers, ditches and groundwater aquifers.

This study used rock magnetic methods, is a method based on mineralogy and granulometry of rock, soil and sediment / sludge [2]. Initially this method only examines past Earth's magnetic field (paleomagnetic), but is now used widely in the environment, especially in the enviromental magnetic. The underlying principle the environmental magnetic is the presence and abundance of magnetic minerals will reflect environmental conditions [5]. Changes in quantity, mineralogy and granulometry of magnetic minerals related to changes in the environment, so that the magnetic mineral analysis as a tool in assessing potential environmental problems.

An example is the coastal environment containing sand deposits of iron, has an abundance of magnetic minerals and the magnetic mineral content is significant enough to be used as an industrial material [12]. In terms of pollution, rock magnetism method can identify pollution by motor vehicle emissions [10], the pollutant fly ash by indusri fossil fuel such as cement industry [11], as well as a variety of industrial wastes, especially industrial metals.

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Several studies of rocks magnetic, especially the pollution of environment magnetic showed a very strong relationship between the magnetic suseptibiltas with heavy metal content [4]. The properties of magnetic and heavy metals content in leachate get that there is a high correlation between the magnetic properties with the content of heavy metals in landfill leachate samples Jelekong, Bandung [7]. Some samples showed a strong relationship between the magnetic susceptibility values, the intensity of IRM and ARM with the heavy metal content of Fe, Ni and Co. Environmental magnetic proxies provide a rapid means of assessing the degree of industrial heavy metal pollution in soils and sediments [15].

There are 3 types of iron bond with other elements in the natural which form of iron-titanium (FeTi) oxides minerals, iron oxyhydroxida , iron sulphide and carbonates iron. Three incoming iron-titanium oxides minerals is magnetite (Fe_3O_4), hematite (α-Fe_2O_3) and maghemite (γ-Fe_2O_3) are the main minerals include environmental magnetic minerals. The relationship type third of iron-titanium oxides can be expressed by a component three system which is composed of FeTi oxide called a Ternary diagram shown in Figure 1. Positions from left to right indicate increasing ratios of ferric (Fe^{3+}) to ferrous (Fe^{2+}) iron while positions from bottom to top indicated increasing Ti content (Ti^{4+}: total Fe). Using (1/2) Fe_2O_3 as the parameter for the Fe^{3+} corner normalizes the diagram to one cation, producing the convenient effect that lines of oxidation (increasing the Fe^{3+}:Fe^{2+} ratio) are parallel to the base of the diagram [3]. Magnetic minerals at the peak of a ternary diagram is rutile (TiO2), on the left edge of mineral wustite (FeO) and the right edge is hematite / maghemite (Fe2O3). The three types of mineral interconnected through titanomagnetite and titanohematite of series.

Ferromagnetic is a magnetic material that has the most powerful magnetism, generally belonging to the family of Iron-titanium oxides, iron sulfide and iron hydroxide. Mineral magnetite, hematite and maghemite is an example of an iron titanium oxide family. The family consists of the iron sulfide is Greigite (Fe3S4) and phyrhotite (Fe7S8), and which belongs to the family of iron hydroxide is geothite (α-FeOOH). Iron titanium oxide family are the most dominant magnetic mineral in nature.

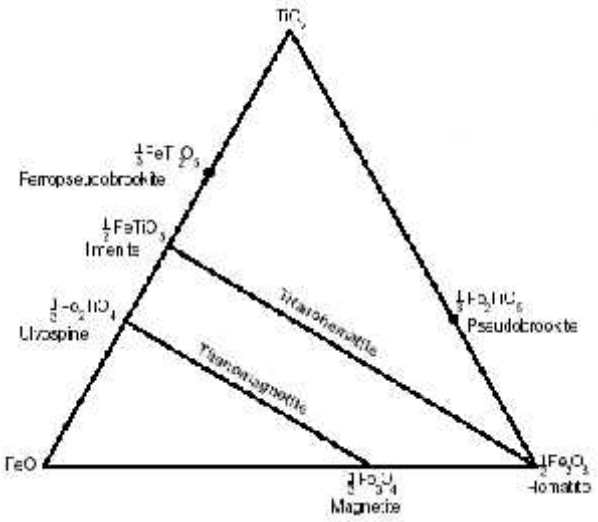

Figure 1. Ternary diagram of TiO_2-FeO-Fe_2O_3. Compositions of important FeTi-oxide minerals are labeled along with mineral names; titanomagnetite and titanohematite solid solution seies are indicated [3]

Isotermal Remanent Magnetization (IRM) is remanent magnetism resulting from short-term exposure to strong magnetizing fields at a constant temperature. In the laboratory, IRM is imparted by exposure (usually at room temperature) to a magnetizing field generated by an electromagnet. IRM is the form of remanence produced in hysteresis experiments and is acquired by ferromagnetic grains with coercive force less than the applied field [3].

An X-ray fluorescence (XRF) spectrometer is an x-ray instrument used for routine, relatively non-destructive chemical analyses of rocks, minerals, sediments and fluids. The relative ease and low cost of sample preparation, and the stability and ease of use of x-ray spectrometers make this one of the most widely used methods for analysis of major and trace elements in rocks, minerals, and sediment. This method is widely used to determine the elemental composition of a material, including heavy metal elements. The working principle of XRF method is based on the collision of atoms on the material surface of the sample by X-rays from the X-ray source [8]. XRF analysis is done based on the identification and enumeration of X-rays characteristic caused by the photoelectric effect.

2. METHODS

Some leachate sludge samples taken at eight leachate pond. Leachate pond depth of around 8m. The last two pond (7 and 8) construction land directly, without cemented, and is often used as a bath buffalo cattle locals. Garbage piles higher position about 10-15 m from the position of the leachate pond. The position of a pile of garbage lie parallel to the 8th position leachate pond. (Figure 2).

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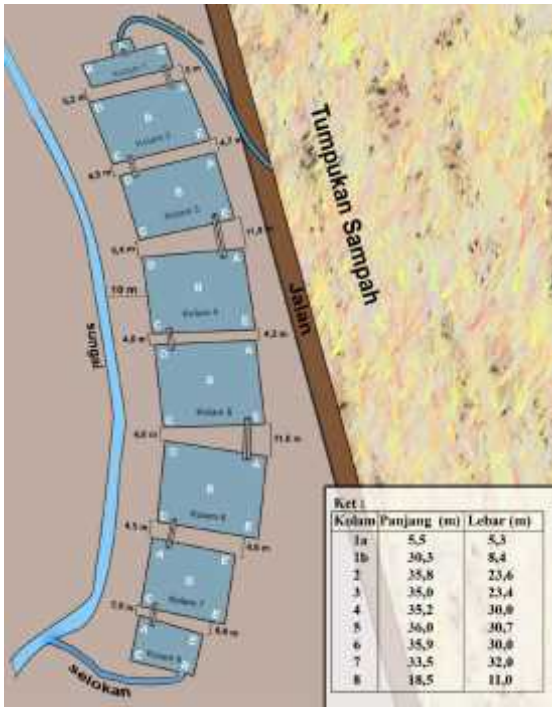
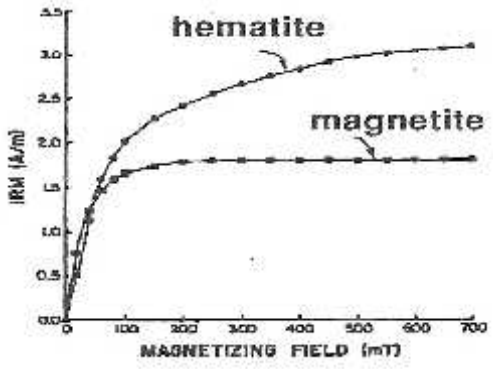


Figure 2. Sketch of leachate pond where sampling

Sampling conduct at each pond taken 5 samples points (4 samples at the corner of the pond and 1 sample in the middle of the pond). Samples are dried, packaged and carried out a series of measurements. In the early stages of magnetic susceptibility measurements were taken using the instrument Bartington MS2 Magnetic Susceptibilitymeter models associated with MS2B sensor. The MS2 system has the ability to measure the magnetic susceptibility of materials with high resolution and accuracy as well as having excellent temperature stability. Magnetic susceptibility measurements of the samples carried out by inserting the sample into the sensor with the sample position in the sensor according to the desired direction. Results of measurement of magnetic susceptibility is the magnetic susceptibility of mass unity. Some of the samples that have significant magnetic susceptibility values, then performed IRM and XRF measurements.

Measurement of IRM is done using a instrument of Electromagnetic Weiss and Minispin Magnetometer. Data analysis was done by plotting a magnetic field values is given a sample to the intensity of the magnetic field for each stage of giving, until saturation occurs. Results of any sample IRM saturation graph will show the kind of magnetic minerals in the sample. Mineral magnetite will reach saturation in fields relatively low at <300 mT, while the mineral hematite reaches saturation at higher fields > 300 mT, even up to 800 mT [3] as in Figure 3.



Figur 3. IRM saturation curve of the magnetite and hematite minerals [3].

Then measured XRF (X-Ray Fluorescence) for determining the heavy metal elements in the sample. The XRF method depends on fundamental principles that are common to several other instrumental methods involving interactions between electron beams and x-rays with samples. The analysis of major and trace elements in geological materials by x-ray fluorescence is made possible by the behavior of atoms when they interact with radiation. When materials are excited with high-energy, short wavelength radiation (e.g., X-rays), they can become ionized. If the energy of the radiation is sufficient to dislodge a tightly-held inner electron, the atom becomes unstable and an outer electron replaces the missing inner electron. When this happens, energy is released due to the decreased binding energy of the inner electron orbital compared with an outer one. The emitted radiation is of lower energy than the primary incident X-rays and is termed fluorescent radiation. Because the energy of the emitted photon is characteristic of a transition between specific electron orbitals in a particular element, the resulting fluorescent X-rays can be used to detect the abundances of elements that are present in the sample.

3. RESULTS AND DISCUSSIONS

After measuring the magnetic susceptibility of the entire sample of 8 leachate ponds, obtained magnetic susceptibility values in the leachate pond 7 and 8 are too high compared to the 6 previous pond. It is indicated for leachate sludge magnetic minerals was mixed with ground magnetic minerals due to the influence of the activity of livestock (buffalo) in the pond, so data in the pool 7 and 8 were not taken for the characterization of magnetic minerals leachate sludge

The results of magnetic susceptibility measurements showed that the leachate sludge samples have significant magnetic susceptibility values ranged from 122.7 to 901.8 (10^{-8} m^3/kg), with an average value of 429.1 (10^{-8} m^3/kg). The magnetic susceptibility values indicate the presence of heavy metals in the leachate sludge.

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Based on the average value of the magnetic susceptibility at 6 ponds leachate samples obtained values vary at each pool (Figure 4). There is no tendency to form a pattern of a certain value or no decrease in magnetic susceptibility values from the first pond to the next pond. This occurs presumably because there is a magnetic mineral seepage of pollutants from the pile of garbage to the leachate pond, because the location of both the parallel and leachate pond position lower than the position of a pile of garbage.

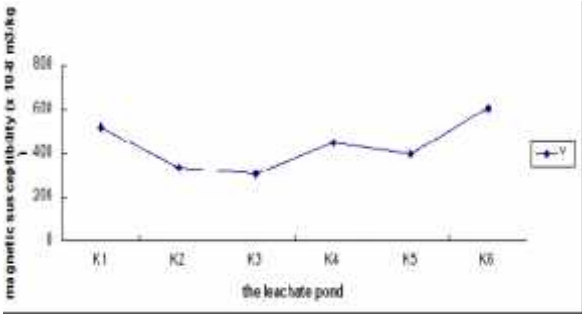

Figure 4. The average value of magnetic susceptibility in any leachate pond

Leachate of landfill leachate sludge samples from two municipal solid waste disposal sites near Bandung, West Java, Indonesia was found to be sufficiently magnetic with mass-specific magnetic susceptibility that varies from 64.8 to 349.0 × 10^{-8} m^3 kg^{-1} [1].

IRM saturation curve pattern shows the predominant type of magnetic minerals in the sample. Saturation that occurs at low field (<300 mT) shows the dominance of the magnetite mineral, while saturation is achieved in the field of higher or hard saturation occurs, indicating the dominance of the hematite mineral

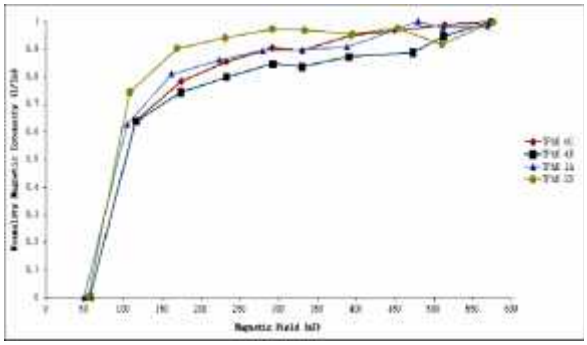

Figure 3. IRM saturation curve of the leachate sludge samples

Most leachate sludge samples saturated at low field (about 250-300 mT), which indicates the presence of the mineral magnetite, except samples 4E, saturation occurs in a magnetic field > 300 mT which indicates the presence of the mineral hematite. The magnetite mineral often is found as a pollutant. Such as a magnetic mineral pollutants found in agricultural soil compost derived from landfill in Mornag, Tunisia, indicating ferrimagnetic mineral that plays a role in the contamination of soil, which is a type of magnetite and maghemite [14]. Megnetite minerals are also found as anthropogenic in landfill Jelekong Bandung [7].

IRM saturation intensity on the leachate sludge samples tend to decrease from the first leachate pond to the next leachate sludge. There is a reduction in the intensity of pollutants on the leachate pond from the estuary to upstream, While the intensity of the sample 7C and 8E very high, due to the construction of the leachate pond is ground so that the leachate sludge magnetic minerals mixed with the soil magnetic mireals.

Results of XRF measurements on samples of leachate sludge, indicating the presence of some heavy metals in concentrations varying, namely Titan (Ti), Vanadium (V), chromium (Cr), manganese (Mn), iron (Fe), cobalt (Co), zinc (Zn), zircon (Zr), Neodinium (Nd), ytterbium (Yb), Rhodium (Rh), and Eopium (Eu). Heavy metals content are dominant, is elemental iron (Fe) with a composition range of 14% - 56% and an average of 39.2% and an element of Rhodium (Rh) with a composition of 22% - 39% and averaged 33.9%. (see Table 1.)

Table 1. Result of XRF measuremant sample 1A

No	Jenis Unsur	Konsentrasi	Unit
1	Ti	1.097	%
2	V	0.093	%
3	Cr	0.028	%
4	Mn	0.471	%
5	**Fe**	**44.385**	%
6	Co	0.211	%
7	**Rh**	**32.413**	%
8	Eu	0.031	%
9	Yb	0.076	%

Most heavy metal is Fe and Rh has the same pattern of the sequence pond, where the percentage content of Fe and Rh is reduced from the first pond to the next pond (Figure 4). The percentage of medium heavy metals such as Mn, Co and Ti form a separate pattern is also different from the first group, the smaller content of the first pond and has the highest content in the second pool (Figure 5). No apparent relationship between the magnetic susceptibility values to the heavy metal content. But the biggest heavy metal content namely Fe and Rh has a positive relationship with the intensity of IRM saturation.

This is presumably because of differences in the dynamics of magnetic minerals in each sample in the leachate pond, which is caused by the activity that occurs in the leachate pond where animals such as

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cattle and there are indication of seepage of leachate liquid from the pile of garbage to the leachate pond in 'parallel'

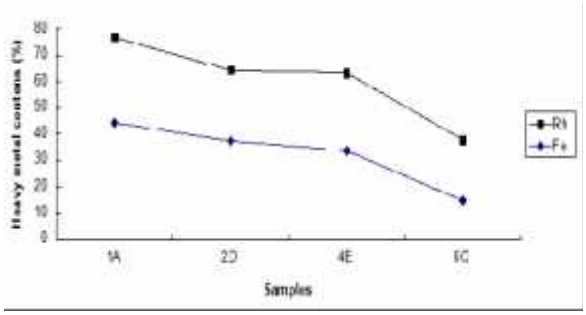

Figure 4. The content of Fe and Rh in each sample at leachate pond

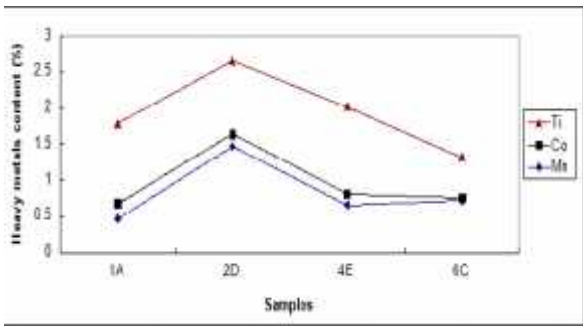

Figure 5. The content of Mn, Co and Ti in each sample at leachate pond

Heavy metals contains found in landfill Air Dingin, Padang is not much different from that heavy metals are found in landfill Supit Urang, Malang. Leachate from Supit Urang landfill contains some heavy metals with different concentrations, such as Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb) and Zinc (Zn) [6]. Than, the tipical heavy metal elements in leachate sludge from waste landfill Jelekong Bandung are Fe, Cu, Mn, As, Cd, Co, Cr, Hg, Ni, Pb and Zn [1]. Pollution Load Index of industrial heavy metals (Fe, V, Cr, Mo, Zn, Pb, Cd, Cu) and the logarithm of saturation isothermal remanent magnetization, a proxy for magnetic concentration, are significantly correlated [15].

Heavy metals is estimated to go into the leachate sludge through a metal garbage and chemical waste, such as remnants of junk vehicles, iron and steel scrap, electric tools and batteries that are not divided properly.

4. CONCLUSION

The leachate sludge samples have significant magnetic susceptibility values ranged from 122.7 to 901.8 (10^{-8} m^3/kg), with an average value of 429.1 (10^{-8} m^3/kg) to indicate the presence of heavy metals in leachate sludge. The dominant type of magnetic mineral is magnetite, and the hematite mineral is found in small quantities. The both magnetic minerals are found as pollutants. The dominant of heavy metal content is iron (Fe) with a composition range of 14% - 56% and averaged 39.2%. The other heavy metal content: Ti, V, Cr, Mn, Co, Zn, Zr, Nd, Yb, Rh and Eu

5. ACKNOWLEDGEMENTS

This is part of a series of Hibah Bersaing (Competitive Grand) research. Acknowledgements to the DIKTI (Higher Education) that has funded this research through the 'Hibah Bersaing' Research Funding, Fiscal Year 2014.

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MONITORING TECHNOLOGY DEVELOPMENT GEOELECTRIC TIME-LAPSE TO MONITOR THE PRONE TO LANDSLIDE IN PADANG USING METHODS GEOELECTRIC TIME-LAPSE RESISTIVITY INVERSION IN WENNER AND SCHLUMBERGER CONFIGURATION

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ABSTRACT

Recently, the landslide disasters often hit the city of Padang. In order to overcome the landslide problem, it is necessary to do a comprehensive research and to observe the physical appeareance and the structure of the subsurface rocks in areas prone to slide. This research aim to identify the presence of sliding plane in areas prone to landslides. Data obtained by using the Wenner and Schlumberger configuration are processed with the help of RES2DINV software. Based on the resistivity values obtained on Track 1 is identified, there are 4 types of rock constituent that is Clay, Sandstone, Limestone, and Andesite. Interpretation of the results showed in Track 1 are sliding plane. Geoelectric Time-Lapse Resistivity Inversion Method done for two sets of data, geoelectric measurements at an early stage and second stage. The magnitude of change in resistivity to both sets of data on average almost the same at all points of measurement which is around 53.6 % in Wenner Configuration and 56.6 % in Schlumberger Configuration , except on certain points, which indicates a greater percentage.

Index Terms— *Landslide disasters, physical properties and structure of the subsurface rocks, , sliding plane, Time-Lapse Resistivity Inversion.*

1. INTRODUCTION

Lately landslide disasters often hit the city of Padang. In order for this landslide problem can be handled thoroughly by the relevant authorities it is necessary to comprehensively research and see the picture of the physical properties and subsurface rock structures in areas prone to landslides. Until now, how the image of the physical properties and subsurface rock structures in the city of Padang has not been disclosed.

West Sumatra Provincial Government has identified vulnerabilities landslide hazards both physical and non-physical. Physical vulnerability is yet no sign of danger on the location of avalanche danger, there is no landslides risk maps and early warning tools have not been installed. While the non-physical vulnerability of landslides danger is that people are not educated to avoid the danger of landslides, the settlement of making new limited land, land tenure system involving the local culture and the lack of ability of the community to prevent, tame, achieving preparedness and responding to the impact of a landslides danger. The threat of landslide danger in West Sumatra in general and in particular city of Padang the amount of the settlement comes at a community situated at the foot of the hillside along strategic highways built on hillsides are quite steep. In the rainy season, many of these areas experienced a landslide. If this is allowed to continue it will disrupt the community in carrying out daily activities.

West Sumatra provincial government has drawn up a disaster plan period 2008-2012 through Perda No. 115 in 2008[1]. With the diversity of potential disaster in West Sumatra province, it takes priority in risk reduction. Priorities are grouped in three levels where each level is determined by factors the possibility of disaster, community vulnerability, and the capacity of available resources. The third level is First Level Risk, is most urgent to be addressed, namely the Second Level Risk should be handled promptly and Third Level Risk is that it can be handled in stages. First Level Risk is if the potential number of casualties and loss / damage incurred huge with very high potential disaster. Landslide included in the category Second Level Risk which must be addressed. Some efforts have been made by the government in anticipation of landslides are making signs prone to landslides and puts heavy equipment at the points that frequent landslides. Despite this effort is considered by many not resolve the problem because the landslide occurred in the area repeatedly. Therefore, it is required that a comprehensive research involving expertise and tools as well as adequate software. One of these areas in the city of Padang is often affected by landslides is the area around Gunung Padang. Gunung Padang is a series of Bukit Gado-Gado, Bukit Air Manis and Bukit Putuih. Gunung Padang is located in the Village Mato Aie, Southern District of Padang, the morphology of the area comprising rolling hills with moderate height, and has an average slope of 30°- 65° (Brotodiharjo et al, 2001). Landslide land at Gunung Padang many cause harm to society, such as the destruction of buildings, damage to physical infrastructure, and the victim died, as happened on 31 July 2001 and in 2009. Given the

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fragility of the area of Gunung Padang against landslides land, it is necessary to research time-lapse geoelectric method to monitor the development of areas prone to landslides at any time.

One of the triggers of landslides is high rainfall. In theory, a rock resistivity value depends on the water content. Is the time-lapse geoelectric method can determine changes in rock resistivity value after and before the rain up to now has not been revealed. In Indonesia, this research is the first to develop the technology of geoelectric time-lapse monitoring to monitor areas prone to landslides, especially due to the season. If the research is successful it will get a "frontier technology" in the geoelectric field to monitor the development of areas prone to landslides at any time.

Landslide is the movement of the slope in the form of rock-forming material, material destruction, soil, or the mixture of materials, moving down the slopes or out. In general, the incidence of landslides caused by two factors: driving factors and triggering factors. The driving factors are the factors that affect the condition of the material itself, while the trigger factor is the factor that causes movement of the material. Landslides occurred on the Earth's surface in the form of a slope or in his physical form shaped region incline. The team of the National Disaster Management Bakornas (2007) introduced the definition of landslides, slope stability disorder, process triggers landslide, landslides hazard assessment, early warning symptoms and landslides, the parameters of physics landslides, mitigation and landslides following characteristics[2]. Landslides are one type of mass movement of soil or rock, or a mixture of both, down or off the slopes as a result of disruption of the stability of soil or rocks making up the slope. There are 6 types of landslides, namely: translational landslides, rotation landslides, moving blocks, rubble stone, soil creep, and the flow of material destruction. Type landslides translational and rotational most common in Indonesia. While most landslides claimed the lives of human beings is the flow of material destruction.

Some previous researchers have used the geoelectric method to map landslide-prone areas. Jaya (2005) have determined the sliding plane in areas prone to landslides through the measurement of the electrical characteristics of the Earth with a case study area in Prigen, Pasuruan, East Java Province. The result is that each layer is dominated by silty and sandy type of soil that has a resistivity of 15-150 Ohmmeter, these results are consistent with the drill data. Angle sliding plane is found is 37.65 ° and 22.7 °[3]. Suhendra (2005) define the geometry of the sliding plane in lane highway between Wanareja -Majenang at Km. 90.4 Cikukun village Wanareja District of Banyumas, Central Java Province using the method of geoelectric resistivity Wenner-Schlumberger configuration. Based on the resistivity values obtained in the village Cikukun is 7.2 Ωm - 9.5 Ωm of 2D geoelectric cross section appears there are three sliding plane and in the village of Cirongge obtained value Ωm resistivity of 2.6 - 3.5 Ωm and of cross-section 2 -D geoelectric appears there are two sliding plane which affects the movement of the soil with a depth that varies between 2 to 9 m[4]. Yilmaz (2007) investigated the land landslide Gurbulak, Trabzon, northeast Turkey using 2D cross section of the shadow of the electrical resistivity. The investigation is directed to determine the thickness of the material that moves, sliding plane and evaluation of groundwater associated with the occurrence of landslides land. Results resistivity and geological information from the landslide area found the body of the landslide area has different degrees and higher degrees of saturation and sliding plane is located at a depth of 10 m[5]. Sule, et al, (2007) using resistivity and GPS to monitor landslide of land in the area Panawangan, Ciamis, Indonesia. Results of the research found that the value of resistivity Halang dominated by clay and formations dominated by breccia may explain differences in outcomes in which the resistivity inversion of the data fields on each interface acts as a sliding plane formations. Resisitivitas lower value indicates the possibility of surface water incharge. While some low resistivity values found in the study area can serve as a trigger for landslides land. GPS survey results indicate the presence of ground movement research area with a maximum horizontal shift of 175 mm and a maximum of 6 mm vertical shift. This indicates that the combination of the two potential methods to monitor landslides land[6]. Colangelo, et al, (2008) applied the 2D electrical resistivity tomography to investigate active landslide area in Basilicata region, south-east Italy[7]. Mondal et al, (2008) using 2D electrical resistivity tomography to characterize high-resolution active landslide area in Garhwal Hialaya, India. Tomogram resistivitity identify what the existence of sliding plane zone at a depth of 10-20 m from the ground[8]. Furthermore, Lapenna, et al, (2012) developed an algorithm for monitoring the data inverse tomography landslides in southern Italy. The result is a robust geoelectric method is effectively applied to contribute to the phase of the disaster management cycle[9]. Sule, et.al., (2007) have used a combination of methods resistivity and GPS to investigate the landslide in Area Panawangan-Ciamis, Indonesia. The results show significant movement of soil in the area investigated by the shift of the maximum horizontal and vertical movement of 175 mm up to 6 mm[6]. Travelletti, et al, (2011) using electrical resistivity tomography method of time-lapse to monitor seepage and subsurface water flow in a landslide with sandstone mixed with clay. Results of the study indicate a significant reduction in resistivity up to 18% compared with the initial state in the scheme rain. This reserach demonstrated that the method of electrical resistivity tomography potentially time-lapse monitoring of water seepage on the incline of sand mixed with clay[10].

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Based on the description above can be concluded that although the geoelectric method has been widely used to investigate the characteristics of landslide-prone areas, but the technology development geoelectric time-lapse monitoring to monitor the development of areas prone to landslides is still very little. In Indonesia, time-lapse geoelectric method is applied for the first monitor developments in areas prone to landslides specified intervals.

2. METHODS

2.1 Research Areas

The research area is located in the city of Padang is in Bukit Lantiak which includes the village Seberang Palinggam, District Padang Selatan.

2.2. Tools and Materials Research

The tools used in the geoelectric survey and geology can be seen in Table 1.

Table 1. Equipment used in the geoelectric survey and geological

No	Tool Name	Specification	Uses	Amount
1	Automatic Resistivity System GF Instruments	Model Ares-G4	Measuring the value of the subsurface resistivity rock	1 piece
2	GPS	Garmin V	Measuring position	1 piece
3	Altimeter	Pauline	Measuring height	1 set
4	Car	CC>1800	Transport equipment field	1 piece
5	Digital camera	Optikal zoom	Shooting observation points	1 piece
6	Geology Hammer	-	Tapping rock	1 piece
7	Compass	North-South	Determining the direction of observation	1 piece

2.3. Data Collection and Processing Techniques

The main equipment used to obtain the resistivity value is Automatic Resistivity System GF Instruments (ARES) with Ares-G4 Model specification made in the Czech Republic.

Data collection techniques that will be used is the Wenner configuration to see the changes in the value of vertical resistivity and method Geolistrik Time-Lapse Resistivity Inversion to see change in resistivity for two different time. Observation points are determined based on topographical maps, road maps and geological knowledge of the area. Prior to execution of measurements in the field, prepared tools and materials as follows: a street map, topographic maps, geological maps, Automatic Resistivity System GF Instruments, altimeter, a position measuring instrument (Global Positioning System), photo camera, clock, means of communication and transportation.

Measurement of resistivity value at each station is followed by measurement of height, and position measurement stations as well as proceed with the photographing position of the station. The tools used to measure the position is GPS and for measuring height is altimeter.

2.4 Data Analysis Techniques Geoelectric

Data processing field geoelectric measurement results done by using software RES2DINV. At this stage try to display the 2-D model that illustrates the value of resistivity of rock at a particular depth. To ensure the quality of the modeling results, resistivity value and the actual depth of the first calculation is used to get the value of apparent resistivity and depth of the next calculation. This process is carried out continuously (iteration) to obtain the best results.

3. RESULTS AND DISCUSSION

Geoelectric measurement data by using Automatic Resistivity System Configuration Wenner GF Instruments can be grouped in a maximum data (Max) and minimum (Min), which consist of data current I (in mA), the data potential difference V (in mV) and data resistivity ρ_a (in ohm.meter), as can be seen in Table 2.

Table 2. Currents, potential difference and resistivity value in Tracks 1 Using Wenner configuration

No.	Tracks	Value	I (mA),	V (mV)	ρ_a (ohm.meter).
1	1	Maks	457.65	365.8	1178.71
		Min	4.88	20.06	31.92

Data obtained by using the Wenner configuration is processed with the help of software RES2DINV form 2D model cross sections that have different colors as can be seen in Figure 1.

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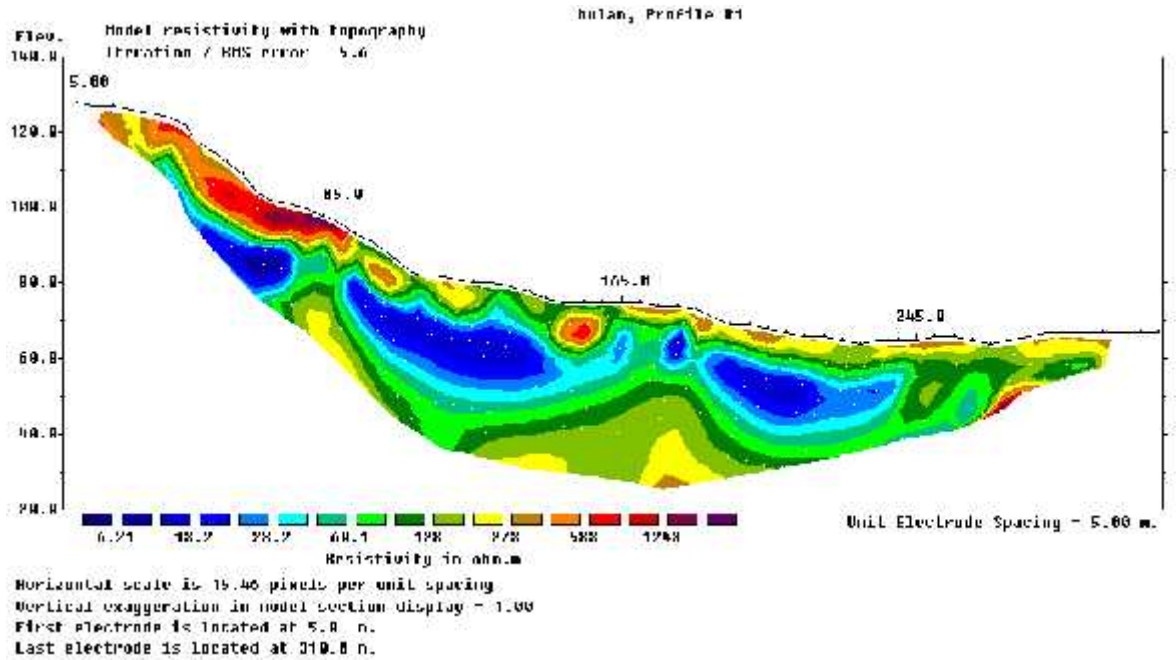

Figure 1. Cross-section 2D with Topography Model in Tracks 1 using Wenner Configuration

Each color indicates a specific range of resistivity values, which can be interpreted as a kind of geological minerals such as can be seen in Table 3.

Table 3. Results of the interpretation of the material on Tracks 1 using Wenner Configuration

COLOR CODE	RESISTIVITY (Ωm)	MATERIAL
	4,55- 94,1	CLAY
	94.1-428	SANDSTONE
	428-913	LIMESTONE
	913-2650	ANDESITE

Geoelectric measurement data by using Automatic Resistivity System Configuration Schlumberger GF Instruments can be grouped in a maximum data (Max) and minimum data (Min), which consist of data current I (in mA), the data potential difference V (in mV) and data resistivity ρ_a (in ohm.meter), as can be seen in Table 4.

Table 4. Currents, potential difference and resistivity value in Tracks 1 Using Schlumberger configuration

No.	Lintasan	Nilai	I (mA),	V (mV)	ρ_a (ohm.meter).
1	1	Maks	829.51	352.65	1179.08
		Min	4,63	7,18	19,32

Data obtained by using the Schlumberger configuration is processed with the help of software RES2DINV form 2D model cross sections that have different colors as can be seen in Figure 2.

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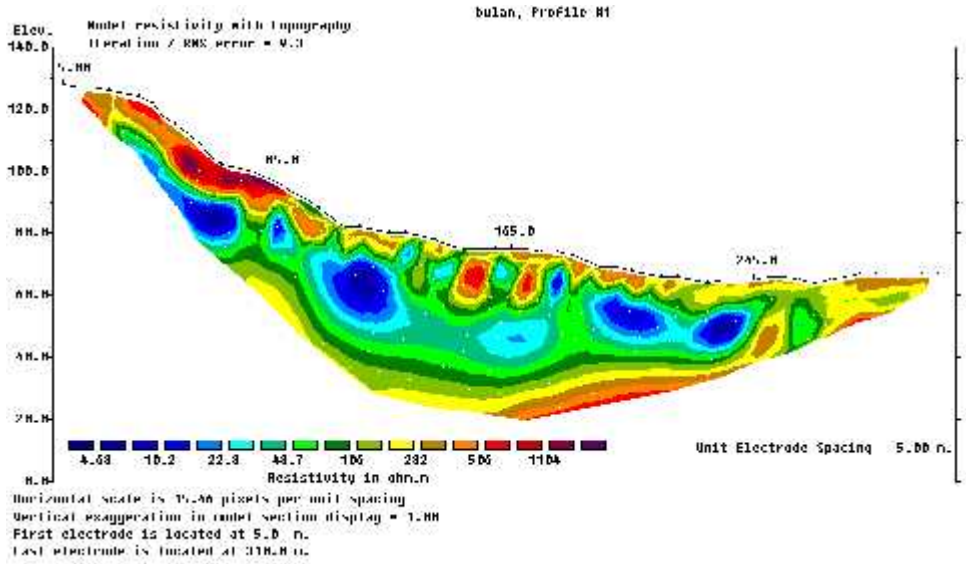

Figure 2. Cross-section 2D with Topography Model in Tracks 1 using Schlumberger Configuration.

Each color indicates a specific range of resistivity values, which can be interpreted as a kind of geological minerals such as can be seen in Table 5.

Table 5.. Results of the interpretation of the material on Tracks 1 using Schlumberger Configuration

COLOR CODE	RESISTIVITY (Ωm)	MATERIAL
	3,406-77,35	CLAY
	77,35-369	SANDSTONE
	369-805	LIMESTONE
	805-2409	ANDESITE

Results of interpretation of data to Ttrack 1 are as follows. Tracks 1 is located at coordinates 0.00^0 58 '3.7" S and 100^0 22' 5.6" E until 0.00^0 58 '3.9" S and 100^0 22' 10.1" E. Sounding point located at coordinates 0.00^0 58 '3.9" S and 100^0 22' 10.1" E. Length of Tracks 1 is 315 m with electrode spacing of 5 m. Based on the resistivity values obtained on Tracks 1 identified there are 4 types of rock constituent that is Clay, Sandstone, Limestone and Andesite The interpretation of the results show there is a field sliding Track 1 which extends from the position x = 15 m to x = 85 m each with a height of 118 meters above sea level to 86 meters above sea level, with a thickness of 32 m.

Processing by using software RES2DINV with Geolistrik Method Time-Lapse Resistivity Inversion done for two sets of data, geoelectric measurements in the early stages (February 21, 2015) and the second stage (June 15, 2015). The results inversion in Wenner Configuration can be seen in Figure 3. This shows the change in resistivity values measured at different times. This difference is due to the absorption of rainwater by surface and then migrate into the inner layer.,

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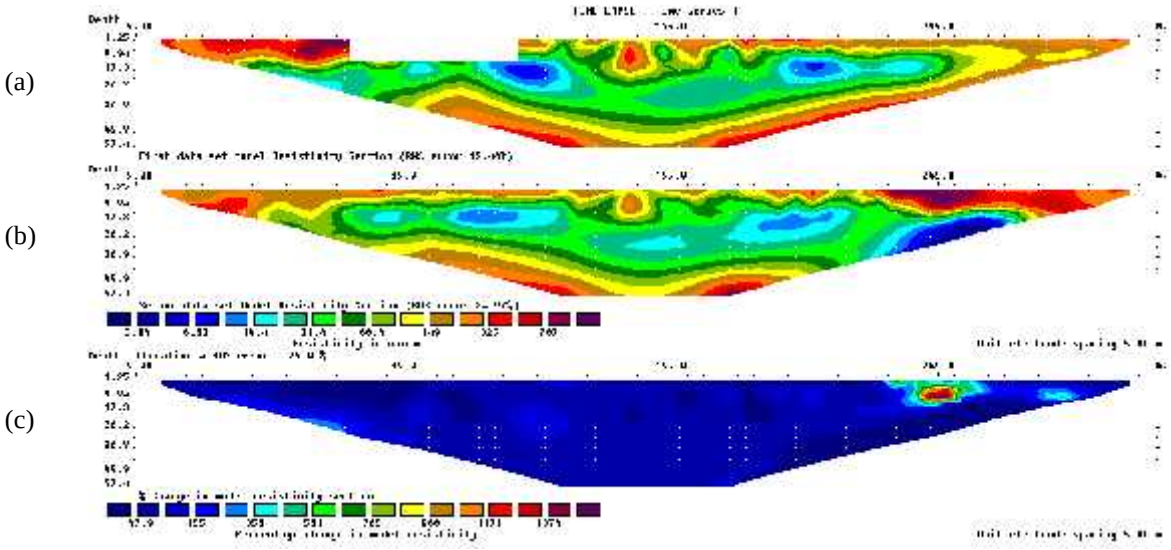

Figure 3. Changes in the percentage of resistivity between the two sets of measurement data in Wenner Configuration (a) First data set Model Resistivity Section. (b) Second data set Model Resistivity Section. (c) Change in Percentage Model Resistivity Section.

The results inversion in Schlumberger Configuration can be seen in Figure 4.
Results of the interpretation of the percentage of resistivity between the two sets of measurement data in Wenner Configuration can be seen in Table 6.

Table 6. Results of the interpretation of the percentage of resistivity between the two sets of measurement data in Wenner Configuration

COLOR CODE	CHANGES IN THE PERCENTAGE OF RESISTIVITY
	11,2-53,6
	53,6-257
	257-663
	663-1070
	1070-1612

The magnitude of change in resistivity to both sets of data on average almost the same at all points of measurement which is around 53.6 %, except on certain points, which indicates a greater percentage. This shows the change in resistivity. values.measured at different times. This difference is due to the absorption of rainwater by surface and then migrate into the inner layer.

Results of the interpretation of the percentage of resistivity between the two sets of measurement data in Schlumberger Configuration can be seen in Table 7.

Table 7. Results of the interpretation of the percentage of resistivity between the two sets of measurement data in Schlumberger Configuration

COLOR CODE	CHANGES IN THE PERCENTAGE OF RESISTIVITY
	12,37-56,6
	56,6-259
	259-664,5
	664,5-1070
	1070-1610

The magnitude of change in resistivity to both sets of data on average almost the same at all points of measurement which is around 56.6 %, except on

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certain points, which indicates a greater percentage. This shows the change in resistivity. values.measured at different times. This difference is due to the absorption of rainwater by surface and then migrate into the inner layer.

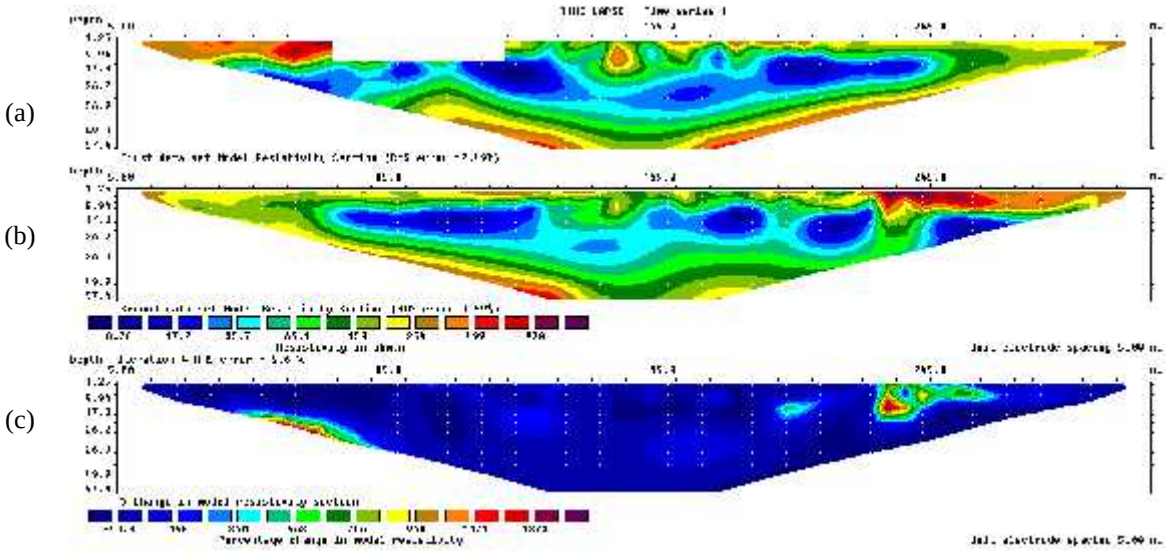

Figure 4. Changes in the percentage of resistivity between the two sets of measurement data in Schlumberger Configuration . (a) First data set Model Resistivity Section. (b) Second data set Model Resistivity Section. (c) Change in Percentage Model Resistivity Section.

4 . CONCLUSION

Based on the resistivity values obtained on Tracks 1 identified there are 4 types of rock constituent that is Clay, Sandstone, Limestone and Andesite. The interpretation of the results indicate there is a sliding plane in Tracks 1.

The magnitude of change in resistivity to both sets of data on average almost the same at all points of measurement which is around 53.6 % in Wenner Configuration and 56.6 % in Schlumberger Configuration , except on certain points, which indicates a greater percentage. This shows the change in resistivity values.measured at different times. This difference is due to the absorption of rainwater by surface and then migrate into the inner layer.

Based on the research can be concluded that the geoelectric method can be used to investigate the characteristics of landslide-prone areas.

5. ACKNOWLEDGEMENTS

I am very grateful to The Funders Leading Research Universities "Development Of Monitoring Technology Geolistrik Time-Lapse To Monitor Landslide Prone Areas In Padang" This is DIPA (Budget Implementation List) Directorate General Of Higher Education, Ministry Of Education And Culture, which has provided funding for The needs of this research. Then I extend thanks also to the Head of the Geophysical Laboratory Faculty UNP and the Mayor Tool Automatic Resistivity System GF Instruments that have allowed me to use the ARES equipment and provide technical guidance Geoelectric. data processing means.

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ISBN 978-602-19877-3-5

DESIGN OF EXPERIMENTAL SET TO DETERMINE THE COEFFICIENT OF KINETIC FRICTION ON COLLISION OF TWO OBJECTS

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ABSTRACT

One of many problems in Physics education at high school is unavailability of experimental equipment for some physical concepts, particularly for collision concept. This final project designed an experimental equipment to explain collision of two objects. The experimental equipment consists of a simple pendulum with a metal sphere clamped by a rigid stand to be released and then the metal sphere hits a block that initially at rest on a railway track. The block moves and finally stops because there is a kinetic friction between block and railway track. This equipment can be used to determine coefficient of kinetic friction for a variety of materials.

Analysis of the first experimental results are coefficient of kinetic friction for steel on steel ($\mu_k = 0{,}55 \pm 0{,}02$), aluminum on steel ($\mu_k = 0{,}48 \pm 0{,}02$) and glass on glass ($\mu_k = 0{,}42 \pm 0{,}03$). The difference between the experimental results and literature data is less than 6%. This indicates that the equipment is accurate enough to determine coefficient of kinetic friction between two objects. Second, the experimental data give a relation that the displacement of the block is linearly comparable with elevation of the sphere and inverted comparable with mass of block and cosine of angle of simple pendulum.

Index Terms— Experimental Physics, Collision of Two Objects, The Coefficient of Kinetic Friction **1.**

1. INTRODUCTION

Physics is a science that requires a proof. Science concerned with how to seek about nature in a systematic way for science is not only a mastery of knowledge in the form of a collection of facts, concepts, or principles, but also a process of invention (Depdiknas, 2003). Therefore, an appropriate learning method for Physics is an experimental method. The experimental method is a method of teaching which invites students to conduct experiments as legal evidence. Commonly, the experimental method is not to find a theory, but rather to test theories that have been found by experts. However, in reality, teachers also can conduct experiments to find theories (Paul Suparno, 2013). In order to do the experimental method, teachers need several equipments that can support experiments in accordance with the concept of Physics.

Lab equipment is an equipment used for Lab Science, Mathematics, Engineering, Social Sciences, Humanities and other Sciences (Permendiknas No.35 tahun 2010). There are some available lab equipments at school for certain topics but not for other topics. Therefore, teachers must be creative in designing simple experimental equipments for bolstering up the experimental activities at school.

Among all unavailable lab equipments at school, momentum equipment has emerged as one of them. In explaining the concepts of momentum, teachers only ask the students to imagine the process of collision of two objects, such as the collision of a billiard ball, a bullet fired into the wooden blocks and a cannon that is fired. Afterwards, the students only read and memorize what is being written in the book fully with a boring formulas. As a result, the concepts of momentum become unattractive to the students. Due to this phenomenon, the authors is interested to design experimental equipments which can explainned the concepts of collision of two objects. By using this equipment, the coefficient of kinetic friction of various materials can be determined.

This research has an aim at designing experimental equipment that can be used to: 1) Determine the coefficient of kinetic friction between two objects. 2) Explain the correlation between the gravitational potential energy (variable angle of deviation of the pendulum and the high ball) with a displacement of the blocks after the collision.

2. METHODS

2.1. Types of research

This research is classified as experimental research. The authors designed a set of experimental equipment that can be used to explain the concepts of collision of two objects. This equipment can also be used to determine the coefficient of kinetic friction between the two fields.

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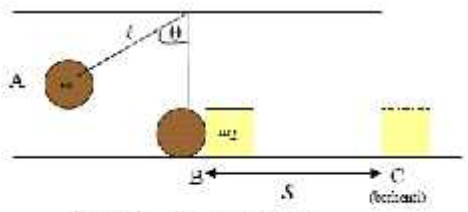
2.2. Research Implementation Phase

2.2.1 The Design of Experimental Device

The Design of equipment that will be made is in the form of a mathematical pendulum using a metal ball attached to a rope at the top end of the stand. The stand is equipped protractor to see the ball and the angle deviation meter scale cm to see the length of rope and the high of a ball from the floor. Strip of the friction with different types of materials, and equipped with a meter scale cm. The rail line is used as a motion of the block after colliding with a metal ball. The collision system of two objects are shown in Figure 1 (Yohanes Surya, 2001):



Gambar 1. Sistem tumbukan

- **The Object Motion from Point A to B (Motion of the ball / object 1)**

At first the objects are static. Because there is a gravitation, the object begins to fall and has a velocity. A work of gravity force will be converted into kinetic energy.

$-(EP_{akhir} - EP_{awal}) = (EK_{akhir} - EK_{awal})$

$$-(m_1 g h_B - m_1 g h_A) = (\frac{1}{2} m_1 v_B^2 - \frac{1}{2} m_1 v_A^2)$$

So that,

$$v_1 = v_B = \sqrt{2g(\ell - \ell \cos\theta)} \quad \text{.....(1)}$$

Or, $v_1 = \sqrt{2gh}$

Explanation:

$v_1 = v_B$, velocity of the ball just before mashing beam (m/s)
g = acceleration of gravity (g=9,8 m/s^2)
h = height of pendulum ball from the floor
m_1 = mass pendulum ball

before colliding static blocks, (v_2=0)

- **The Blocks Motion / Objects 2 from Point B to C**

When the ball hit the block, there is an energy transfers resulting the static block at position B moves as far as S. Because between floor and block appears friction force, the block will be stopped at point C at the end. By noting the shift of the object (S), the velocity of block after collision (v_2') can be decided by using the following concept:

$$(v_2')^2 = 2.g.\mu_k.S \quad \text{.....(2)}$$

Explanation:

v_2' = Velocity of Block after collision
S = The distance traveled of block from point B to point C
μ_k = coefficient of kinetic friction between the block with floor
m_2 = block mass
N = normal force

By using the law of linear momentum conservation on collisions between balls and blocks, the velocity of ball after collision can be determined (v_1').

$$v_1' = v_1 + \frac{m_2}{m_1}(v_2 - v_2')$$

because the static blocks, then v_2=0

$$v_1' = v_1 - \frac{m_2}{m_1}(v_2') \quad \text{.....(3)}$$

Explanation:

v_1' = Velocity of the ball after hitting the blocks.

- **Overview of Friction**

The coefficient of friction between two objects are different, depending on type of the object. Coefficient of kinetic friction between the floor and blocks can be determined through this designed equipment. It is done by analyzing the motion of the block from the point B to point C, as seen in figure 2.

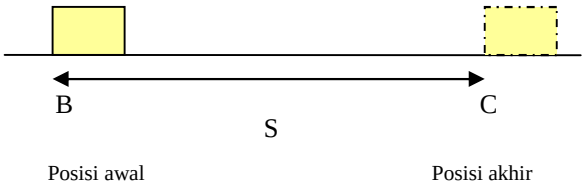


Figure 2. The Block Motion from point B till stop at Point C

After being hitted by swingging ball, the block will be moved from point B until the time it stops at point C, the acceleration of the block is static (a = constant), then:

$$S = \frac{1}{2}(v_t + v_0)t \quad \text{.....(4)}$$

The position of the block stops after moving for a time t sec = (x_t) and the distance traveled of blocks as far as S. After moving for t, the object stops, then the final velocity is zero (v_t = 0).

$$v_0 = \frac{2.S}{t} \qquad (5)$$

$v_0 = v_2'$, = Velocity of block after collision

With the concept of work-energy, $W_{F\,total} = \Delta Ek$. For the motion of block from point B to C, the one which affects the work is kinetic friction, where:

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$$\mu_k = \frac{(v_0)^2}{2.g.S} \text{ ....(6)}$$

By substituting equation (5) into the equation (6), the coefficient of kinetic friction can be written as below:

$$\mu_k = \frac{2.S}{t^2 g} \text{ ....(7)}$$

b. Calibration and Testing Tool

To know the designed experimental set is accurate or not, calibration and testing need to be done. To have an accurate experimental result, the test result was evaluated and improved.

c. Data Retrieval

Once the instrument and experimental design is reliable and function, the data retrieval of the experiment can be performed. It is repeated twelve times. The equipment used during the process of data collection is an equipment for collision of two objects that consist of the main stative, small stative, swinging metal ball, block covered by various types of materials and areas of friction. The time is noted by using a stop watch when the block moves till it stops.

d. Data Analysis

The result of experimental data were analyzed with equations contained in the basic theory by observing the rules of writing mean numbers. Based on the results of the analysis, the conclusion can be drawn.

e. Develop and Create Reports

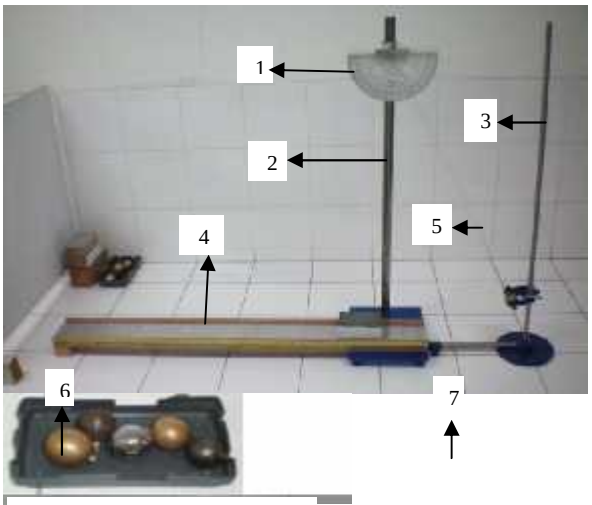
The experimental results and analysis of the data are then compiled in a research reports.

f. Develop Guiding Experiments

To avoid mistakes on the designed experimental set that can be used at secondary level school, then it is designed a complete and clear module.

3. RESULTS AND DISCUSSION

The result of the designed experimental set to determine the coefficient of kinetic friction on collision of two objects can be seen in figure 3.



Keterangan:
1 = Arc Scale
2 = Main Stative
3 = Small Stative
4 = Areas of friction
5 = Pendullum
6 = Swingging Metal Ball
7 = Block covers with various materials

Figure 3. Designed Experimental Set of Collision of Two Objects.

3.1. Determine the Coefficient of Kinetic Friction

Coefficient of kinetic friction are determined in this experiment through: the coefficient of friction of steel on steel, aluminum on steel and glass on steel. Data processing results are shown on Table 1:

Table 1. The coefficient of kinetic friction material

	Material	μ_k Eksperiment	μ_k literatur
1	steel on steel	$\mu_k = 0{,}55 \pm 0{,}02$	$\mu_k = 0{,}57$
2	Aluminum on steel	$\mu_k = 0{,}48 \pm 0{,}02$	$\mu_k = 0{,}47$
3	Steel on aluminum	$\mu_k = 0{,}47 \pm 0{,}02$	
4	Glass on glass	$\mu_k = 0{,}42 \pm 0{,}03$	$\mu_k = 0{,}40$
5	Glass on steel	$\mu_k = 0{,}43 \pm 0{,}02$	

From Table 1, it appears that there is a little difference between the value of the coefficient of kinetic friction calculation results with coefficient of kinetic friction as cited in Marthen Kanginan (2000), and Sears, Zemansky (1993). The comparative value of the coefficient of kinetic friction experiments with literature is determined by the equation (Darmawan Djonoputro, 1984):

$$K_r = \left| \frac{\mu_k literatur - \mu_k eksperimen}{\mu_k literatur} \right| x100\%$$

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The relative difference (Kr) Calculation results of coefficient of kinetic friction are steel on steel (3.51%), aluminum on steel (2.13%), and glass on glass (5%). Thus, it can be stated that the collision of two objects tool is designed, quite accurately used to determine the coefficient of kinetic friction of various types of materials.

The coefficient of kinetic friction of aluminum on steel is $«_k = 0{,}48 \pm 0{,}02$, while the coefficient of kinetic friction of steel on aluminum is $«_k = 0{,}47 \pm 0{,}02$. It can be concluded there is no significant difference between the coefficient of kinetic friction of aluminum on steel with steel on aluminum.

3.2 The Correlation between the Ball Height and the Distance traveled of block

With a mass of 194.2 grams balls remain, the mass of 299.4 grams block and the field of aluminum on steel friction (μk = 0.47). The authors measured the average shifting values for twelve times repetation with various height of balls. Then they made a graph, as shown in Figure 4:

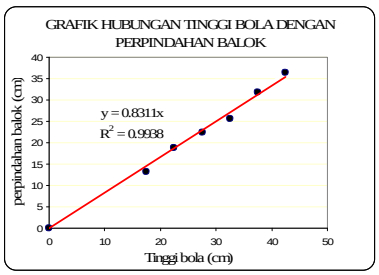


Figure 4. The Correlation of the Ball Height with the Distance traveled of block after Collision

It can be interpreted that there is a high correlation on the shift of the ball is in linear-shaped line after the collision. The linear equation is: y = 0,8311x. It meaned there is a positive valuable slope line. Thus it can be stated that the correlation between the height of the ball with the distance traveled of block after collision is directly proportional.

In mechanics, it can be calculated as the following:

$$E_{p\,bola} \approx \Delta E_{k\,balok} \approx W_{gesekan}$$

$$m_1.g.h \approx m_2.«_k.g.S \quad ; \text{if } A = m_1.g$$

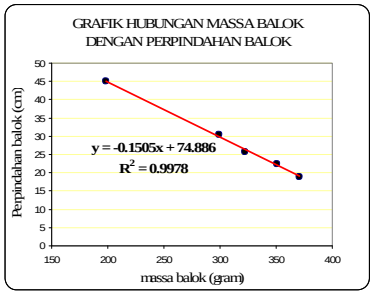
So that: $A.h \approx B.S \qquad B = m_2.«_k.g$

$$S \approx \frac{A.h}{B} \text{ .....(8)}$$

From (equation 8), it appears that the height of ball (h) the shift of block after ground balls (S) is directly proportional. So the result as shown on the graph before is in accordance with the theory of mechanics.

3.3 The Correlation between Mass of Block and the Distance Traveled of Block after Collision

With a mass of ball = 194.2 grams, the field of aluminum on steel friction (μk = 0.47), rope length = 71 cm, deviation angle = 47 degrees and high balls = 32, 5 cm, the authors created the average shifting values for twelve times repetation on different mass. Then, they made a graph, as shown on figure 5.



Gambar 5. The Correlation between Mass of Block and the Distance traveled of block after Collision

From figure 5, it can be seen that the span of block mass is about 198,1 gram till 370,4 gram. The correlation between them is in the form of liner-shaped line after the friction. The linear equation is: y = -0,1505x + 74,886. It meaned there is a negative valuable slope line. Thus it can be summed up that the correlation between mass of block and the distace traveled of block after collision is not directly proportional.

In mechanics, it can calculated as the following:

$$E_{p\,bola} \approx \Delta E_{k\,balok} \approx W_{gesekan}$$

$$m_1.g.h \approx m_2.«_k.g.S \quad ; \text{jika} \quad A = m_1.g.h$$

Maka: $A \approx m_2.B.S \qquad B = «_k.g$

$$S \approx \frac{A}{m_2.B} \text{ .....(9)}$$

From (equation 9), it is seen that the mass of block (m_2) and the distance traveled of block (S) after collision is not directly proportional. So the result as shown on the graph before is in accordance with the theory of mechanics.

All in all, the findings showed twofolds; (1) that the distance traveled of block after collision will never remain the same with zero, although the mass of the block is increased. Meanwhile, it will be zero if the height of the ball is also null. (2) If the mass of the ball is constant (m_1= 194,2 gram) and the mass of block is less 520 gram (m_2 < 520 gram), the velocity of the ball after collision is exactly in accordance with the distance traveled of block. While if the mass of the block is more than 520 gram (m_2 < 520 gram), the velocity of the ball after collision is exactly not

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accordance with the distance traveled of block. The ball will be bounced out.

4. CONCLUSION

4.1. Conclusion

a. By using this designed experimental set, the coefficient of kinetic frictions are determined. They are steel on steel ($\mu_k = 0{,}55 \pm 0{,}02$)with relative difference k_r = 3,51 %, aluminum on steel ($\mu_k = 0{,}48 \pm 0{,}02$) with relative difference k_r=2,13 %, glass on glass ($\mu_k = 0{,}42 \pm 0{,}03$) with relative difference k_r= 5%, and glass on steel ($\mu_k = 0{,}43 \pm 0{,}02$). Other findings is the coefficient of kinetic friction of aluminum on steel is the same with steel on aluminum.

b. There is a positive linear correlation between height of the ball with the distance traveled of block after collision, if the mass of the ball is 194,2 gram and the mass of block is 299,4 gram. It can seen on this equation: y= 0,9078x – 2,4865. Meanwhile, for the mass of the ball (194,2 gram) and the mass of block is 370,4 gram, there is a negative linear correlation between height of the ball with the distance traveled of block after collision. It can be seen on this equation: y = -0,1505x + 74,886.

4.2. Suggestion

It is suggested to use timed censor for accurate results. Since at this research, the researchers only used stopwatch to count the time on the shift of the block when it is hitted till it stops because of friction.

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ISBN 978-602-19877-3-5

EFFECT OF CALCINATION TEMPERATURE ON PHASE TRANSFORMATION AND CRYSTALLITE SIZE OF GRANITE POWDER

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ABSTRACT

Granite powder was prepared from granite rocks from Solok, Indonesia. The samples was dried and calcined for 1 hours at temperatures from 500 , 700 ℃, 800 , 900 ℃ and 1000 ℃. Phase transformation and crystallite size of the calcined powders have been investigated as a function of calcination temperature by room-temperature X-ray diffraction (XRD). It is seen that the quartz and albite phase of granite samples was successfully obtained. With increasing calcining temperature, another phase also appears as feldsfar, biotite, tourmaline and coesite. Crystallite size of quartz phase decreased from 63.85 nm to 56.20 nm and no there is a change which means for albite phase.

Keywords : *Granite rocks, calcination temperature, XRD, Phase transformation and crystallite size*

1. INTRODUCTION

Granite is an igneous rock in which the crystals have rough with the mineral composition of quartz, feldspar, plagioclase sodium and other minerals. Granite began its modern life as a building stone: a durable, sturdy surfacing material. Because of its hardness and imperviousness to moisture and acid, granite was a perfect countertop material [1-6].

Material phase performance, depend on the reduction of particles size and high surface area of the prepared material. On the other hand, the associated challenge with purification methods is; when the product is calcined at high temperatures the crystallite size increases and the surface area decreases due to the particle growth [7]. A knowledge of phase transformation and crystallite size is helpful in understanding the surface and bulk properties of granite phase. Moreover, it is an important point to study the crystallite size and their corresponding crystalline phase at various calcination temperatures from the issue of view of practical use of the granite powder.

The aim of this article is to characterize the granite powder prepared by the dried method. The effect of calcination temperature on the phase transformation and crystallite size has been characterized using X-ray diffraction (XRD).

2. METHODS

Preparation of granite Powders. Granite powders were prepared by dried method using natural granite rocks from Solok, Indonesia as starting material. The primary particle size of natural granite powder is about 75 µm. The washed samples were calcined at 500 , 700 ℃, 800 , 900 ℃ and 1000 ℃. in air for 1 hours, respectively.

Characterization. The granite samples were characterized by an X-ray powder diffractometer (XRD, CubiX3 Cement) using Cu-Kα radiation (λ = 1.5406 ˚A) at 45 kV and 40 mA and were used to determine the identity of any phase present and their crystallite size. The crystalline size was calculated using the Scherrer formula, $D = 0.9\ \lambda/\ \beta \cos\theta$, where λ is the wavelength of X-ray radiation, β is the full width at half maximum (FWHM) of the peaks at the diffracting angle θ [7].

3. RESULTS AND DISCUSSION

Phase Transformation. The XRD technique was used to investigate the phase transformation of the prepared samples. Fig. 1 shows the XRD patterns of the prepared samples with calcination at 500 , 700 ℃, 800 , 900 ℃ and 1000 ℃ in air for 1 h. All samples are crystalline. The XRD pattern of the powder formed at 500 ºC is characteristic of quartz (SiO_2) with the diffraction peaks at 20.07, 26.67, and 50.25 17.6, 24.1, 31.3 and 35.6^O, albite with the diffraction peaks at 23.68, 30.04 and 37.32 17.6, 24.1, 31.3 and 35.6^O, and feldsfar with the diffraction peaks at 33.99, 35.75, and 51.53^O. When the calcination temperature is above 700ºC, biotite, tourmaline, and coesite phase peaks appear. The diffraction peaks at 26.73 and 55.63^0 were due to the biotite phase, at 36.61 and 45.69^0 to tourmaline, and those at 28.87 and 33.19^0 to coesite. This suggests that there is a phase transition from quartz to coesite at about 1000ºC. With further increase in the calcination temperature from 500 to 1000 ºC, the XRD peaks become sharper and the intensity of biotite phase increased indicating the improvement of crystallization of biotite phase. Residual quartz and albite phase still exists in the samples up to 1000ºC.

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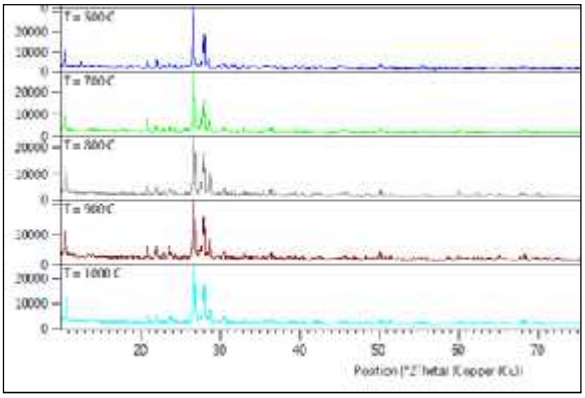

Fig 1. Spectra XRD of granite powder calcinated at 500 , 700 ℃, 800 , 900 ℃ and 1000 ℃.

Crystallite size. Crystallinity of the granite powders calcined at various temperatures has been studied. The crystallite size of the particles has been estimated from the Debye–Scherrer's equation using the XRD line broadening. Simultaneously, the peaks become narrower as the temperature increases resulting in the increase of crystallite size. The variation of crystallite size for each phase was calculated and the results are presented in Table 1. At higher calcination temperatures, the crystallites formed are litte in size, which can be attributed to the thermally no promoted crystallite growth and atomic diffusion. Crystallite size of quartz phase decreased from 63.85 nm to 56.20 nm and no there is a change which means for albite phase. Apparently, the crystallite sizes can be correlated to the surface areas, i.e. smaller size crystallites have larger specific surface areas [8].

Table 1. The variation of lattice parameters and crystallite size with calcination temperature

Temperature (^{0}C	Crystallite Size (nm)					
	Quartz	Albite	Feldsfar	Biotite	Tourmline	Coesite
500	63.85	56.92	64.02			
700	74.53	56.47	79.78	94.98		
800	51.10	53.86	56.38	76.93		
900	53.66	55.77			61.93	
1000	56.20	56.67				64.37

4. SUMMARY

In summary, granite powders were synthesized by dried method using natural granite rocks as the starting material. The crystalline phase and particle size of granite depending on the calcination temperature. With increasing calcining temperature, quartz and albite phase still exists in the samples up to 1000ºC. When the calcination temperature is above 700ºC, another phase also appears as feldsfar, biotite, tourmaline and coesite. Crystallite size of quartz phase decreased from 63.85 nm to 56.20 nm and no there is a change which means for albite phase.

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ISBN 978-602-19877-3-5

DEVELOPMENT OF 2D VIBRATION DETECTOR USING FLUXGATE SENSOR BASED ON PERSONAL COMPUTER

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ABSTRAK

The development of 2D vibration detector using fluxgate sensor based on personal computer has been done. This detector can be oprated for both vertical and horizontal axist. In previous work., the vibration detector has been develop for limited 1D. The detection system consist of hardware and software part. The hardware part, consist of fluxgate sensor circuit and interfaceing. Digiliization of analog fluxgate sensor output is done using ADC in microcontroller. The vibration data is processed using software develop with visual basic (C# language) and MPLAB IDE. The processed data is presented in personal computer display with 2D graph as fungtion of time

Keywords: *2D, Vibration detector, fluxgate, personal computer*

1. INTRODUCTION

In line with the advancement of technology, the application of magnetic sensors in measurement and control engineering becomes increasingly growing. Its application can be found in navigation system, geophysical exploration, the earth's magnetic field mapping, position and distance determination of the object in high resolution [1]. In control and measurement, the slight magnetic field changes need high accuracy and sensitivity sensor [2]. There are a wide variety of magnetic sensors that have been developed for controlling and measuring such as hall effect sensors, magnetoresistif sensor, SQUID, and fluxgate sensors [3].

Fluxgate is a magnetic sensor that operate based on magnetic flux changes. The fluxgate sensor capable of detecting very small response up to nano tesla [4,5]. This sensor has a fairly wide range of measurement and detects the weak changes in magnetic flux. The measured magnetic flux is depends on the distance of the object. The characteristics of fluxgate sensor can measure the small distances [5], this ability made the sensor can be implemented as vibration detector. In the previous work, the mathematical models of vibration based on fluxgate sensor has been developed [6].

In this paper, the development of vibration detector based on fluxgate sensor will be presented. The detector can be operated in detection 2D vibration. The system consists of mechanical part, signal processing, microcontroller and personal computer for displaying data.

2. METHOD

In this work, experimental research laboratory is adopted as research model. In this experiment, data retrieval is done repeatedly, then analyzed, conclusions drawn, and reported the results. The characteristic of sensor is investigated as function of magnet position.

There are some equipment and component used in this study which are PC, downloader, analog and digital multimeter. The personal computer is used in programming the microcontrollers using MPLAB X IDE V1.70. The K510 downloader is used as microcontroller programmer [7,8]. Multimeter is used to measure the value of the components that will be used such as resistor and voltage in electronic circuits.

The electronic component utilize in this system consist of fluxgate sensor, resistor, capacitor, microcontroller as well as other supporting components. The supporting materials used are spring and magnets. Mechanical design of the system is combining from springs, body mass, mast poles, magnetic, fluxgate sensor as shown in Figure 1.

As shown in Figure 1, the mechanic system is built from vertical and horizontal sub system. The springs with constan k are used as vibration detector in both vertical and horizontal system. The spring oscillates at the point of equilibrium. A body of mass (M) is a load that serves as a buffer. For horizontal system, the magnet1 (m) is oscillating follow the movement of spring in horizontal direction. In other hand, the magnet2 (m) oscillating follow the movement of the spring and vertical directions. Sensor1 and sensor2 are flugate sensor installed in both vertical and horizontal system. This sensor will detects changes in magnetic position in vertical and horizontal direction for sensor2 and sensor1, respectively. The vibration is equivalent to the response given by the damping effect due to reduced friction and damping spring.

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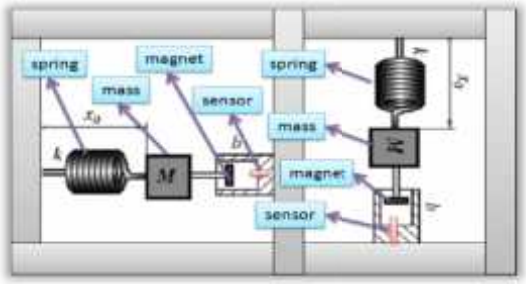

Figure 1. The design of the mechanical system

a. Modules of the system

The modules of the vibration detector system can be seen in Figure 2.

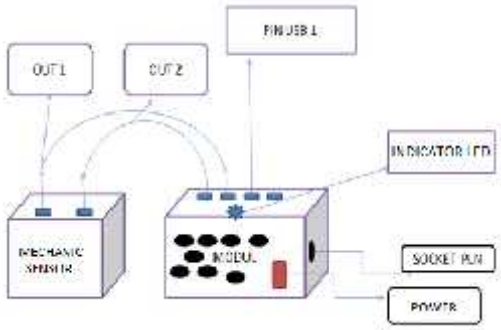

Figure 2. Modules of the system

Based on Figure 2, the out 1 represents the sensor output the result of motion detection magnet in vertical direction and out 2 is the sensor output the result of motion detection magnet horizontal direction. The connection to PC is done by using PIN USB1 and a LED is used as indicator when the system connected to PC. The electricity supply come in via PLN socket and controlled by ON/OFF button.

.

b. Block diagram of the system

Generally, the system consists of a power supply circuit, fluxgate sensors, signal conditioning circuits, microcontroller PIC 18F4550 and a PC. The data can be transferred to the PC using an interfacing software such as Visual C # programmer software and software MPLAB X IDE [8,9,10]. Block diagram of the system are shown in Figure 3.

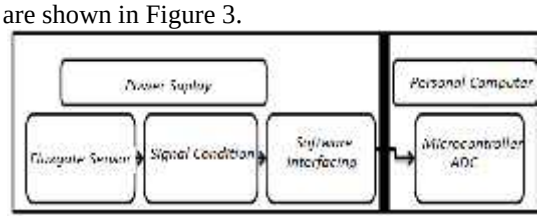

Figure 3. Block diagram of the system

In Figure 3, the fluxgate sensor is utilized to detect the vibration of the magnet. Output of the fluxgate sensor are sent to the signal conditioning. The data obtained from the analog signal conditioning to be converted into digital data by the ADC. Microcontroller is programmed as signal processing and interfacing the selectronic system to a personal computer.

This research was carried out through several stages that are preparation and implementation stage. The preparation stage is the stage of preparing a research proposal, a preliminary survey to obtain the necessary data and documentation studies and literature related to the research problem. The second stage is implementation phase of research, this study begins by assembling the components in accordance with an instrument that has been designed and programmed the microcontroller.

The things to be considered in the implementation of this study are determination the performance and design specification. The investigation of performance specifications on system is done by identifying the functions in each constituent part of the system of measuring instruments by means of shooting every part of the system of measuring instruments as well as explain the functions of each section. On other hand, the determination of design specifications of the system is done by comparing the output of the system with standart measuring devices.

Data collection techniques in this research is conducted through measuring physical quantities contained in the system. The data is processed and interpreted using a PC. The measurement technique is performed both directly and indirectly. Data obtained directly is output voltage of fluxgate sensor that has been digitized and time, while the data obtained indirectly is amplitude, magnitude, accuracy and precision of the system.

3. RESULTS AND DISCUSSION

In this study, a vibration detector has been developed. The specification of the system is obtained in the form of performance and design. Vibration detectors are assembled using fluxgate sensor with a spring and a load. In case of vibration, the system will vibrate and trigger the fluxgate sensor. The assembled 2D vibration detector is shown in Figure 4.

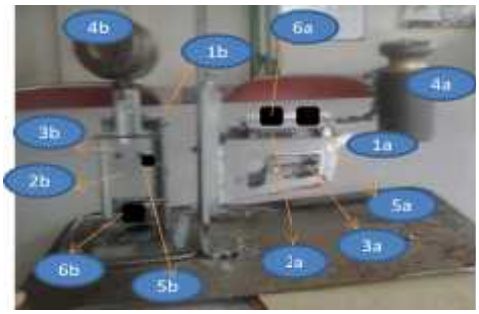

Figure 4. The assembled 2D vibration detector

In case of vibration, the mechanical system is vibrating so fluxgate sensor will respond to the

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vibration. Mechanical system is covered by a box 29 x 18 x 35 cm in size. As shown in Figure 4, the system is consisted of calibrator in horizontal direction (1a) and calibrator in vertical direction (1b). The load is swing in horizontal arm (2a) and the vertical arm (2b). The 1 kg load (4a) and (4b) are installed on a spring (3a) for horizontal and (3b) for vertical direction. A magnet (5a) and (5b) is mounted in front of each fluxgate sensor (6a) and (6b) for horizontal and vertical direction, respectively.

The vibration will trigger the mechanic system to vibrate and the magnet changes the position relative to the fluxgate sensor. Variation of the magnet distance to the fluxgate sensor will produce the electric signal. This signal will be processed in a signal processing module as shown in Figure 5.

In Figure 5, a signal processing module installed in 21x16x8 cm box and consisted of pin connector fluxgate sensor (1), pin USB (2), On/ Off switch (3) and pin cable connector PLN (4). This module combines several electronic circuits for signals processing as shown in Figure 6.

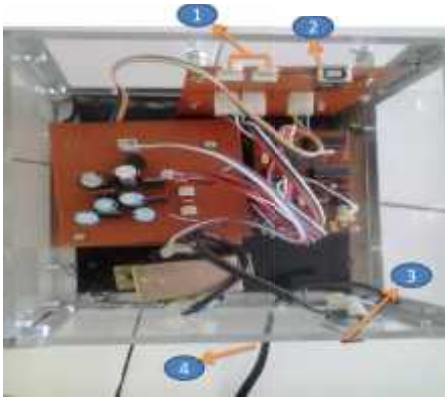

Figure 5. The signal processing module

Figure 6. Electronic circuit for signals processing

Figure 6 is shown the signal processing module of the fluxgate sensor. The supply voltage is given by a power supply (1) that provides voltage for microcontroller and circuit board. Signal processing is done on circuit board (2) and microcontroller PIC18F4550 (3). The digital data as output of microcontroller data is sent to the PC via USB serial bus.

Operating the device require a PC with the specification has been using a minimum net framework 4.0. The data presented in graphic software that has been created with Visual Basic programming language C# that called tool driver. This tool driver is used to display graphics, monitoring and data storage. The tool driver display is presented in Figure 7. As shown in the display, (1) is a title for the chart, (2) Represents the plotted graph of vibration data in horizontal direction and (3) in vertical direction. The noise filter is present on (4). The (5) is an auto scroll, (6) input the scale on the axis, (7) button set, (8a) and (8b) is count value for vertical and horizontal direction, respectively. The start and stop (on/off) data retrieval is on (9) and strip status of USB connection between the PC and system is shown on (10).

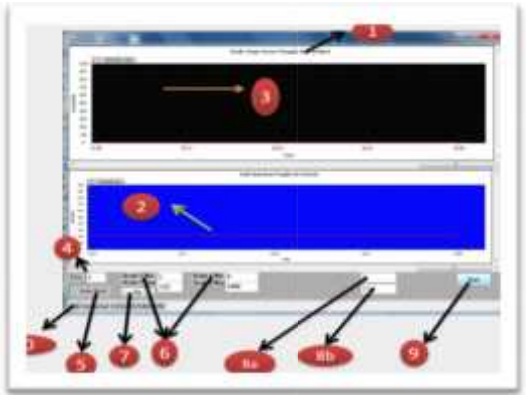

Figure 7. Tool driver display [11]

To integrate the system to a PC needed tool driver. Tool driver included with the data storage process that can be programmed to store data on a regular basis. The data is automatically saved when a USB connection is disconnected or program terminated. The data are stored in the application folder with the folder title “Log Data” and file name are stored according to the time of data storage. The file extension is set to .xls, therefore the file can be opened using Microsoft Excel application.

In integrating the vibration system to a PC needed a power supply circuit. The signal is processed and then forwarded to the microcontroller. The output voltage generated by the signal processing is converted into digital form by the ADC module contained in the microcontroller and the results will be stored in the memory address ADRESL and ADRESH. This program is developed using MPLAB X IDE. The flowchart of the program is presented in Figure 8.

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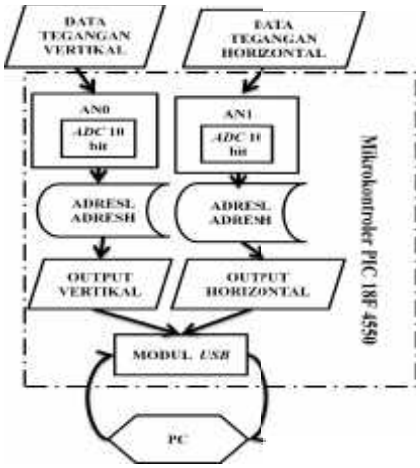

Figure 8. Flowchart on PC program [11,12]

In the microcontroller, there is a USB module that programmed to be connected to a PC. This USB module will be configured as interface between the data stored in the microcontroller and PC. Measured data is presented on tool driver that developed using Visual Basic [12]. The detected vibration as function of vibration source distance for both vertical and horizontal direction are shown in Figure 9 and 10, respectively. There are four variation of the vibration source distance a, b, c and d with value 0.5m, 1m, 1.5m and 2m, respectively.

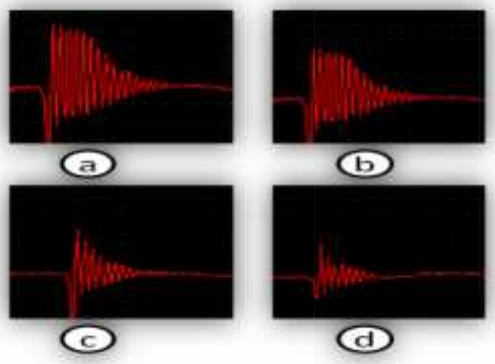

Figure 9. The vibration in vertical direction

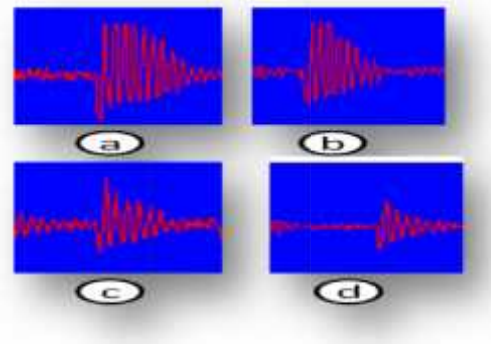

Figure 10. The vibration in horizontal direction

The developed program (tool driver) has advantages. The application can be zoomed to the running data and recorded data. The vibration data can be monitored in real time. Other advantages we are the recorded data format can be opened using general software, so that the stored data is more flexible to use. In operating this system, to operate optimally mechanical sensors need to be conditioned in order to be free from external magnetic fields such as magnetic materials and magnetic fields from power lines. In this 2D vibration detector, the system will generated vibration signal if vibrations that occur can actually vibrate the magnet so that the sensors can detect changes in the position of the magnet to the sensor.

4. CONCLUSION

The 2D vibration detector using fluxgate sensor with personal computer display has been developed. This sensor consist of mechanical system, fluxgate sensor, signal processing circuit and PC as display. The tool driver 12755 is used in sofware operating. Overall, the system can operate and generate vibration signal on the display. The direction of the vibration can be detected as well.

5. ACKNOWLEDGEMENT

This work supported by National Strategic Research (Stranas) Grant. No.023/SP2H/PL/Dit. Libtabmas/V/2013. The research title “Design and Development of Earthquake Detection System Based on fluxgate Sensor”

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ISBN 978-602-19877-3-5

STUDENT'S PERCEPTION OF MATHEMATICS AND SCIENCE DEPARTMENT OF BIOLOGY EDUCATION PROGRAM TOWARD BASIC CHEMISTRY COURSE AT THE UNIVERSITY MAHAPUTRA MUHAMMAD YAMIN SOLOK

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ABSTRACT

The study was conducted to determine the student's perception of Mathematics and Sciences Department of Biology Education Studies Program toward learning basic chemistry courses at the University Mahaputra Muhammad Yamin Solok. This research is a descriptive study with 72 students as sample of Biology Education who was taking Basic Chemistry course from semester 2009/2010 until 2012/2013. Based on the results of analysis data, it can be seen that the desire to learn is good (average of 3.55), the desire to get a good value is good (average3.17), perception of lecturer is excellent (average 4,14), effort to learn is good (average of 3.32) and the student's interest is good (average3.98).

Index terms: perceptions, basic chemistry

1. INTRODUCTION

The college is one of the formal education institution which has higher quality of education resources in order to achieve national goals to increase human's intellectual. University Mahaputra Muhammad Yamin (UMMY) Solok is a private university in Solok city that consist of four faculties, namely the Faculty of Education, Faculty of Agriculture, Faculty of Economics, and Faculty of Law.

Faculty of Education is one of the faculties in UMMY Solok which have some purposes:

a. Producing graduates who have creativity and innovative works in the field of education based on the values of the nation's cultural character.
b. Producing graduates who are professional in their field and dignified.
c. Improving the quality of service to stakeholders
d. Improving the quality of graduates, as well as the quality of education facilities
e. Improving the quantity and quality of research to reinforce learning
f. Developing research to produce products of science technology and arts, especially in education field.
g. Increasing the quantity and quality of training programs and professional development of personal educational.

To achieve these objectives, the Faculty of Education UMMY Solok needs to improve the quality of the learning process.

Improving the quality of the learning process can be done through some high intellectual human such as professors, assistant professors, laboratory assistants, and students. And also are supported by Physical Resources consisting of curriculum / syllabus, SAP (Unit Event Class), books / references for learning process, guiding lab, laboratory, learning media and others.

Improving the qualities are described above is one strategy that can be taken to get quality of teaching and student learning outcomes can be improved. In order to optimize the utilization of learning resources, it is necessary to know the factors which influence the learning process in the campus and outside. In general, the factors that can influence learning process outcomes are divided into two categories, namely internal factors and external factors. Both of these factors affect each other in the individual processes that determine the quality of learning outcomes. Internal factor is effects that come from individual itself that influence affects results of individual learning. The internal factors include physiological factors and psychological factors. Beside internal factors, external factors can also influence the learning process of students. In this case, the Shah (2003) explained that the external factors that affect learning can be classified into two categories, namely social and environmental factors of non social environmental factors.

The main factors that affect the learning process at the college level are student's interest to follow the course during the semester running. According to the theory described by Reber in (the Shah, 2003) the interest is not a term that is popular in psychology due to its dependence on a variety of other internal factors, such as the concentration of attention, curiosity, motivation, and needs. So simply, interest is the tendency and high excitement or great desire for something. Interest in learning, is a very important factor to be discussed. Considering its importance, the experts agreed that interest is a must absolute in any activity, including in learning.

Based on these opinions, it is clear that arouse attention and interest in learning are an important

ISBN 978-602-19877-3-5

factor in the learning process. Based on the results of direct observation that researcher did through information was taken the students from lack of discipline in following the lesson, and no discipline in collecting the tasks was given by the lecturer. The results of the authors observation showed that ± 50% of students arrive on time, ± 35% came late 5-10 minutes, ± 13% came late 15 minutes, and ± 2% arrive late more than 15 minutes. Based on the result it can be seen that the learning interest of students is still low. Therefore, it requires a special study to find the causes of the low interest of student in learning. Because interest in learning is the main factor that determines the success or failure of a learning process. If the students have low interest toward learning process the result will be disappointed or otherwise.

The present study will discuss about how students interest in following the course in Faculty of Education UMMY Solok, particularly in the Department of Biology Education Studies Program PMIPA on Basic Chemistry course. Researchers define the object of research are the student of Biology Education who graduated from Biology Education course program is expected have skills not only to be a biology teacher, but also to become a science teacher. Therefore, students of Biology Education should know that science education has great potential and strategic role in preparing qualified human resources to face the industrialization and globalization era. This potential will be realized the science education program could produce students who are proficient in their fields and successfully grow the logical thinking ability, creative thinking, problem-solving skills, critical, control technology and adaptive toward a changes and current development.

Standard for Science Teacher Preparation (NSTA, 2003: 11-13) mentions that the recommendation relating to the standard content must be controlled by a Biology teacher include: core competencies (core competencies), further competences (advanced competencies), and supporting competence (supporting competencies) , For supporting competency, Biology teacher also prepared to apply effectively the concepts of mathematics and science (science) Biology another learning which covers the basic concepts of:

a. Chemistry, including general chemistry and biochemistry with basic laboratory techniques,
b. Physics, include light, sound, optical, electrical, energy, magnetism, and thermodynamics,
c. Earth and space, energy and cycle includes geochemical cycles, climate, oceans, weather, natural resources, and changes in the earth,
d. Mathematics, including probability and statistics.

NSTA recommendation suggests that Biology teacher must comprehend about the material and also have competence in chemistry, which is related with chemistry itself in the cycles of live. Because of that the students of biology education program learn about basic chemistry and biochemistry. But the reality on the ground shows that program the majority of the students of Biology Education is less interest in the subjects of basic chemistry, it is seen by many students who arrive late at the learning process, lazy asking or responding of questions were given by the lecturer. They also get a bad mark and lazy reading book related chemistry.

Seeing the lack of interest of students of Biology Education in following the lecture Basic Chemistry, the researchers interest to know the students' perceptions in basic chemicals course, through a study entitled **Student's Perception of Mathematics and Science Department of Biology Education Program Toward Basic Chemistry Course at the University Mahaputra Muhammad Yamin Solok**.
This study focuses on student's perceptions of Biology Education courses that are already on basic chemistry course. With the formulation of the problem "How can student's perceptions of the Department of Biology Education Studies Program PMIPA towards learning Basic Chemistry course at the University Mahaputra Muhammad Yamin Solok?"

The Purpose of this study is to determine the student's perception of Biology Education Studies department PMIPA towards learning Basic Chemistry course at the University Mahaputra Muhammad Yamin Solok.

2. RESEARCH METHODS

This research was conducted in Mathematics and Science Department Biology Education Studies Program through quantitative research. This research is descriptive research; Arikunto (2005: 234) explains that descriptive research is a form of research that demonstrated the greatest to describe the events there. The characteristics of the descriptive method are 1) Concentrating on the problems that exist in the present and future actual, 2) Data collected initially conceived, described and analyzed.
The population in this study is biology education students who have taken Basic Chemistry course ranging from semester 2009/2010 to 2012/2013. The number of students Biology education program who have taken the Basic Chemistry course are 34 students in 2009, 8 students in 2010, 13 students in 2011, and the 29 students in 2012.

The sampling technique is used total sampling. But after the questionnaires was distributed. The amount of questionnaires was amounted only 72 questionnaires, and there were 12 questionnaires were not returned.

ISBN 978-602-19877-3-5

3. RESULTS

Table 1.Data Analysis Questionnaire

NO	STATEMENT	$\bar{X}$
1	Before Basic Chemistry lesson, I prepared books, stationery or other necessary learning tools	4,54
2	I am convince that every task that I am doing the basic chemistry is right	3,74
3	I learned basic chemicals regularly not only when the test basic chemistry course	3,49
4	I taught by self without governed by a parent/guardian	4,31
5	Every problem in comprehending the basic chemistry course material, I will ask others	3,72
6	When the chemistry lecturer explains the material I give advice or suggestion	2,35
7	If there are any problems or a difficult on chemistry task, I am trying to solve itself without asking help from others	2,69
8	Every assignment of a basic chemistry I was working directly at that time	3,4
9	I gather basic chemical assignment given by professors on time	4,78
10	If the basic chemical material do not understand I am trying to find library to help me understand	3,35
11	I feel that all the lessons are important and pointless	4,88
12	I like to borrow the basic chemistry notebook of my friend to be copied at home	2,93
13	After Basic Chemistry exam, I tried to repeat the answer of the exam at home	3,06
14	If there are any questions that I cannot answer, I tried to fix it	3,35
15	I believe in my own ability that I will succeed in learning	4,33
16	When the lecturer gives the opportunity to ask, I let it go, though there are materials that I don't understand	2,6
17	I'm just learning basic chemistry if the situation allows	2,21
18	If there is a task I put the basic chemical assignment when it is should be collected.	1,96
19	After basic chemical examination, I will forget it and I do not care if I was able to answer or not	3,63
20	I do the task of basic chemical assisted with my friends.	2,57
21	During basic chemistry exam if there is a chance I will cheat to my friend	3,74
22	If there is a lot of interesting program on TV, I am not going to learn the basic chemistry	3,93
23	When a friend invited refreshing, I would choose to follow them than learning chemistry	4,13
24	Basic chemistry Lecturer provide basic chemical materials based on the syllabus	4,83
25	I do basic chemistry assignment in the campus	3,82
26	Lecturer chemistry often make students confused in the basic chemistry course material	3,93
27	Lecturer of basic chemicals course often tell a story than the delivery of basic chemical materials	4,6
28	In the process of teaching and learning the lecturer would rather give a task while giving the material	3,93
29	Condition during learning process basic chemistry course tend to tense and bored	3,42
30	In the learning process chemicals I tend to fuss and does not care when lecturer explains the lesson	4,24

Based on the analysis above, the students' perceptions of Basic Chemistry courses can be grouped as follows:

Table 2. Recapitulation Data Analysis Questionnaire

Variable	Sub Variables	Average	Criteria
Student's perception	1. The desire to learn	3,55	Good
	2. The desire to get a good value	3,17	Good
	3. Perception of lecturer's ability	4,14	Very Good
	4. Effort to learn	3,32	Good
	5. Student's interest	3,98	Good

ISBN 978-602-19877-3-5

4. DISCUSSION

Based on the results of data analysis showed the student's perception of Biology Education program toward Basic Chemistry courses is good. When we analyzed one by one can be seen that the average student desire to learn is good with average of 3.55. This suggests that the desire of students to study well, although formerly when they was senior high school level there are some students biology education came from the social sciences and vocational. The desire to learn well is also supported by the good effort to learn and interest in learning. With good the desire, effort, and interest in learning it can be seen that the students' learning motivation Biology Education courses well.

Good motivation course also supported by the desire, the desire to get a good value. This is demonstrated by the average value of 3.17. However, the data also indicated that not all students are motivated to obtain a good value. This is because not all students assume that the basic chemical is a pleasant subject. If I see from the student's perceptions of lecturer's ability, the student assessment is 4.14 with a good category.

5. CONCLUSION

Based on the analysis of data it can be concluded that student's perception Mathematics and Science Department of Biology Education Program toward Learning Basic Chemistry course at the University Mahaputra Muhammad Yamin Solok is good.

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ISBN 978-602-19877-3-5

PROFILE OF SENIOR HIGH SCHOOL STUDENT'S NEEDS FOR LIFE SKILL ORIENTED -CHEMISTRY

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ABSTRACT

Learning in the context of the development of life skills should reflect the need of various student life skills to live in community. Theis aim of this study was to describe the learning needs associated with necessary student life skill. In addition, this preliminary study is the result of a study on chemistry teacher competencies. The subjects involved in this research were 15 teachers who are members of the MGMP Chemistry Bungo City. The Questionnaires were used as instruments to collect the data in the form of response of chemistry teachers for learning chemistry . The interviews weare used to obtain inforamations about the experiences of high school chemistry teachers in Bungo district. Analysis of data used qualitative description method. From the Rresults of the study can be concluded that the students of High School in Bungo City in need of life skills integrated with learning chemistry, . i.e. 89% for personal skills,. 85% for social skills, and 77% for vocational skills.

Index Terms— *Need analysis, Life skill, Learning of chemistry*

1. INTRODUCTION

Potentials to have a significant ability to conform of society needs must be trained either by physical activity and mental activity [1]. Physical activity can develop positive ability to provide students to maintain life in society. Mental activity experienced by the student is expected to change their behavior based on the thought of integration as a result reduces the physical activity

Physical activity participation has the potential to improve the personal development [4]. The skills that integrate mental activity and physical activity should be taught to improve the capabilities and skills of the students [1]. The skills necessary to improve performance and optimize the potential of the students are very relevant to life skills. Life skills such as positive behavior, effective communication and make effective decisions [3]. According to the World Health Organization (1999), lifeskill oriented learning is very important for physical and mental development of students in the social life of of society.

Life skill in chemistry learning context is very important to be implemented due to some reasons, among others: first, activities of students in learning chemistry directed to use experimental methods and demonstrations. Second, the chemistry learning - oriented approach to problem solving. Third, the ability and skills that commonly arise in the chemistry learning many experienced directly by students in daily life.

Some abilities and skills have the potential to perform in chemistry learning, for example, the ability to brave and confidently perform under pressure, problem solving skills with critical thinking, the ability to confront and resolve challenges, the ability to set goals, the ability to communicate, ability to handle success and failure, the ability to work with a team and in a system, and the ability to accept idea or feedback from others.

2. METHODOLOGY OF RESEARCH

2.1 Research participants

The population were all high school chemistry teacher in Bungo. The research participants consisted of 15 chemistry teachers who were participating in MGMPs.

2.2 Instruments of research

The instruments of this research were questionnaires and interview. Questionnaires was used to assess chemistry teachers' perceptions of life skills education related to learning chemistry . Interview was used to collect data of high schools chemistry teachers' experiences in bungo district . Method of data Analysis was descriptive qualitative.

In the beginning stage, it was need preparations including small discussion with the teachers in the forum of chemistry MGMPs Bungo. In the data collecting stage, there are two activities, namely administering questionnaires and conducting interviews on chemistry teachers at MGMPs in Bungo. the data from questionnaires and interviews would be analyzed and used as an initial step to develop a chemistry learning tool life skill oriented. Results of this analysis was put into the evaluation material to prepare lesson plans, teaching materials and evaluation tools that match the needs of high school students should be equipped with life skills.

ISBN 978-602-19877-3-5

3. RESULTS AND DISCUSSION

3.1 Description Results of Interviews with teachers in the Chemistry MGMP.

The Profile of chemistry learning needs based life skill was obtained from the results of questionnaires and interviews analysis. In the early stages of this research, underway a case study. The case study is a way to deal with a variety of data such as questionnaires and interviews. Questionnaires and interviews were conducted to gain a better understanding of the phenomena that occur in the context of real life [7]. The main data source of this research is the collection of in-depth interviews conducted with teachers MGMPs Bungo district. Interviews were conducted to identify the perceptions of participants and the level of involvement of teachers in providing students' life skills.

3.1.1 School A

There were two chemistry teacher from school A involved in this study. Both of them were active in the chemical MGMP. The first teacher states that: “I feel that the chemistry subjects is taught as to mastery the material and improve the ability of students to understand the material. To integrate life skill in chemistry learning requires cooperation and support from various parties so that the results can be maximized”.

The second teacher said that: “Many of the problems and demands which must be encountered by the teacher so that designing and implementing learning chemistry is a heavy burden”.

3.1.2 School B

There were three chemistry teacher from school B involved in this study. third of them were active in the chemical MGMP. The first teacher states that: “In designing learning chemistry -based lifeskill is ideally mapped beforehand potential benefits as outcomes that really needed a high school student.

The second teacher said that: My experience is that we can not do all the abilities and skills in of each class. To organize the ideal chemistry learning, we should choose two or three skills that maximum is done”.

Three other chemistry teachers had planned and tried to add the values lifeskill in chemistry learning. All of them felt no difference perceived benefit to the development of students' potential.

One chemistry teacher from the School of B (Teacher 5) explained that: Each end of the semester, when the period of study has been completed, the teacher held a gallery to present the results of projects that have been completed by the student. Each class of the school year is planned to complete the project tasks in accordance with the content of essential material.

3.1.3 School of C

Teachers from School C said that:” I find that life skill has significance and value in the study of chemistry. However, I have not done an evaluation and reflection to follow up on this activity”. Another teachers from School C said that based learning lifeskill desperately needs more time to plan the learning process. However, when teaching materials used to provide activities are integrated with the values lifeskill, then indirectly life skills will appear in the learning activities.

3.2 Result Of Analysis Response Teacher Against Lifeskill Needs For Student

Percentage of life skills needs in four dimensions based on teachers’ responses can be seen in Figure 1

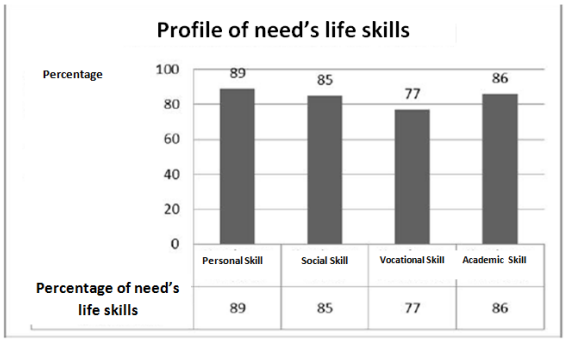

Figure 1 above showed that student needs for personal skills of 89%. This skill is important for life in society to improve their ability in order to be helpful to others. Skills that can develop their capacity and realize the weaknesses that owned.

Student needs the social skills of 85% . High school graduates must have communication skills, ability to work, and have the nature of empathy. When students have the social skills then students will be able to establish a good relationship in social life.

Student needs to achieve 77% of vocational skills. High school graduates should be equipped with skills that became the basic capabilities of some certain professions, especially in jobs that still need a lot of skilled practitioners.

Student needs to achieve 86% of academic skills. For high school graduates majoring in science, academic skills related to mathematical logic capability and scientific work must been carried out in the learning chemistry process. However, these skills have not reached to the extent of involving the realm of thought complex or at the level of high-level thinking skills. The skills included in lifeskill is one unified whole [5]. Life skill is education that provides personal skills, social skills, intellectual skills and vocational skills for work or independent business.

ISBN 978-602-19877-3-5

3.3 Result Analysis Response Teacher Against Importance of Instructional design of Chemistry-Oriented lifeskill

Data from a preliminary study on the importance of instructional design of Chemistry -oriented lifeskill can be seen in Table the 1st below.

Table 1. Response teacher chemistry of MGMPs Bungo disctrict

No.	Response teacher	Percentace
1	Lifeskill training needs for teachers.	88
2	Lifeskill is part of the curriculum	70
3	Lifeskill including local content	54
4	Learning resources that use the environment and used in the form of textbooks Chemistry -Based lifeskill	88
5	The values of entrepreneurship integrated on the learning	86
6	Creativity-oriented towards the development lifeskill	85
7	Rides to solve problems in life	88
8	Activity of students indicated skills	75

Table 1 showed chemistry teacher responses MGMPs Bungo district on the importance of the preparation of instructional design of chemistry-oriented –life skills. The need for teachers to receive training lifeskill reached 88%. teacher responses about lifeskill are part of the curriculum, this response reached 70%. Lifeskill including local content, the response has reached 54%. Learning resources that use the environment and used in the form of textbooks Chemistry -Based lifeskill reached 88%. The values of entrepreneurship is integrated in the learning reach 86%. Creativity oriented lifeskill development reached 85%. Rides to solve problems in life reaches 88%. Activity students showed proficiency reached 75%.

To integrate lifeskill in chemistry learning, things that must be considered and the chemical characteristics of the components that are associated with learning. The things that need to be considered, among others, namely: students, curriculum, teachers, teaching materials, school location, school facilities, classroom conditions, and laboratories. Teacher as facilitator presenting the material must be able to identify the values of lifeskill that should can occur at any stage of the learning activities carried out [6]. Teaching materials are designed such is the material blend with lifeskill. The learning process carried out in the classroom, in the laboratory and the surrounding environment is able to dig up and gave rise lifeskill values its own.

4. CONCLUSION

Results of a preliminary study showed the importance of learning-oriented chemical life skill based on data from chemistry teacher responses to questionnaire and interviews. Chemistry teacher who participated in this study can increase the integration of life skill with chemical materials. Chemistry teacher requires practical training to organize life skill based learning model effectively. Chemistry teacher facilitates the learning of students in accordance with the conditions in the context of achieving the specific goals of learning that has been planned. In addition, the learning is directed so that students can always think positive and achievement. Results of this study are profiles lifeskill integrated with the learning needs of the chemical. Student needs of personal skills to achieve 89%. Student needs to achieve 85% of social skills. Student needs of vocational skills to achieve 77% . Student needs of academic skills to achieve 86% . The skills included in lifeskill is one unified whole. Teacher as facilitator presenting the material must be able to identify the values of lifeskill can occur at any stage of the learning activities are carried out.

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ISBN 978-602-19877-3-5

THE DEVELOPMENT OF PROBLEM BASED LEARNING WORKSHEET ON REACTION RATE FOR SENIOR HIGH SCHOOL STUDENTS

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ABSTRACT

The goal of this research is to produce a srtudent worksheet based on problem based learning and reveal the practicalities on the rate of reaction matter. Student worksheet is based on problem-based learning cycle, namely: the problem, the core question, inquiry, problem solving, conclusions, strengthening the concept, and exercises. The type of this research is Research and Development (R & D) that uses four D models (4-D models). LKS development using phases: (1) define (2) design (3) develop and (4) disseminate. This study is limited to the development stage. Worksheet developed validated by 5 validation team and test the practicalities by 3 chemistry teachers and 27 students of XI IPA at SMAN 9 Padang. Based on students' test the practicalities of the test result obtained the average value of moment kappa of 0.81, with a very high level of practicalities, while at the moment kappa the teacher obtained 0.84 with the practicalities of that is very high level. Based on the results it can be concluded that worksheet based on problem based learning on rate of reaction matter has a very high practicalities level.

Index Terms -problem based learning, Student worksheet based on problem based learning, rate of reaction, research and development, 4-D models

1. INTRODUCTION

Reaction rate is one of chemistry matter on chemistry curriculum. This matter has interrelated ness among factual, conceptual, principal and procedural. Example of factual matter is the substance that reacts slowly and the substance that reacts fast. The meaning of reaction rate is an example of conceptual. Relationship between concentration and reaction rate is kind of principal and how to determine the reaction order based on experimental data is kind of procedural.

Based on observation on learning process of reaction rate at some Senior High Schools, especially at SMAN 9 Padang, had found that the students used discussion sheet that contained some problems that did not instruct or allow students to find self concept, they only used the concept. Students could solve the problems after teacher explained the materials first. This made students only copied the answers from the book or from their friends. This discussion sheet had the procedural matter in the form of experimental procedures, and it did not guade students in finding concept. The discussion sheet also did not have pictures, it was not make students interested to solve the problems. Teeneger as old as senior high school students still like colourful picture. Colour is an interesting factor that can influence student's sight and colorfull design can give a positive effect on student development[1]. Nowdays. worksheet used in learning reaction rate at many senior high schools is worksheet that has matter resume, example of problem solving and exercises. Students can solve the problem after read the matter resume and attend the teacher explanation. Students solve the exercise by copying the answer from the books or matter resume. This makes the learning process does not cause active student. In learning process, teacher has to make students active, mental activity and physical activity. If students only accept the concept from teachers, students do not have a meaningful learning[2].

An interesting learning media can motivate students in learning process. Learning media makes student actively involved in learning, and develops student thought in solve the problem. Problem solving is a good technique to understand the concept matter. This also gives satisfaction for students in finding concept. Students are expected to solve some problems they found, and to understand a complex information by using analisys[3]. Problem based learning (PBL) worksheet can be used as a learning media.

Problem based learning worksheet developed is based on problem based learning cycle namely, the problem identification, the core question, investigation, problem solving, strengthening the concept and exercises. This worksheet has a problem as the first step of learning, then students investigate to finding the answer of that and get a concept. This worksheet makes critical thinking students, and also make students solve the problems. Students could get

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conclution from the problem solving, and also find and solve the problem that relate to chemistry[3].

Learning of reaction rate at some Senior High Schools in Padang have used worksheet which is not problem based learning worksheet. This is a research and development that develop problem based learning worksheet on rate of reaction. This problem based learning worksheet can be used as learning resources in implementation of 2013 curriculum or KTSP curriculum. This worksheet begins a problem at the learning process and asks students solve it. It means students should be critical thinking and develop their thought to solve the problems. It makes students active in learning process, and the learning change from the teacher centered to the student centered. Based on this background, it has been done the research about " The Development of Problem Based Learning Worksheet on Reaction Rate for Senior High School Students"

2. RESEARCH METHODS

This study is a research and development (R & D). Research and development is the research that is used to produce a product and test the effectiveness of that products [5]. The products is problem based learning worksheet on rate of reaction matter. This study was conducted at XI 5 science class of the 2014/2015's school year in SMAN 9 Padang The subjects were 2 chemistry lectures of Faculty of Science and Mathematics, State University of Padang (FMIPA UNP), 2 chemistry teachers of Senior High School 9 (SMAN 9)Padang, 1 chemistry teacher of Senior High School 1 (SMAN 1) Padang, I chemistry teacher of Senior High School 14 and 27 students of XI 5 science class at SMAN 9 Padang. The instrument of this research were validity sheet and practicalities sheet. Data were analyzed using kappa moment [4].

$$kappa\ moment\ (k) = \frac{P - Pe}{1 - Pe}$$

Description:

K = Kappa moment that shows the validity of the product

P = The proportion is realized, is calculated by the amount of the value given by the validation team divided by the amount of the maximum value

Pe = The proportions were not realized, calculated by the amount of the maximum value deducted with the total value given by the validation team divided by the amount of the maximum value

Table 1. The Level of Practicalities Based on Kapaa Moment (k)

Interval	Level of Practicalities
0,81 – 1,00	Very high
0,61 – 0,80	High
0,41 – 0,60	Medium
0,21 – 0,40	Low
0,01 – 0,20	Verylow
≤ 0,00	Not valid

This student worksheet was designed by model of the development of learning tools basic as stated by Thiagarajan and Semmel that is *four D models (4-D models).* This models has four phases of development, namely: (1) *define* , *(2) design* (3) *development* and (4) *disseminate* [5]. This study is limited to development phase.

In the *define* phase consist of 5 analysis, they are analysis of the front end (initial-final), the students analysis, the task analysis, the concept analysis and the analysis of learning outcome. The initial-final analysis goal was to identify the teachers and students problem in learning chemistry, especially on rate of reaction matter. The students analysis conducted on grade XI of Senior High School who has age between 15-17 years old. According to Piaget's theory of development, the level of thinking the children in 11 years old to adult has an ability to think logically and solve problems through a systematic experiments [5].

The task analysis in the form analysis of Core Competence, Basic Competency, and the subject of this matter. The concept analysis was conducted to identify the main concepts to be taught. The main concepts of the rate of reaction matter include the concept of reaction rate, the expression of reaction rate, collision theory, the factors that affect the rate of reaction, and order of reactions. Analysis of learning outcomes is the phase of conversion of the results of the task analysis and concepts analysis into a learning goals.

At *design* phase, was a developed student worksheet based on problems that adapted from the cycle of *problem based learning* and writing form of this worksheets in the book Guide of Teaching Material's Development. phase. This phase aims to produce a student worksheets based on problems that have been revised by comments and suggestions from the validation team. This phase consists of 3 steps, namely validation revision and test the practicalities.

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3. RESULTS AND DISCUSSION

3.1. Result of Research

3.2.1. Define

In the define phase produce a 5 data, namely front end, students analysis, task analysis, concept analysis, and learning outcomes analysis.

a. Analysis Front-End
   In this analysis, the fact that obtained is the process of learning in rate of reaction matter using the worksheets and discussion sheets that have not lead students in finding the concept by themselves but used the concept by the teacher. Students can work the practice questions after reading the material and teacher's explanations. This resulted the students were not active in the learning process.
b. Students Analysis
   Based on observations in the learning process, it was known that students prefer learning by using interest teaching materials, used a pictures and color.

The student on grade XI of senior high school has an average age of 17 years old. According to Piaget, the thinking level of children in this age are formal operations developmentally. In general, characteristics of thinking teenager at this phase is to obtain the ability to think abstractly, reason logically and make a conclusions from the available information. According to the theory of the development of Piaget, the level of thinking the children aged 11 years old to adult has the ability to think logically and solve problems systematically [5]. By knowing and understanding the characteristics of the students, it would make it easier to design a student worksheet based on problems suitable for use by students.

c. Task Analysis

Based on the analysis of Basic Competency (KD), the next step was to formulate the learning indicators. Those are the indicators contained in the rate of reaction matter.

1. Understanding the concept of reaction rate based on the examples given.
2. Designing and conducting experiments about the factors that affecs the reaction rate in a group at the laboratory.
3. Analyzing the factors that affect the reaction rate (concentration, surface area, temperature, and catalyst) through the experiments.
4. Explaining the effect of concentration, surface area, and temperature on the rate of reaction based on the collision theory.
5. Distinguishing a diagram of activation energy and chemical reaction by using a catalyst and without a catalyst.
6. Determine the reaction order, rate equation and time of reaction based on the experimental data given.

The next step was designed the learning activities based on formulated learning indicators. These activities designed should make students achieved the basic competencies at the end of the lesson.

d. Concept Analysis

Analysis of the concept was the identification of the main concepts that should be learned by students. These were. the concepts in the reaction rate

1. Rate of reaction and reaction rate equation
2. Collision theory
3. Factors that affect the rate of reaction
4. Rate equation and reaction order

e. Analysis of learning outcomes

The learning outcomes in this matter is as follows.

1. Students are able to explain the concept of reaction rate based on the examples given.
2. Students are able to explain the collision theory and its relationship to the rate of reaction.
3. Students are able to explain the factors that affect the rate of reaction based on the collision theory.
4. Students are able to distinguish the activation energy diagram and a chemical reaction by using a catalyst and without the catalyst.
5. Students are able to calculate the reaction order, equation of reaction rate and reaction time.
6. Students are able to determine the order of the reaction based on experimental data.
7. Students are skilled in designing, conducting, and concluding, and presents the results of experimental about factors that affect the rate of reaction and the reaction order.

3.2.2. Design

The design phase was to design a problem based learning worksheet that were developed on reaction rate on grade XI of senior high school. These are steps were performed at this phase .

a. Selection the format

This phase was done by selecting the format of students worksheet based on the analysis in the define phase. Teaching materials developed in the study was in the form of teaching materials Student Worksheet.

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b. Design the student worksheet

At this phase, the result was draft of problem based learning worksheet on reaction rate matter. The format of this draft based on the book Guide of Teaching Material's Development. This format had been adapted to the phase of *problem based learning* that includes: finding the problem, problem analysis, discovery and reporting, integration and evaluation.

3.2.3. Development

The development phase aimed to produce a problem based learning worksheet that have been revised by the validation team, so we got a device that can be used in research. At this developtment phase was obtained the validity of research data and the practicality of the student worksheet.

a. Validity of Student Worksheet

The problem based learning worksheet on reaction rate matter that has been designed for was validated by two lecturers of chemistry at Faculty of Science and Mathematics, State University of Padang and two chemistry teachers. In the validation sheet was requested a comments and suggestions from the lectures and teachers. Based on that comments and suggestions, revision of this student worksheet was done before tested. These were the components revised based on suggestions of validation team.

1) Addition of work procedure on a model that can be experimented by students.
2) Change the "let's find" column, so the students can find a problems by themselves.
3) Change some images to be seen clearly.
4) Add the assessment table at the end of the answer key
5) Clarify some information on the model.
6) Add an exercises

The student worksheet was revised based on the comments and suggestions given by the validation team in validation sheet before tested the practicalities.

b. Practicalities Test of Student Worksheet

The practicalities of student worksheet were found from the use of the products based on limited testing in the school. This was regarding the practicality and feasibility of the developed products. Practicalities data obtained from the giving questionnaires to the chemistry teachers (questionnaire responses teachers) and students (students questionnaire responses). Here are the results of the practicalities analysis by questionnaire responses teachers and students.

Table 2. Results of Analysis the Practicalities of Student Worksheet by Teacher and Student Questionnaire Responses.

Subjects	Teacher	Student
The average of kappa moment	0.84 (Very high)	0.81 (Very high)

3.2. Discussion

3.2.1. Validation of Student Worksheet

The data of student worksheet's validity was obtained by asking for a comments and suggestions the validation team to worksheets. This student worksheet is validated by the 4 validation team, they are 2 chemistry lectures of FMIPA UNP and 2 chemistry teachers of SMAN 9 Padang. The selection of this 4 experts is based on the idea that to test the construct validity an instrument, can be used an expert opinion *(Expert judgment)* that a minimum number of 3 person [6].

Validation sheet was requesting the comments and suggestions of validation team to the product (Worksheet based on problems). Then,, based on that comments and suggestions given by the validation team, there were several components that must be repaired. Components that have been fixed were as follows.

a. Changing some images to be seen clearly. The good imageson the worksheet makes students easily to understand the purpose of draw / models.
b. Changing the "let's find" column, so that students can found the problem of the model by themselves.

   Before the revision, the "core questions column" students are given a problem that students are less analyze the existing models. Therefore, we can repairs the core question that the students who discovered the problem, so that students are more critical and reason the problems logically.
c. Adding a varied exercises for students to apply the concepts that have been discovery.

   Reproduced the exercises so that students not only solving the problems which associated with the concept, but also can solve the associated and varied problems. In addition, by addition the exercises, students more understanding and remembering a concept.
d. Adding the assessment table at the end of the answer key

   Addition assessment table on the answer key aims makes students know how many of the concepts that they have been understood. By knowing the assessment score, they can evaluate

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themselves so make an improvements to get better grades than before.

e. Adding a work procedure on a model that can be experimented by students.

With the work procedures, the students can be observing directly a process, because students will be more easily understood and more time for remembering a concept if they own look and feel.

According to the comments and suggestions given by the validation teams, the next step is revision the student worksheet based on problems in rate of reaction matter. The revised of this student worksheet then tested its practicality.

3.2.2. Practicalities of Student Worksheet by Teachers

The practicality of this student worksheet seen from the product use and the results of limited trial which regarding the practicality and feasibility of this products. A learning materials are said to be practical if the learning materials is able and easy to use and can be interpreted [7] .The practicalities test conducted by 3 chemistry teachers of SMAN 9 Padang.

Based on Table 2, the average of kappa moment by teachers responses questionnaire is 0.80 which has a high-level of practicalities. Overall, the practicalities by teacher responded was student worksheet is in conformity with the basic competencies and learning outcomes. The presented model has been able to facilitate students in finding the problem. The questions and the investigations have been able to guide the students in solving a problem that has been discoveried, and find their concepts. This also allowed the teachers to increase the activity of students in class. This means that the problem based learning worksheet based on reaction rate can be used in school learning activities.

In the aspect of the ease of the use, this student worksheet, had an average kappa moment of 0.79 which had high-level practicalities. This means that the materials on student worksheet was delivered simply, so easily to understood by teachers, and the clues in student worksheet was easily to understood by teachers. With the student worksheet, the students would have the ease in learning because there are a clues that easy to understand so that the learning process will be faster [8].

Among the 5 indicators on the aspects of the ease of use by teachers, in the 5th indicator student worksheets had a value of k = 0.50 with a medium-level of practicalities. The big and thick size of student worksheet caused it is not easy to carry anywhere.

In the aspect of learning efficiency, student worksheet had an average kappa moment of 0.80 with a high-level practicalities. This means that by the student worksheet, the time to learning becomes more efficient. This was consistent with one of the student worksheet function according to Widjajanti [8]. is that the student worksheet can be used to speed up the process of teaching and not me consuming in learning process.

In the aspect of student worksheet benefit, it had an average kappa moment of 0.89 which had a very high-level practicalities. This means that student worksheet could give a big benefits for teachers, one of them could increase the teacher's role as a facilitator. With the students worksheet, the teacher could monitoring and assess the performance of the students and a groups as well as obtain the information about student understanding through student activity in the learning process. By using student worksheet, the teacher did not need to explain too much material because students were required to be active in finding the concept by themselves, because the use of worksheets in the learning process could change the teacher-centered learning into a student-centered learning [9].

3.2.3. Practicalities of Student Worksheet by Students

In addition to teachers, the practicalities test was also conducted by 27 students of XI grade of SMAN 9 Padang.

An average of kappa moment for the practicalities of student responses questionnaire contained in Table 2 was 0,81 which was a very high-level practicalities. Overall, the practicalities which responded by student showed that the student worksheet allowed them to found the problem. The question of investigation lead the students to solve the problems and find the concept by themselves. The image whuch had a color can attract the attention of the students.

In the aspect of the ease of use, this student worksheet by had an average kappa moment of 0.80 which was a high-level practicalities. This means that the materials on student worksheet was delivered simply, so easily to understood, and the clues in student worksheet was easily to understood by students. By using the student worksheet, the students would have the ease in learning because there were a clues which was easy to understand, so that the learning process will be faster [8].

In the aspect of learning efficiency, the student worksheet had an average kappa moment of 0.79 which had a high-level practicalities. This means that by this student worksheets, the student could be studied with the speed of each others.

In the aspect of student worksheet benefit, it had an average kappa moment of 0.83 which was a very high-level practicalities . This means that the student worksheet had a benefits for students, one of them was to increase the student's interest through pictures and illustrations.. By using student worksheet, students could find their own concepts. Questions and models were easy to understand by students. The

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questions in the worksheet could guide students in finding their own concept, so the teacher did not have to explain too much material because the students were required to be active in finding his own concept. The student worksheet used in the learning process can change the teacher-centered learning into a student-centered learning [9].

The student worksheet based on problems that have been produced were still up on the practicalities of the test phase, it is suggested to other researchers to see the effectiveness of this worksheet in learning process. If this worksheet can improve learning outcomes, it is suggested that worksheet can be used in the learning process of reaction rate for class XI SMA / MA.

4. CONCLUSION

Based on research that has been done, then the result is the Student Worksheet based on problems in rate of reactiom matter for XI grades of senior high school. This Student Worksheet based on problems in rate of reaction matter is already valid and has a level practicalities by teachers and students is very high.

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ISBN 978-602-19877-3-5

THE EFFECT OF E-LEARNING ON CHEMISTRY LEARNING OUTCOMES IN INDONESIAN EDUCATION SYSTEM: A META-ANALYSIS

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ABSTRACT

The use of e-learning in teaching and learning process is a relatively new phenomenon in Indonesian education setting. Yet, studies on its implementation are continually growing. Literature search on Indonesian Publication Index and Google Scholar from 2015 and earlier revealed 49 studies on the implementation of e-learning in chemistry instruction. These papers were then condensed to 18 based on inclusion and exclusion criteria to find papers that investigated the effect of e-learning on chemistry learning outcome, which then further condensed to nine papers that compared learning outcomeson e-learning and conventional instruction and gave ample data for effect size calculation. Analysis showed thate-learning resultedsignificantly higher learning outcomes than did conventional method. The weighted mean effect size for nine studies was 1.08 with standard error, SE of 0.08 and 95% confidence interval of 0.92 to 1.24. This study analyzed heterogeneity and moderator variables to get general pattern of the effectivenessofe-learning on chemistry learning outcomes.

Index Terms— e-learning, learning outcomes, conventional learning, Indonesian education.

1. INTRODUCTION

e-learning is continually growing in educational setting around the world. The development of e-learning system, its implementation and theoretical study one-learning in teaching and learning process are rising in both developed and developing countries. Apparently, e-learning has brought impacts on learning performance, motivation and enjoyment on learning. In this study, a meta-analysis wasdone to understand the effect of e-learning on chemistry learning outcome.

1.1. e-learning and related terms

As the word implies, e-learningcan be defined as the use of electronic mediaor Information and Communication Technologies (ICT) in teaching and learning process. The media include stand-alone devices like audio/video tape, hard disc, floppy disc, CD/DVD-ROM; and networks like LAN and Internet, satellite broadcast, interactive TV (Govindasamy, 2002; Paris, 2004; Guri-Rosenblit, 2005; Cohen and Nycz, 2006; Ellis et al., 2009;Wilson and Gapsiso, 2014). As a result other terms like technology-based learning, computer-assisted learning, distributed learning, web-based learning, internet-based learning, and online learningare used interchangeably with e-learning(Tsai and Machado, 2002; Waight et al., 2002; Paris, 2004; Shakeb, 2011; Wilson and Gapsiso, 2014).

Some authors imply a specific meaning of e-learning while others explicitly describe e-learning in different definition (Moore et al., 2011). In its major breakthroughs, e-learning is defined as the use of Internet or web in teaching and learning process(Bates, 2001; Gunasekaran et al., 2002; Tsai and Machado, 2002; Nichols, 2003; Welsh et al, 2003; Zhang, 2003; Ruiz et al., 2006; Sun et al, 2007; Khumbar, 2009; Williams et al., 2011). Regardless of the definition, e-learning has brought impacts on how material is transferred to students. e-learning is not only for distance learningbut can be used in combination with face-to-face instruction (Anand et al., 2012). The latter system is called blended or hybrid learning.

Cohen and Nycz (2006) concluded that Learning Objects and software tools that aid in their development, storage, use in teaching, and administration are important aspects of e-learning. Learning Objects are raw materials of the system.Accessible locations to put learning objects are called Learning Object Repositories. It consists of two types. The first contains only metadata for learning object and the actual learning objects are stored in various location. The second type holds metadata and the learning objects in one location.

Khumbar (2009) learnedsix tools extensively used in e-learning. The first is Course Management System (CMS) or Virtual Learning System (VLS) or Content Management System (CMS) or Learning Management System (LMS) or Learning Content Management System (LCMS). TheyincludeMoodle, Sloddle, Lectureshare, elementK, Blackboard, AuthorIT, E-learning Solution, etc. The other tools include blogs, wikis, email, Messenger, and e-learning 2.0.

1.2. Challenges for e-learning

There are four major challenges of e-learningin both developed and developing countries (Andersson and Gronlund, 2009). They include courses, individuals, technology, and context. Challenges in courses include the depth of curriculum, subject content, pedagogical model, and teaching and learning activities implemented. Students' motivation, conflicting priorities, academic and technological confidence, students' economy, teacher's competence

ISBN 978-602-19877-3-5

are some factors that affect students' retention to take e-learning courses. Individual challenges are stressed in developed countries.

Technological issues relate to cost, usability, appropriateness of technology (Qureshi et al., 2012), network security, bandwidth, storage solution (Frehywot et al., 2013), and infrastructure. Contextual challenges include organization's management on schedule and financial for e-learning (Zoroja et al., 2007), and cultural and societal issues (Quimno et al., 2013). These two categories of challenges are emphasized in developing countries.

1.3. Advantagesof e-learning

Waight et al. (2002) summarized nine benefits of e-learning including cost effectiveness (Agariya and Singh, 2012; Welsh et al., 2003), lifelong learning (Gunasekaran et al., 2002), global customers (Welsh et al., 2003), personalization, collaboration and interactivity (Capper, 2001), learner centeredness, just-in-time access to information, increased learner diversity, and blurring of lines between learning and work. In addition, e-learning can improve tracking (Welsh et al., 2003), reduce information overload, provide asynchronous interaction, offer learning at any time and any place (Capper, 2001), be consistent and repeatable, and provide convenience to user (Gunasekaran et al., 2002). In rural areas, e-learning helps develop social and mental ability, and fills the gaps between educated developed cities and rural undeveloped areas (Anand et al., 2012).

Students who find the technology easy to use and useful for their course work have a positive attitude towards e-learning (Adewole-Odeshi, 2014). Students discover that e-learning appears to be at least as effective as traditional instructor-led methods such as lecture (Ruiz et al., 2006). e-learning can be a superior instruction if it provides timely and meaningful feedback from instructor and is targeted to learner with specific style like visual, read/write learning style (Eom et al., 2006) and assimilator and converger learning style (Manochehr, 200). Kekkonen-Moneta and Moneta (2002) found that online students outperform lecture students in computing course. In the same fashion, web-based application in e-learning encourage students to engage with materials in a timely and active manner leaving them outperform students who learn through traditional instruction (Scida and Saury, 2006).

1.4. History of e-learning

e-learning has its roots on the invention of Internet in the mid-20th century. Internet has expanding the spread of knowledge through online education which then made education became more viable to distance students (Harasim, 2006). Figure 1 represents brief history of e-learning.

In Indonesia, Universitas Terbuka (Open University) first implemented distance education. The system has been conveying knowledge through radio broadcasting, TV, CD-ROM, and distributed printout materials. Nowadays, it also uses Internet to reach the students.

With the advance of ICT, there have been 34,628 schools and universities that have access to the Internet (Wikipedia, retrieved August 22, 2015). Several universities including schools in Indonesia have implemented e-learning in teaching and learning activities. Most of them use Moodle as an open source e-learning software. Some of the institutions adopt and implement the whole features of Moodle, some of them modify and add other features for their e-learning system. Some instructors may simply use web blog for e-learning.

YEAR		EXAMPLE
1861	*Telegraph is Invented*	
1876	*Telephone is Invented*	
1969	*Computer data networking is Invented (ARPANET)*	*DARPANET/ARPANET*
1971	*Email is Invented*	
1971	*Computer Conferencing is Invented*	*1971*
Mid 70's	University Courses are Supplemented by Email and Conferencing	
Mid 70's	Virtual Communities of Practice	Scientists use EIES to colaborate
1981	First Totally Online Courses (Nonformal, Adult Education)	The Source; EIES
1982	First Online Program (Executive Education)	• WBSI Executive Education (EIES)
1983	Networked Classroom Model Emerges (Primary and Secondary Schools)	• ICLN Research Project in 4 Countries • RAPPI: Canada X-Cultural Project I Countries • SITP (1990)
1986	First Totally Online Undergraduate Classroom	• Virtual Classroom (NJIT)
1985	First Totally Online Graduate Courses	• Connect-Ed (New School of Social Research) • OISE (University of Toronto)
1985	First Totally Online Labour Education Network	• Solinet (Canadian Union of Public Employees)
1986	First Online Degree Program	• Connect-ED (1986) • 1989 University of Phoenix
1986	Online Professional Development Communities Emerge	• OISE Ontario Educators Online Courses
1989	*Internet launched*	
1989	First Large Scale Online Courses	• Open University (U.K)
1992	*World Wide Web is invented*	• *CERN (Switzerland)*
1993	First National Educational Networks	• 1993 SchoolNet (Canada) •
1996	First Large-Scale Online Education Field Trials	• Virtual-U Research Project

Figure 1. Brief history of e-learning (source: Harasim L, 2006)

In this study e-learningwas defined as the use of CMS/VLS/LMS/LCMS, Blogs, email, Wikis, messenger and other form that use Internet in teaching and learning process.

1.5. Meta-analysis

Meta-analysis is a procedure to systematically and statistically summarize findings of several previous quantitative studies by examining the sample size and the effect size of each study included (Best and Kahn, 2006). The effect size is the difference between mean score of the experimental and that of the control groups. Effect size can also be converted from t-ratios, F-ratios, percentages, and correlational coefficient (Borg and Gall, 1989). The mean of the effect sizes for all studies included is then calculated to estimate the typical effect of the phenomenon under study.

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2. METHODOLOGY

2.1. Literature search

Relevant studies were located through a comprehensive search of publicly available literature published from 2015 and earlier. Data sources and search tool used were Indonesian Publication Index (IPI) and Google Scholar. The searched terms included e-learning, online learning, distance learning, Internet, web, blog, Moodle, LMS, chemistry, learning outcome, learning performance, Indonesia. From IPI website, researcher was directed to website of online journal of some universities in Indonesia. Below are journals and/or universities from where articles were cited:

a. Jurnal Chemica, Universitas Negeri Makasar.
b. Jurnal Inovasi Pendidikan Kimia, Universitas Negeri Semarang.
c. Jurnal Jurusan Pendidikan Kimia, Universitas Pendidikan Ganesha.
d. Jurnal Pendidikan Kimia, Universitas Sebelas Maret.
e. Jurnal Pendidikan Kimia, Universitas Lampung.
f. Jurnal Riset dan Praktik Pendidikan Kimia, Universitas Pendidikan Indonesia
g. Jurnal Pendidikan dan Pengajaran.
h. Universitas Negeri Medan.

2.2. Screening process: inclusion and exclusion criteria

Screening of the research studies was carried out by scanning the abstract and result in the full-text article. The initial electronic database searches yielded 49 articles. Abstracts and full-text of these studies were examined to ascertain whether they met the following three initial inclusion criteria: (1) the study addressede-learning as this study defines it; (2) thestudy appeared to use a controlled design (experimental/controlled quasi- experimental design); and (3) the study reported data on student achievement or another learning outcome; (4) the study providedample data to compute effect size.

During the first screen, 31 articles were excluded because they did not measure the effect of e-learningon learning outcome or performance. Seven articles did not use experiment or quasi-experimental design in the study nor it contrasted learning outcomes of e-learning and conventional method. As a result at the second screening only 11articles were included. The final screening resulted 9 articles for they provided ample data for computing effect size. Articles included are presented in table 1.

Table 1. Analysis of included articles in the study

No	Author	Year	Methodology	Topic	Education level	Mode of study	Theory explicited	Technology used	N	g	SE	95% CI for g (Lower / Upper)
1	Astuti, P	2010	Experiment	Gasoline	Grade XI	e-learning Vs. Books &Worksheet	Problem solving (applied to both mode)	Webblog	62	0.524	0.255	0.030/ 1.031
2	Sandi, G	2012	Quasi-experiment	Hydrocarbon	Grade X	Blended learning Vs. Conventional	Student-centered Vs. Teacher-centered	Moodle, e-mail, chating)	152	0.386	0.163	0.068/ 0.707
3	Pratiwi et al.	2013	Experiment	Hydrocarbon	Grade X	Blended learning Vs. Conventional	Team-Games-Tornament (applied to both mode)	Facebook	64	0.875	0.259	0.379/ 1.393
4	Juniar et al.	2013	Experiment	Colloidal system	Grade XI	e-learning Vs. Conventional	Number Head Together (applied to both mode)	Webblog	80	1.034	0.236	0.582/ 1.507
5	Lumban Batu,' V.V.	2013	Experiment	Hydrocarbon	Grade X	e-learning Vs. Conventional	STAD (applied to both mode)	Webblog	80	1.278	0.243	0.814/ 1.768
6	Juniar and Hannum	>= 2013	Experiment	Rate of reaction	Grade XI	e-learning vs. Conventional	Contextual learning (applied to both mode)	Webblog	80	2.364	0.290	1.819/ 2.955
7	Juniar et al.	2014	Experiment	Atomic structure & Periodic table	Grade XI	e-learning Vs. Conventional	Think-pair share (applied to both mode)	Webblog	80	1.398	0.247	0.927/ 1.897
8	Lubis, D. E	2014	Experiment	Colloidal system	Grade XI	e-learning Vs. Conventional	STAD (applied to e-learning)	Webblog	72	1.342	0.259	0.850/ 1.863
9	Pane, E. M	2014	Experiment	Colloidal system	Grade XI	e-learning Vs. Handout	Number Head Together (applied to both mode)	Webblog	80	1.815	0.264	1.315/ 2.350

2.3. Data analysis

To avoid bias of sample sizes, Hedges' g was used to calculate the effect size of the studies; suitable for both small and big sample size (Turner and Bernard, 2006). Hedges'*g* is actually Cohen's *d*—which uses the pooled standard deviations of both groups in the denominator—with a correction factor for use with small sample sizes.The precision of each

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mean effect estimate was determined by using the estimated standard error of the mean to calculate the 95% confidence interval.

$$g \cong \left(1 - \frac{3}{4N - 9}\right) d$$

2.3.1 Test of homogeneity

Next, effects sizes were tested for homogeneity.Homogeneityanalysisis necessary to check if all studies come from the same population or not.The test for homogeneity (Q), based on Hedges and Olkin (1985), can be used to determine whether the effect sizes of the studies were homogenously distributed. Q value is tested againsta chi-square distribution to find the significance. To calculate the extent of heterogeneity, I^2 statistic can be used for the analysis (Huedo-Medina et al., 2006). I^2 value is calculated from Q value with formula 1 below.

$$I^2 = \begin{cases} \dfrac{Q - (k-1)}{Q} \times 100\% & \text{for } Q > (k-1) \\ 0 & \text{for } Q \le (k-1) \end{cases} \quad \text{(formula1)}$$

2.3.2 Moderator Variable Analysis

When chi-square value from the heterogeneity test is significant, then moderator variables are present to explain differences of the outcomes observed across studies (Möser and Schmidt).Effect size comparisons were done for the variables: mode of learning, pedagogy learning experience, and content area (topic). Q test statistic is computed for studies within each of the *J* level (number of comparison)of the moderator resulting Q_j. The difference between levels of the moderator from overall statistic for all studies (Q_T) can be tested using a between-groups statistic (Q_B), like formula 2. By comparing the value of $Q_B$to chi-square distribution (df = j-1), the significance ofthose categorical moderators to the studies' effect size is known. The analysis is presented in Table 2.

$$Q_B = Q_T - \sum_{j=1}^{J} Q_j \quad \text{(formula2)}$$

Table 2. Test of moderator variables

No	Variables	Contrast	k	Weighted Mean Effect Size	SE	Lower limit	Upper limit	Q Statistic
1	Mode of learning	Purely online (e-learning)	7	1.351	0.097	1.160	1.541	23.827*
		Blended learning	2	0.523	0.139	0.251	0.796	
2	Pedagogy learning experience	Same approach implemented	7	1.286	0.097	1.096	1.477	13.847*
		Only applied to e-learning (student centered and STAD)	2	0.656	0.139	0.384	0.928	
3	Topic [a]	Hydrocarbon	3	0.706	0.121	0.470	0.943	12.169*
		Colloidal system	3	1.369	0.147	1.082	1.657	

[a] The moderator analysis for this variable excluded studies that did not report information for this feature. *p < .05.

Fixed-effect meta-analysis was performed because it was assumed that each study was estimating the same quantity and the underlying true exposure in each study was the same. The difference of effect sizes in the meta-analysis wasmainly due to sampling error and they actually all shared a common mean.

3. RESULT

Among nine, seven studies contrasted face-to-face instruction with purely online learning while the other two contrasted it with blended learning. The individual effect size estimates included in this meta-analysis ranged from a low of +0.39 to a high of +2.36. The mean effect size for overall nine studies was +1.08. The mean effect size for seven purely online learning studies was +1.35while that for blended learning was +0.52.The Q test for overall nine studies yielded a significant chi-square result (Q_T = 53.61, p < 0.05). The I^2 for the homogeneity was 85.08 %.Seven studies that contrasted purely online learning with classroom instruction had a significant Q test value (Q_T = 27.27, p < 0.05). On

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the other hand, two studies that contrasted blended learning with classroom instruction had insignificant Q test value (Q_T = 2.51, p > 0.05).

The test of moderation indicated that the mode of learning was a significant moderator of the effect sizes, χ^2(1, *N* =750) = 23.83, p <0.05). When considered separately, the effect sizes from purely online learning were heterogeneous, χ^2(6, *N* =534) = 27.27, p <0.05);yet the effect sizes from blended learning were homogeneous, χ^2(1, *N* =216) = 2.51, p >0.05). Students' learning outcome was higher through e-learning mode than it was through blended learning mode (weighted mean effect size 1.35 > 0.52).

Next, it was found that added pedagogy learning experiences was a significant moderator of the effect sizes, χ^2(1, *N* = 750) = 13.85, p <0.05). When considered separately, the effect sizes from the same treatment (same pedagogical approach implemented) in both e-learning and conventional method were heterogeneous, χ^2(6, *N* = 526) = 30.13, p <0.05); as the effect sizes from different treatment (added approach implemented only to e-learning class) were heterogeneous, χ^2(1, *N* = 224) = 9.63, p <0.05).

Lastly, it was found that topic taught in e-learning was also a significant moderator of the effect sizes, χ^2(1, *N* = 528) = 12.17, p <0.05). When considered separately, the effect sizes from Hydrocarbon topic were heterogeneous, χ^2(2, *N* =296) = 9.68, p <0.05); yet the effect sizes from Colloidal topic were homogeneous, χ^2(2, *N* =224) = 4.80, p > 0.05). Yet again, learning outcome was higher in Colloidal topic than it was in topic of Hydrocarbon (weighted mean effect size 1.37 > 0.71).

If analysis was applied to studies of purely online learning (k=7), null hypothesis was rejected (Q_T = 27.27, p < 0.05). Test of moderation on topic and extra pedagogy experience in e-learning done revealed insignificant moderation effects for both categories (Q_b was 0.10 for topic and 0.00 for added experience in e-learning). The mean effect size for Colloidal system topic was (+1.37) higher than that for Hydrocarbon topic (+1.28). The mean effect size for added pedagogical experience in e-learning system was (+1.34) lower than that for the same experience implemented in both e-learning and conventional method (+1.35).

4. DISCUSSION

On average, e-learning (purely online and blended learning) resulted higher learning outcomes than did conventional method. The overall analysis showed that all studies had significant positive effect (none of the effect size included zero and negative value in their confidence interval), favoringe-learning (purely online and blended learning). The effect size ranged from g = +0.386(d= +0.388) to g = +2.364 (d= +2.387).It indicated that the strength of effect sizes ranged from small to large positive effect size (Cohen, 1988). In other wordse-learning resulted better learning outcome than did conventional method with degree varying from small, medium to large.

Nine articles studied gave heterogeneous result on effect size; the effect sizes were significantly different across studies. The I^2 for all studies, 85.08%, indicated that heterogeneity was considerably high (Deeks, 200). This large variance among effect sizes value was not only due to sampling error but might also be a result of other factors named moderator variables.

Test of moderation showed thatmode of learning, different pedagogical experience implemented, and topic taught in e-learning were all significant moderators of the effect size. In contrast to earlier studies ((Means et al., 2013), the mean effect size for purely online learning (+1.35) was higher than that in blended learning (g = +0.52). Yet again, Q statistic of studies on purely online learning showed high heterogeneity. This result insisted for exploration of more variables to explain the difference in effect sizes. The big positive effect of e-learning must be influenced by other factors that could not be defined in this study. Blended learning, on the other hand, though having effect with medium strength revealedhomogeneous distribution of the effect sizes.

Three studies measured the Colloidal system, a topic thatdoes not cover calculation (no worked-out example needed). The same number of studies measured Hydrocarbon, a topicwith many worked-out examplerequired. Of both, the mean effect size of learning outcome for Colloidal system appeared larger (+1,37) than that for Hydrocarbon (+0.71).

Consistent with earlier analysis, two studies in Hydrocarbon topic that used blended approach had smaller mean effect size (+0.52) than the other one that used purely online learning mode (+1.28). When analysis was done on studies of purely online learning, the mean effect size was still larger in Colloidal system topic (+1.37) than that in Hydrocarbon topic (+1.28). Reasonably explanation might relate to the need of modeling or direct lecture from teacher on concepts that require drill and practice like those in Hydrocarbon topic. e-learning should provide enough materials for students to study and practice, otherwise students will not get benefit for either the process or the outcome.

4.1 Implication for further research

It is recommended that experimental and controlled quasi-experimental designs report the practice features of both experimental and control conditions. For comprehensive result on meta-analysis, it is encouraged that studies use various types of technology, pedagogical approach, topics, level of education, and other features to understand the effect of e-learning in learning performance.

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ISBN 978-602-19877-3-5

EARLY PROFILES OF GENERIC SKILLS PRESERVICE CHEMISTRY TEACHERS OF JAMBI UNIVERSITY

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ABSTRACT

Descriptive study was conducted analysis of the early profile of the generic capabilities initial preservice teachers in basic chemistry Class. We have conducted at 45 research subjects include of chemical education student Jambi University (preservice chemistry teacher) who took a course of advanced basic chemistry. Among other benefits of research as a foundation to create learning programs that develop basic chemistry generic skills. The results showed that the initial generic capability profiles in basic chemistry lectures covering generic skills profile modeling is relatively low (54.0), inference logic is low (40.7), and the causal is low too (45). Thus, in general, when the Advanced basic chemistry will be implemented, the students already have generic skills, but still relatively low (mean = 46.3) thus needs to be improved through the development of device-oriented class on generic skills and the integration of the generic skills in the basic chemistry teaching.

Index Terms— *Generic skill, preservice chemistry teacher, basic chemistry*

1. INTRODUCTION

Generic skills are of the most important capabilities and professional needs for the preservice chemistry teachers in order to gain successful in their professional works in schools as well as in other educational fields.

These skills are not suddenly appeared inside the preservice teachers (students), but they need the process of learning through a training program and lecturing as well. In order for obtaining maximum results, the students should be capable and proficient in determining variables, formulating the problem, solving problems, and others.

Generic skills are basic skills that need to be owned by prospective teachers. Hoddinott and Young stated that generic skills are not specialized disciplines, own generic skills include problem solving, critical thinking, analysis, communication, technology skills, and cooperation [1]. Generic skills is also known as key skills or core skills (core ability). The role of generic skills are essential in order to support learning and emphasis on aspects of the process and products of science. It is based on learning objectives chemistry as a process of improving students' thinking skills, so that students are not only capable and skilled in the field of psychomotor, but also able to think systematically, objectively, and creatively. To give greater emphasis on aspects of the process, students need skills such as observing, classifying, measuring, communicating, interpreting the data, and experiment gradually in accordance with the level of students' thinking skills and course materials are in accordance with the curriculum Sumaji [2].

Undiscovered a specific research on generic skills, especially related of lectures to basic chemistry. Generic skills can be described as "new" that has not been developed or are classified experts. For example, until now scientists have not much to formulate a detailed and complete information about generic skills, especially in the field of chemistry. This is a challenge for scientists to chemical development efforts.

Generic skills should have been owned by the preservice teachers of learning experiences that have been lived, but the mastery of high and low will be influenced by whether or not a lot of experience gained and how their profile especially in basic chemistry lectures are questions that need to be investigated to obtain the answer. Generic skills of preservice teachers (students) and are often less likely to get attention. Examples of skills in making a graph, they often experience significant difficulties and they also do not know exactly what to do to make the chart appropriately. In addition, the use of mathematical symbols are also not getting enough touches means of various parties lecturers. Whereas generic skills in using mathematical symbols are very important for student teachers.

Given the importance of generic skills seen in lectures basic chemicals, then crawl through the research conducted at the generic skills possessed by preservice teacher as initial information for the development of the lecture will be held. Generic skills which is certainly captured as a result of the formation prior learning experiences that chemistry teaching in high school, of lectures or learning basic chemical one another. Chosen as the basic chemical materials in dripping and materials to be developed are given this material is deemed relatively rich with generic skills.

In connection with the above, it should be sought or dug generic skills that exist in the basic chemistry learning, it became the foundation as an aspect that can be applied for the benefit of education, especially in chemistry education. How much learning

ISBN 978-602-19877-3-5

basic chemistry can develop generic skills on preservice teachers are things that need to be known for the improvement and development of future teaching program. Development of generic skills is inseparable from the development of thinking skills and cognitive strategies learners [2]. The purpose of this study was to determine the early profile generic skills preservice teachers in advanced basic chemistry

2. METHODOLOGY

2.1 Methods

The method used in this research is descriptive analysis method.

2.2 Subjects

The subjects of this study were first year students of Chemistry Education who take advanced basic chemistry in a higher education institutions. Number of subjects were as many as 45 students.

2.3 Instruments

The research instrument in the form of generic skills tests such as tests stuffing. This test has been tested and have high validity (r = 0.67), and the reliability Cleaner ($\alpha = 0.76$)

3. RESULTS AND DISCUSSION

3.1 Results

Early generic skills profile data on the class of advanced basic chemistry preservice teachers as showed in Table 3.1

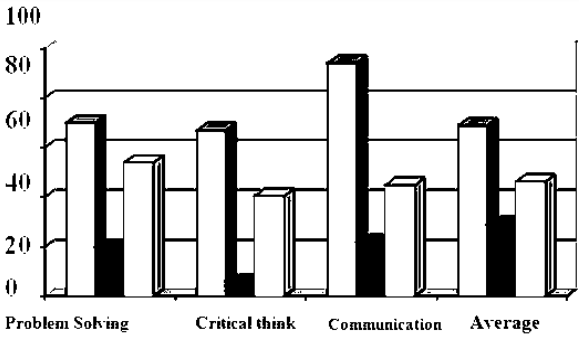
Table 3.1 Early generic skills profile data preservice teacher of on the class of advanced basic chemistry

Statistic	Lectures of Basic Chemistry		
	Problem solving	Crtical Thinking	Communication
Average	54	40,7	45
SD	12	15,5	16
Min	20	6	22
Max	70	67	94

Described that. Generic skills could be captured from basic chemistry of class skills include problem solving, critical thinking, and communication. The average value of generic skills acquired are as follows: problem solving is relatively low (54.0), critical thinking is relatively low (40.7), communication is relatively low (45.0), and the overall generic skills in basic chemistry lectures 2 students prospective teachers was low (46.3). However, it turns out individually among them were thinking about memampuan generic classified as moderate (such as problem solving and critical thinking = 70 = 67) and high (as in communication = 94)

3.2 Discussion

To facilitate in discussion, the results of research in table 3.1 above can be observed in the graph 3.1.



Graph 3.1 early generic skills profile preservice chemistry teachers' college of basic chemistry 2

Based on these research results, as shown in the graph 3.1 could be argued that prospective teachers have had generic skills before of advanced basic chemistry class carried out, although the average value is relatively low (46.3). Generic skills is likely to grow as a result of preservice teacher implement previous lectures on basic chemistry courses 1. generic skills itself on the basic chemistry lectures 2 is not developed and trained. Thus, their skills grow because of the way he thinks.

In general that generic skills of problem solving, critical thinking, and communication has been owned by preservice teachers, although still relatively low. This would be the foundation in order to support the development and improvement aspects of the generic skills in college-tuition next. As it is known, that the generic skills necessary to practice a long time [2], thereby melatihkan generic skills that need to be repeated.

The results of previous studies of interest that arise from Mubarrak [3] reported that the view that generic skills is defined as the skills gained from learning or training that can be applied or adapted to new situations and different. Generic skills have distinguishing characteristics and resembles a group of related skills, yet meet the needs and challenges of increased workplace at different times as the progress of technological change, social and context changes. This view is consistent with the objectives of science education according to Hodson (1992); Salganik and Stephens (2003) in Mubarrak [3], namely: (a) study science, to understand the ideas generated by science (ie, concepts, models, and theories), (b) learn about science, to understand the important issues in philosophy, history and methodology of science, and (c) learn to use science, so that students are able to perform activities embody leadership and scientific knowledge in life.

Generic skills as an instrument to overcome the problem of skills needs at the present time (days) and in the future. Is based on the anticipation of skills needs in social change, technology and global

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competition. Increased generic science skills of students who achieved as described above can not be separated from the important role the learning process. Learning process on the concept of translational rotation, resonance, and oscillations successful spring associated with the planning, implementation, and evaluation of outside models are implemented. The importance of managing the learning process starts from the goal setting sebangaimana opinion of Smith et al [3]. the establishment of common goals and objectives in each program or curriculum planned always involve a common generic term anyway. Guidance on the selection of the developers of the curriculum to skills necessary for social functions and the achievement of human development effort for all time. This is in accordance with the results of studies showing the generic role of science in the life in the future is needed by student teachers.

4. CONCLUSION

Early generic skills profiles were identified on advanced basic chemistry class includes generic skills of problem solving, critical thinking, and communication. Generic skills for problem solving (54.0), critical thinking (40.7), and communications (45). Thus, in general, when the advanced basic chemistry class will be implemented, the preservice teacher already have generic skills, but still relatively low (mean = 46.3) thus needs to be improved through the development of programs and devices lecture oriented generic skills and the integration of generic skills the basic chemistry in lecture 2.

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ISBN 978-602-19877-3-5

DESIGN AND IMPLEMENTATION OF CHEMISTRY TRIANGLE ORIENTED LEARNING MEDIA ON HYDROCARBONS

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ABSTRACT

Chemistry learning should be displayed with 3 chemical representations which are macroscopic, microscopic and symbolic.These made students easily to learn chemistry. Macroscopically, chemical phenomena can be studied by students through laboratory work, but it was sometimes not done at schools. Micrroscopic representation can be presented in animated form. One of the alternatives that can be done to help students understand the concept of hydrocarbon material is Chemistry Triangle-oriented learning media, This Multimedia presents the concept of chemistry with the three types of representation, namely, the macroscopic, microscopic, and symbolic. Learning media can enhance students' motivation and be enable students to learn independently. The aim of this study was to design the valid and practical Chemistry Triangle-oriented learning media and revealed the impact of the use of the media to the learning outcomes of students that suitable to low , medium and high skill level. This experimental study was started from designing Chemistry Triangle-oriented instructional media, doing validation and testing practicality of the media. This valid and practical media was used to high school students low, medium and high skill level. There were three senior high schools chosen as experimental class. Achievement test were analyzed by using t-tests and two-way ANOVA. Results of this study showed that the learning outcome of students using Chemistry Triangle-oriented learning media significantly higher than students who learned without using media. Chemistry Triangle-oriented learning media is suitable for students who are capable of low, medium or high ability. There is no interaction between the use of instructional media and chemical capabilities of students in influencing their learning outcomes

Index Terms— chemistry triangle, instructional media , learning outcomes

1. INTRODUCTION

The progress of a nation is determined by the quality of human resources. One way to improve the quality of human resources is through the learning. Learning is a process of interaction of students with teachers and learning resources in a learning environment. The learning process needs to be planned, implemented, evaluated and monitored in order to run effectively and efficiently (regulations of national education minister 2007;6)

Chemistry is a science that is acquired and developed based on experiments. Chiu (2005: 1) declare the experiment in chemistry filled with interesting phenomenon, in activities such experiments produce knowledge that is always developed and very complex. Nahum (2004: 302) adds that the complexity and abstractness of chemistry to make students have difficulty explaining chemical phenomena in macroscopic and sub-microscopic.

Chandra seragan (2007: 294) argues that the concepts in chemistry presented in three levels of representation, ie, macroscopic, submicroscopic (molecular) and the symbolic. The three level of the representation also known chemistry triangle. Macroscopic representation is a representation which describes most tangible and visible nature of the phenomena in the everyday experience of students. Submicroscopic representation (molecular) is an explanation of the phenomenon on the level of particles (atoms, molecules or ions). Symbolic representation (symbol) is a representation using chemical symbols, formulas, equations, models and computer animation to symbolize substance. These three levels are inter-related representation and an important character in learning chemistry. To develop students' understanding of chemistry, learning should guide students to use and connect the three levels representation (Wu, Krajcik and Soloway, 2001: 822). Learning which does not include all three levels of this representation will make students have difficulty in understanding the chemistry of matter as a whole.

Most students think that chemistry is a science that is difficult to learn, because chemistry is study of invisible atoms, intangible and abstract concepts. Consequently, students have difficulty in making the connection between the concepts contained in chemistry such as the relationship between macroscopic and submicroscopic. This difficulty can

ISBN 978-602-19877-3-5

be caused by limitations of the completeness of the facilities that support learning activities, such as learning media, lab equipment, time constraints, as well as other facilities and infrastructure.

Learning can be effective when all the components that affect learning support each other in order to achieve the goal. One component that is very influential in the current study is the use and selection of appropriate learning media in order to improve the ability of students.

Technological developments have changed the paradigm in information and communication, which is no longer limited by time and space. Through technology where they can get the needed information wherever and whenever. Forms of popular technology today is the computer. Computer can input various media attributes such as color, motion, and sound can be created interactively. Kozma (1991: 2) states that the media attributes of learning using computer technology good to use in exploring the concepts and principles of the material, especially science.

To solve the problem of learning process mentioned above, can be done by utilizing the efforts of the various advantages possessed by computer technology. One advantage of computer-based learning media is to provide convenience to combine images, videos at the macro level, graphics, animation at the micro level with voice, text and chemical symbols on a symbolic level (Thompson, 1994). Completeness media in interactive multimedia technology involves utilization of all five senses, so that the power of imagination, creativity, fantasy, and student emotional well-developed.

The subject matter of hydrocarbons, besides containing the theoretical concepts, must also be accompanied by laboratory experiments . Practical implementation of the subject matter of the hydrocarbons would assist students in achieving basic competencies and indicators desired. Schools must be equipped with chemical laboratory to perform this lab work, but in general, chemistry lab at High School has not run smoothly. Various reasons no practical implemented partly because the tools and materials for the lab were not enough, a shared laboratory for learning biology and so on. The aim of this study is to produce Triangle Chemistry oriented instructional media on hydrocarbons and determine the impact of using media on students learning outcomes

This media can be used by chemistry teachers in schools that do not have laboratory facilities or schools that have inadequate laboratory facilities to assist the learning process. The media can also be used by students to study independently at home to repeat material already learned. Other uses of instructional media were as self-learning material for students who have better level of thinking skills.

This Learning Media also equipped with student worksheet (LKS). LKS aims to facilitate the use in carrying out the study. According to the Ministry of Education (2008: 13), the advantage of LKS is to facilitate students in independent study and understand the subject matter. The use of instructional media and LKS were expected to enrich the learning experience of students.

2. METHODOLOGY

2.1 Research Design

This study consisted of two phases. First step, study design based on the principles of research and development. The instrument were used in this phase was the validation and observation sheets and also questionnaires to teachers and students. The Second step were used a quantitative approach in form Quasi Experimental Design. The design used in this study was a Randomized Control Group Only Design. The selected sample in this study was 88 students in the experimental group were taught by Chemistry Triangle-oriented instructional media, and 88 students in the control group were taught with conventional method (without Chemistry Triangle-oriented media)

2.2 Procedures

Development of Chemistry Triangle-based learning media uses 4-D models. First of all, done the needs analysis to determine what obstacles faced in chemistry learning at school and to know what kind of chemistry learning desired by the students. Analysis of Competency Standards and Basic Competencies were done to determine how the hydrocarbons should be studied and what concepts should be known to the students. At this stage also analyzed the characteristics of the students.

Secondly, the results of the first phase (defining phase) were used as a basis in the second phase (designing phase). After learning indicators formulated, as well as the main concepts set out the next step is to design chemistry triangle -oriented media and Student Worksheet (LKS) on the material hydrocarbon. It also drafted the manuscript that contains material that is conveyed through animated images

Chemistry triangle-oriented learning media is composed of three levels of representation, namely the macroscopic displayed in the form of video demonstrations, submicroscopic level and symbolic form in animated images. The design phase consists of four steps: a) Early design of learning media, b) taking pictures for a concept that can be practiced through the experiment to be made a video, c) The process of editing, were done using software Corell Video Studio Pro 4 d) Phase designing on the computer using Macromedia Flash 8. The components are inputted into the media were the visualization of the macroscopic, submicroscopic and symbols in detail can be mentioned as images, graphics, text,

ISBN 978-602-19877-3-5

audio and video recordings, chemical equations and symbols of elements.

Thirdly, chemistry triangle -oriented learning media was validated by chemistry education lecturers and teachers as media users. Media be revised as suggested by validator. After revision is complete, this learning media was implemented to 30 students to see the practicality and effectiveness of the media.

Finally, the media were used in actual learning process at three schools that is high school students low, medium and high skill level. This is done to determine whether Chemistry Triangle oriented learning media can be used for students with all levels of academic ability.

2.3 Instrument

Type of data collected in this study are primary data. In order to develop Chemistry Triangle oriented learning media , firstly, validation sheet were used to know content and construct validity of learning media (multimedia, work sheet and evaluation tools)

Secondly, questionnaires were used to know the response of students and teachers after learning media was implemented. It was done to know the practicality and effectiveness of the media. Achievement test also be done to know students' understanding of the concepts on subject matter.

Finally, this valid, practical and effective media was implemented to senior high school students that suitable to low , medium and high skill level. There were three senior high schools chosen as experimental class. Achievement test were analyzed by using t-tests and two-way ANOVA. The instrument used in this study can be seen in Table 1.

Table 1. Types of Data and Research Instruments

No	Data Types	Instruments	Respondents
1	Content and construct validity	validation sheet	chemistry lecturers Chemistry teachers
2	Validity media design	validation sheet	lecturer of instructionsl media
3	practicalities	questionnaire	Chemistry teachers & students
4	effectiveness	Achievement test	students
5	learning outcomes	Achievement test	students

2.4 Data Analysis

1. Validity of linguistic, construct and content , as well as the practicalities of media were analized based on the modified categorical judgments of Boslaugh (2008). Validator's assessment for each statement was analyzed using formula of Cohen Kappa where at the end of processing obtained Kappa's moment

$$Kappa's\ moment\ \ (k) = \frac{P - Pe}{1 - Pe}$$

Description:
k = kappa moment which indicate the validity of the product
P = proportion realized, is calculated by the amount of score that is given by the validator divided by the maximum score
Pe = The proportion of unrealized, is calculated by the amount of the maximum score is reduced by the amount of the total score of the given validator divided by the maximum score

Category decisions based on kappa moment (k) (Boslaugh, 2008):
0.81 to 1.00 = validity / practicalities very high
0.61-0.80 = Validity / high practicalities
0.41-0.60 = Validity / practicalities of being moderate
.21-.40 = Validity / low practicalities
.01-.20 = Validity / practicalities very low
0,00 = Invalid / impractical

2. Data of learning outcomes were obtained from implementation the learning media in three schools were analyzed using t-test and two-ways ANOVA

Result and Discussion

Observation results and interviews with teachers and students concluded that teachers usually teach these hydrocarbon materials just by using the lecture method and teaching materials that are used only textbooks. The teacher has not used chemistry instructional media in accordance with the characteristics of the material and technological developments. In learning process, students just listen the explanations from the teacher, without directly observing, like learning using the media. Conventional methods used by teachers lead students difficult to understand chemistry as a whole. It was the basis for researchers interested in creating and developing this instructional media.

Based on the level of cognitive development, students at senior high school were at the formal operational step. The students have been able to realize a whole in his work as the result of logical thinking. At this stage, students are able to think abstractly and understand the principles underlying the formal concepts and theories as well as can be solve a hypothetical problem. Analysis of Competence Standard and Basic Competence produces indicators and concepts in the hydrocarbon material to be learned and understood by students. Results of the analysis are presented in Table 2.

Table 2. Concepts in Materials Hydrocarbons

Indicators	Concepts
- Identify the elements C, H and O in carbon compounds. - Describe the peculiarities of carbon atoms to form carbon compounds. - Distinguishing the	- Conduct an experiment to identify the elements carbon and hydrogen. - The specificity of carbon atoms - primary C Atom , secondary, tertiary and

ISBN 978-602-19877-3-5

primary C atom, secondary, tertiary and quartenary. - Grouping of hydrocarbons by saturation binding and layout name. - Summing up the relationship boiling point hydrocarbon compounds with a relative molecular mass and structure. - Explain the concept of isomers and its application in the nature of hydrocarbons. - Write a simple reaction to the compounds of alkanes, alkenes and alkynes.	quaternary. - Grouping based hydrocarbon saturation and governance name. - Relationship boiling point hydrocarbon compounds with a relative molecular mass and structure. - Isomer alkanes, alkenes and alkynes. - The oxidation reaction, addition, substitution and elimination.

The main components of this Chemistry Triangle oriented learning media is as follows.
a. Display opener. This view contains the title of the media, makers and Menu.
b. Main course. Loading the contents of media that was developed consisting of competence, material, summary and example problems.
c. Display Materials. Loading of hydrocarbon material, which is composed of organic and inorganic compounds difference.

Components of Student Activity Sheet has been prepared consisting of: a) Title dipraktikumkan material, b) Competence: according to the curriculum, c) Learning Objectives: according to the indicators to be achieved, d) Material brief: according to RPP. and e) Activities: in the form of activities that train students to build concepts Nieveen (2007: 127) describes the characteristics of the product is said to be valid if it reflects the spirit of knowledge (state-of-the-art knowledge) or called the validity of the content. While the components of the product in a medium of learning should be interconnected to one another (construct validity). This means that the terms of a product is said to be valid if it meets the criteria for the validity of content and construct validity. Validation is done by 2 professors of chemistry and 2 chemistry teachers as practitioners.Validation is done 3 times because there are suggestions for improvement of the validator eg. opening look very simple, the picture is less clear, enlarged font size. The latest validation results of media and students worksheet can be seen in Table 3 and Table 4

Table 3. Results of Final Validation of Media

No	Rated aspect	Val 1	Val .2	Val .3	Val .4	KAPPA MOMENT	Categories
1	CONSTRUCT						
	Score obtained Validity (Kappa value) Categories validity	6	5	8	5	0,75	HIGH
2	CONTENT						
	Score obtained Validity (Kappa value) Categories validity	29	33	39	30	0,78	HIGH
3	LANGUAGE						
	Score obtained Validity (Kappa value) Categories validity	15	16	18	13	0,71	HIGH

Media assessed valid by the validator because the media content has been created based on basic competencies and learning objectives. Media already visualize the representation of the macroscopic aspect, submikroskopis and symbols are relevant and true. In konstrukmedia assessed valid because the program presented by the systematic delivery of material good. Representation of symbols in each frame image is consistent. Articulation and intonation on the recording suarsudah clear, precise and understandable. Media components (color, text writing, video animation, images, sound, frames and backgrounds) have been harmonized.

Students worksheet assessed valid by the validator with high validity value. The reason is because the correspondence between the material and exercises. Didactic aspects of regulating the use of worksheets that are universal, can be used well for students who are slow or clever.

Table 4. Validation Results of students worksheet (LKS)

No	Rated aspect	Val 1	Val.2	Val.3	Val.4	KAPPA MOMENT	Categories
1	DIDACTIC						
	Score obtained Validity (Kappa value) Categories validity	2	3	3	2	0,68	HIGH
2	LANGUAGE						
	Score obtained Validity (Kappa value) Categories validity	9	9	9	9	0,67	HIGH
3	CONTE						

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	NT						
	Score obtained Validity (Kappa value) Categories validity	9	9	10	9	0,68	HIGH
4	DISPLAY						
	Score obtained Validity (Kappa value) Categories validity	9	9	11	9	0,74	HIGH

Test the practicalities of students worksheet oriented triangle chemistry aims to determine the extent of the benefits, ease of use and efficiency-oriented media usage time chemistry triangle and students worksheet by teachers and students. Analysis of the practicalities of the student questionnaire data show a very high practicality categories namely with the score obtained was 63.9. By using the obtained Kappa moment practicalities value of 0.82. According to the student, chemistry-oriented media and LKS triangle is easy to use, easy to understand, interesting, and can motivate students to learn. Questionnaire practicalities of Media Study and worksheets for teachers in general contain statements that describe the response of the media and the assessment of teachers and worksheets. Questionnaire results practicalities of this gives an average score of 33 with a Kappa value of 0.79 (very high practicality category. According to the teacher, among others, that the concepts conveyed through the media and worksheets to assist teachers in providing concrete explanation of the theories on the material in sub microscopic Hydrocarbons. Media and students worksheet produced material allows teachers to link with the real world, presents the lessons clearly, can explain the concept in concrete, reflection, and authentic assessment

Instructional media and students worksheet which is valid and practical use for learning in 3 schools. Students learning outcomes were analized using t test and the results can be seen in Table 5

Table 5. Analysis of Students learning outcomes

CLASS/CATEGORY	N	MEAN	SD	t_{calc}	t_{table}
Experiment	88	70,45	10,65	4,270	1,645
control	88	64,18	8,74		
Experiment/ high	29	70,21	15,84	2,364	1,670
Control/high	29	61,52	11,88		
Experiment/ middle	30	72,53	7,41	3,125	1,670
Control/middle	30	66,53	7,46		
Experiment/low	29	68,55	6,02	2,835	1,670
Control/low	29	64,41	5,05		

Analysis showed that the learning outcomes of students who used Chemistry Triangle-oriented media and LKS is well capable of high, medium or low, or overall, better than students who learn without the use of that media . Students are capable of being obtaining better learning outcomes than students with high and low ability. This may be due to the learning process of students with the ability of being more motivated and serious attention to the media and serious work on worksheets. Students who are capable of medium ability more interested and excited in comparison with the low and high ability students.

However, it can be said that media and LKS produced already can direct students' attention to focused on lesson content, This can be seen from the results of learning outcomes was better than learning outcomes of students who did not use the media and the LKS (control class).

Analysis of Hypotheses about whether there is an interaction between the use of media with the level of students' ability to influence the outcome of learning, can be seen in Table 6.

Table 6. Analysis of interaction between the use of media with the level of students' ability to influence the learning outcomes

Source of variance	**sum of squares**	**degrees of freedom**	**Middle square**	**t_{calc}**	**t_{table}**
line	1733,01	1	1733,01	18,51	3,84
collumn	451,87	2	225,94	2,41	3,00
interaction	153,46	2	76,73	0,82	3,00
In cell (error)	15913,14	170	93,61		

The data in Table 6 shows that there is no interaction between the use of media with the level of students' ability to influence the learning outcome . It means that learning process using Chemistry Triangle oriented media is not affected by differences in the level of student ability. All students, whether that has a high capability, low and medium gain better learning outcomes when learned using Chemistry

ISBN 978-602-19877-3-5

Triangle oriented learning media compared with students who learn without using that media.

3. CONCLUSION

Chemistry Triangle oriented learning can help students to make meaningful connections between one concept to another, which connects all three aspects (macroscopic, submicroscopic and symbolic). This learning can be realized by using multimedia learning. In this study has been made Chemistry Triangle oriented. instructional media and students worksheets.The media have already judged valid by the validator, assessed practical and effective by teachers. From questionnaires filled out by the students can be concluded that the media and the resulting worksheets can help students understand the concepts of the three levels of representation that is macroscopic, submicroscopic and symbolically. The Media was used in learning in 3 senior high school (with students who are capable of low, medium or high ability). Data analysis showed that the students learn using the Chemistry Triangle-oriented media get better learning outcomes (significantly different) than students who learn without the use of media. Students who moderate ability obtain learning outcomes better than high and low ability. There is no interaction between the use of media with the level of students' ability to influence the learning outcome

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ISBN 978-602-19877-3-5

DESIGN AND VALIDITY KIT FOR ELECTROCHEMISTRY AT XII CLASS OF SENIOR HIGH SCHOOL

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ABSTRACT

In Education of Grade Curriculum, a teacher must be creative and innovative in preparing each item based on enviroment, facilities, and student's condition at school. A teacher must be able to develop lesson media to get respon on student's thinking activities. Lesson media is an important factor in learning process. The purpose of this research is to develop lesson media Kit and experiment worksheet for senior high school to be valid. The type of this research is ***Research and Development*** *by using development model by* ***Gustafson & Branch****. This development model applied system approach principles. It consisted of five steps. They were analysis, designing, developing, evaluating, and implementation. In this research, lesson media is just developed until developing step. Analysis step was curriculum analysis, it consisted of curriculum analysis and student's analysis. In designing step was done planning of lesson media. In developing step, lesson plan was planned or designed then it was validated by validators from Chemistry Department and validator from education evaluation. Kit for electrochemistry was revised based on the recomendation and correction from validators. The data analysis was processed by statistics descriptive qualitative for validation lesson media by validator. Based on evaluation of validator, media is categorized as valid at competency of concept of oxidation-reduction and electrochemistry in technology and daily activities.*

Index Terms— Kit, design, validity

1. INTRODUCTION

Study of chemistry is a branch of science coming from experiment that rises and develops from experiments in the laboratory. Thus, in the process of learning is needed lab works for holding students' understanding in concept material of chemistry. Marking on students' works and demeanor can be obtained from these lab activities. Therefore, it is necessary to have some media in helping the learning activity, also the media that are needed to do lab works.

The learning media used is one of key factor for learning success. It has important roles, such as an orientation for teachers to handle learning activities and as a main source for the students to study well. Badan Standar Nasional Pendidikan (BSNP), an Indonesian institute which standardize, ensure and manage the quality of Indonesian Education, issues a guidance to review textbooks and learning media. It includes contents properness (compatibility between material and standard of competence and basic competence, accuracy of material, and learning proponent material) and presentation properness (presentation techniques, learning presentation, and presentation completeness). It can be said that learning media must comply these requisites, so it can be properly used.

One of chemistry subjects which is given to SMA grade XII IPA (Science) is Electrochemistry *(Elektrokimia)*. This subject has material width and depth that is developed from content standard. There are many concepts in electrochemistry which are needed much times to learn it, including some practical works that must be conducted to understand more about its application in daily life. Therefore, it is needed a good solution to teach the material clearly, completely, and effectively in tight time.

The final target that must be achieved in every learning is four-education pillar mentioned by United Nations Educational Scientific Culture Organization (UNESCO); learning to know, learning to do, learning to live together, and learning to be. Those must be work optimally. It is important to have a good needs analysis to know what media learning have to be completed by the learners so the learning process consisting optimally and the learning target reached well. There are some of learning completeness; RPP *(material learning plan)*, learning materials, evaluation tool, and learning media.

The result of survey in some schools in West Sumatera shows that less using of learning media in electrochemistry subjects, some school labs do not have tools and materials needed in lab works indeed. Then, the survey result shows in some company

ISBN 978-602-19877-3-5

supplying lab work tools for schools, Kit as lab tool used in electrochemistry subjects, is not available yet. Based on this case, it is important to upgrade availability of lab tool for this subject, especially the availability of Kit.

Kit is a simple lab tool conditioning the students can perform some experiments in a group in classroom. Kit can be also used to develop students' cognitive, affective and psychomotor. By using Kit, students are expected to think and analyze their researches during the experiments scientifically. Moreover, kit used in learning process is expected to help learning achievement. Kit as learning media is one of learning source to deliver the learning idea designed by teachers to conduct a conducive learning process for students. As said by Munadi (2008:7), learning media is thing that can be deliver the idea from such planned sources that conduct a conducive learning environment, so students can enroll learning process effectively and efficiently. As Kit is important to facilitate lab activity and good understanding in electrochemistry subject, so it is necessary to examine the validity of Kit used in learning process. Kit as learning media has to be designed to teach SMA students about electrochemistry grade XII IPA.

2. REVIEW OF RELATED THEORY

2.1. Learn and Learning

Sanjaya (2008:215) said that in the context of curriculum implementation, learn is not only saying lesson material but also organizing the environment for students to study. It is usually what is said as learning. This case implies that in the process of it, learning the students must be point of activity. It is expected to form character, civilization, and to advance students' life quality.

Learning needs to empower each talent of every student to mastering lesson competence. Empowering is orientated to support the achievement of lesson competence and attitude. Lastly, each individual becomes learner forever and create learner civilization.

2.2. Learning Tools

Tools which are used in learning process is named learning tools. Based on Indonesian Government Regulation No. 19 Year of 2005 Article 20 about national education standard mentioned that "Learning Process Plan (RPP) consists of syllabus and material delivering plan including at least learning target, learning material, learning technique, learning source, and learning output evaluation". It can be concluded that RPP is learning tool that must be prepared by teacher in every education level before doing learning process.

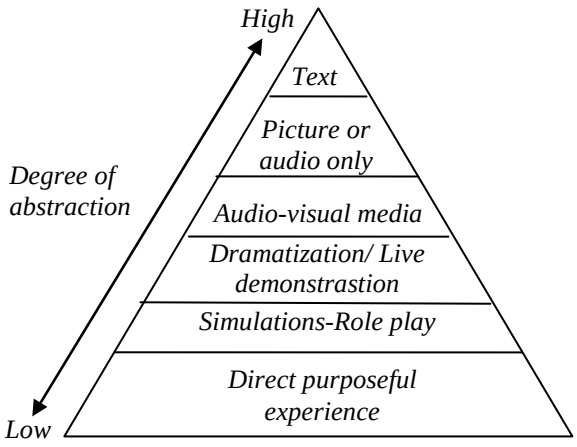
2.3. Media in Learning Process

2.3.1. Learning Media

Learning media are things extending and delivering an idea from the source programmatically so conduct a conducive learning environment that receiver can learn effectively and efficiently.

Learning process is process of communication, delivering the message from source to receiver. A message consists of content or idea, which is presented by communication symbols in verbal, or non-verbal, the process named encoding. The interpretation of symbols done by students is named decoding. In this interpretation, sometimes they are successful but sometimes they are not. So, there is a fault in understanding what is listened, read or seen. It may be caused by disruptions that obstruct the communication, it named barriers or noise. Therefore, it is needed media in learning process as a way to communicate message and feedback, and then delivering idea can be done efficiently and effectively.

Dale's Cone of Experience is the most representation used as theoretical base in media using is learning process. In this case, Edgar Dale classified experience from concrete to abstract level. Level of experience in the cone is based on how much senses included in it. Below is graph of cone experience:



Picture 1. Dale's Cone of Experience (Chomsin, 2008:31)

Dale's Cone of Experience shows level of experience achieved by students. The media is in the form of text having high degree of abstraction for students to understand material given in the text. Degree of abstraction becomes lower as increasing of experience achieved by students. For instance, if media

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instructional which is given in the form of text, it cannot make students achieve the experience except which got by eyes. However, if media are more complete, such as having simulation- role play, it will make students achieve more experience as more sense are used in it. The more senses used in the learning process, the more competence got by students. In the same way, this cone of experience explain direct learning experience and learning experience by using symbols given from concrete things to abstract things. Actually, it gives particular implication to the development of learning technology. Based on this analysis, Electrochemistry Kit is formed later. By using this Kit, students that perform lab activity can exercise their analytical ability, carefulness, supervision and communication of what is seen during the process. Therefore, the senses are used in the process. It is also expected more valuable, effective and efficient.

2.3.2. Kit as Learning Media

Kit is a set of tools and materials that helps learning process and make lab activity working fast, practically and economically. By using Kit, the experiments can be done in a classroom without laboratory. Essentially, learning achievement is impacted by condition and interaction during learning process. A good learning condition in using kit can create a fun learning process. The students will be ruled in learning process actively and it can increase learning achievement then.

Arifin (2005:110) stated that lab activity doing in classroom must fulfill these rules;

1.The experiments do not produce warm gas.
2.Tools and substances have already prepared in a box for each person/group in making the process easily.

Kit has some excess as said by Sumiaty (2002:38);

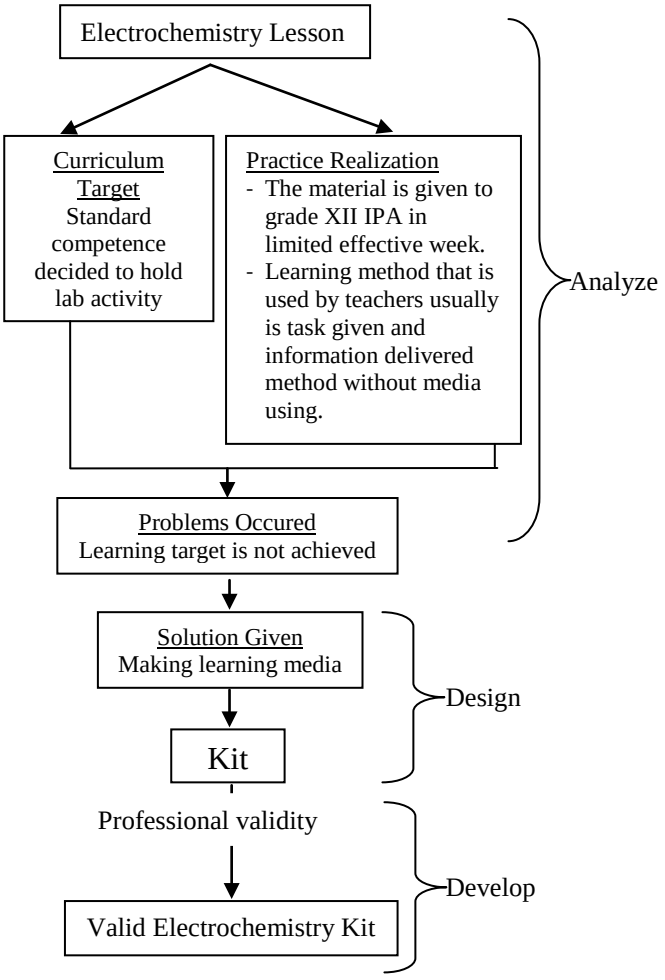
1.Kit helps schools having no laboratory.
2.Kit can replace activity doing in laboratory
3.Kit increases students' understanding in chemistry
4.Kit is easy to carry out

Tools and materials are already available in a box so that can overcome teacher's matter in preparing those things.

2.4. Theoretical Framework

Electrochemistry material for grade XII IPA is one of subjects in chemistry. To understand this material is needed lab works. Nevertheless, practically, this material cannot be explained completely because of lack of effective week. Then, chemistry teacher try to take a solution by giving some assessment. However, learning target is quite unreachable in this case.

It is important to use learning media to overcome this problem. The media is called Kit. By using it, planned learning target is expected to be filled and learning output is expected to be great. Systematically, theoretical framework can be explained by the graph below;



Picture 2. Theoretical Framework

3. THE METHOD OF RESEARCH

3.1. Type of Research

Based on the objective of research, designing and creating learning media also examining its validity, so types of this research belongs to research and development category. It tries to conduct a new product in learning, which is named Kit, a lab tool used to teach electrochemistry for grade XII IPA.

Research and development purposes to produce a set of learning media, such as syllabus, lesson material, media, laboratory module, students assessment, tool to measure learning progress, etc. (Latief, 2009:2). It is necessary to do this research and development because of problem occurred in using inadequate learning media. Researcher from result of

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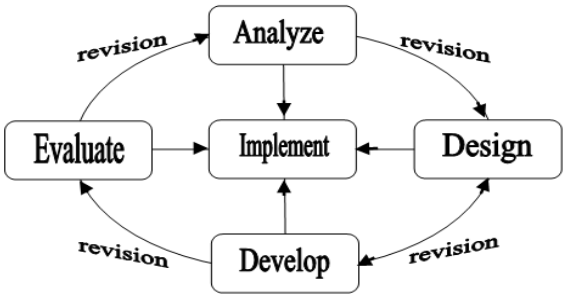
needs analysis finds the problem in real practice. Borg and Gall (2001:624) said that Research and Development consists of a cycle in conducting a product, testing and revising it based on data gained.

3.2. Model of Development

The research uses core elements of instructional development model found by Gustafson and Branch (2001). This development model applies some approaches including five steps; analyze, design, develop, evaluate and implement. This research is done until developing step. Development model of Gustafon and Branch as seen below;



Picture 3. development cycle of Gustafson and Branch (McKenney, 2001:94)

The picture shows that a development research coming from implementation of fieldwork progress. by looking at implementation, it can be done a need analysis. Then, a revision can be hold to find an essential problem. Based on that, the steps to design a product can be started. The product designed must be concerned on implementation, so it can produce a greater product than before. The design of new product will be revised to have a new good quality product. It also has to develop to get a better product and it may not deviate from the implementation done. After that, it should be revised again and run down to test practically. The last step is evaluating the tested product and it can be made as reference to use in different condition.

3.2.1. Step of Analyze

This step is needed to get a representation of real condition. It is also called need assessment steep. The type of analysis is essential concept. It is a step to verify a main concept to compiling concepts. The essential concept is chosen from several main concepts to be developed into lesson material by looking at SK, KD and target indicator. In line to this research, the subject is about electrochemistry. Next, designing step can be started.

3.2.2. Step of Design

Design is a plan, planning a form, etc. In this step, learning media that will be developed has to be decided based on the analysis in the step before. It is meant that the media is Kit. After that, a learning plan using Kit will be designed in a form of lab work.

3.2.3. Step of Develop

In this step, the product validation will be done to assess the design. Professional validator will validate it whether it is properly used or not. It is expected to evaluate the strength and weakness of new product. By knowing the weakness of product, it will be revised later to detract its bad risk.

The step of implement and evaluate are not taken yet. It is conducted until development step.

3.3. Technique of Data Collecting and Research Instrument

The level of product validation will be known after validation data issued by professional usually using questionnaire as research instrument. It is because of Kit development based on curriculum (KTSP) and textbook used. The questionnaire used must be adjusted with estimation orientation of SMA chemistry textbook issued by Education National Standard Institute (BSNP).

3.4. Technique of Data Analysis

The data collected will be analyzed by descriptive statistic to get average rate and its percentage. Data analysis technique can be elaborated as below:

Product validation data will be processed by using Kappa formula;

$$K = \frac{\rho 0 - \rho e}{1 - \rho e} \quad (1)$$

$\rho 0$ = Realization mark
ρe = Not Realized mark
K = Kappa Value

Explanation:

1. Realization mark is total digit answered by respondents divided with maximum total value.
2. Not Realized mark is maximum total value reduced with total digit answered by respondents divided with maximum total value.

Determining of marking category is based on interval table that is modified from Kappa formula as seen below:

Table 1. Interval Category of Product Validity

Interval	Category
< 0	Much not valid
0 – 0.20	Not valid
0.21 – 0.40	Less valid
0.41 – 0.60	Valid enough

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0.61 – 0.80	Valid
0.81 – 1.00	Very valid

(M (Modified from Boslaugh, 2008:12)

4. FINDINGS AND ANALYSIS

4.1. Step of Analyze

4.1.1.Curriculum Analysis

Curriculum implementation requests students being active to upgrade their knowledge and teacher roles as facilitator. In learning chemistry, students are asked to experience and apply scientific methods by doing experiments. Later they can process, interpret the data and communicate the results verbal or non-verbal. Then, students can find a concept based on research or its result.

Competence standard of learning media developed is applying the concept of oxidation-reduction reaction and electrochemistry in technology and daily life. Moreover, basic competences developed are:

a) Apply concept of oxidation-reduction reaction in electrochemistry including electrical energy and its use to avoid corrosion in industry.
b) Explain oxidation-reduction reaction in electrolysis.
c) Apply Faraday law to electrolysis electrolyte dissolved.

Determined by SK and KD, students must have some skills after had studied the material, these are;

a. Students can equalize redox reaction by using an half reaction and oxidation numeral.
b. Students can apply concept of redox reaction in electrochemistry system including electrical energy and its use to avoid corrosion in industry.
c. Students can explain work principle of Volta cell that mostly used in daily life.
d. Students can explain oxidation-reduction reaction in electrolysis cell and application of Faraday law concept.

Minimum skill that must be mastered by students may also be used as learning target generally. Based on that learning target, learning indicators of electrochemistry subjects can be elaborated then, such as: Equalize redox reaction by using a half reaction (ion electron); Equalize redox reaction by using oxidation numeral; Conclude features of redox reaction that happens spontaneously from experiment data; Represent arrangements of Volta cell or Galvanic cell and explain functions of each part based on experiment; Explain how electrical energy can be conducted from redox reaction in Volta cell; Write down cell symbol and reactions happened in Volta cell; Count potential cell based on standard potential data; Explain work principle of Volta cell that mostly used in daily life; Determine reaction happened in anode and katode in electrolysis reaction based on experiment data; Write down the reaction happened in anode and katode between dissolved and active electrode or inert electrode; Explain factors that conduct the corrosion; Explain some ways to avoid corrosion; Apply concept of Faraday law in electrolysis cell; Write down electrolysis reaction in metal plating and purification.

Indicators above may be used to understand concepts of chemistry lesson that will be learned by students. There are as stated below: Concepts of redox reaction and precept of oxidation numeral; Equalization of redox reaction using an half reaction and oxidation numeral; Electrochemistry including Volta and electrolysis cell; Concepts of Volta cell; Cell potential; Application of Volta cell in daily life; Electrolysis reactions (reaction in katode and anode); Factors that conduct corrosion and its avoidance; Law of Faraday I and II; Electrolysis in industry

Looking at SK, KD, indicator, learning target and electrochemistry material concepts above, students are expected to be active in doing observation, experiment, and group discussion in learning process. Therefore, they can build the knowledge, find and achieve learning experience directly. Moreover, they can understand the concepts deeply and can apply it in daily life.

4.1.2.Students Analysis

There are some phases of cognitive development mentioned by Piaget; (1) sensory-motorist phase (0-2 years old), (2) pre-operational phase (2-7 years old), (3) concrete operational phase (7-11 years old), and (4) formal operational phase (more than 11 years old) (http://id.wikipedia.org/wiki/Jean_Piaget).

Piaget theory of cognitive development above implies that students of SMA facing formal operational phase. It means that students have already had ability to do some works as result of logical thought, to think abstractly, to understand principles that bases formal concepts, theory application and to analyze hypothetical problems.

By using learning media, students are expected to be more creative, active and innovative in learning process. The goal of using learning media is to place students experience directly. Learn will be more valuable if students 'work' and 'experience' it directly than know it only. Learning by using media give various experience for students trough interaction happened in group, especially within laboratory activity, such as discussion, cooperation in solving problems, finding concepts by observation, investigation, collecting data, interpreting data, concluding and applying the concepts in daily life.

4.2. Step of Design

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Electrochemistry kit is designed by considering some aspects, such as: safety, ease in using and treating, economical value, accuracy in measuring. The result must be kit that can be used as tool to do lab work in classroom. It is created in a box composing labs tools and low concentrate substances. Kit must be made as safety as possible to minimize bad risks when doing experiments. Kit is also completed by manual book and experiments result sheet.

4.3. Step of Develop

This step is taken to produce Kit that properly used in Electrochemistry subject. Instrument prototype of validation is given to validator to know exactly the validity of media. Based on validation data, kit will be issued as valid media after doing some revisions. It means that kit is revised according to suggestions from validator.

Validation result given by validator is presentated in Electrochemistry Kit Validation Sheet. It can be seen in the table below. Concluding validation result is based on criteria mentioned in Method of Research:

Table 2. Electrochemistry Kit Validation Result

Marking Indicator	Validation Mark
Compatibility with SK and KD	4
Compatibility with learning material	4
Compatibility with students characters	3,5
Provoke students motivation	3,5
Content of value	3
Kit's treatment and shape	3,5
Scores	21,5
Validity (Kappa mark)	0,88
Category	Very Valid

Validation result of Electrochemistry kit shows the valid category. The average mark is 0,88 and it is called very valid. The average mark explains that Kit has already suited with competence, learning material, strategy, and learning method. Kit can motivate students because it has already matched with their characters. Content of value is high enough and it is easy to preserve. There are some suggestions given by validator;

1) Resize tools used in Kit
2) Try to accommodate two sets of electrochemistry tool in a box

5. CONCLUSIONS AND SUGGESTION

5.1. Conclusions

The finding of research comes up to two conclusions, those are:

a. Kit as electrochemistry-learning media can be developed by resizing of some lab tools and accommodate two sets tools in a box.
b. Kit conducted has a good validity, it is 0,88 score. It means that it has been developed well and can be used in classroom learning process.

5.2. Suggestion

Taken from the result of research, there will be suggestion occurred, such as:

It is necessary to upgrade this research finding by testing Kit to students' SMA grade XII IPA to know more how its use and effectiveness in achieving students' success and reaching learning target.

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ISBN 978-602-19877-3-5

THE DEVELOPMENT OF DISCOVERY LEARNING – BASED MODULE IN BUFFER SOLUTION TOPIC FOR SENIOR HIGH SCHOOL INSTRUCTION

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ABSTRACT

Developing discovery learning- based module appears to be one of many attempts that teachers can do to fulfill the demand of the new curriculum implemented, Curriculum 2013. This research aimed to develop valid and practical module in topic of Buffer Solution for Senior High School instruction. This research belongs to Research and Development (R&D), a study that consists of four stages namely (1) defining, (2) designing, (3) developing, and (4) disseminating. This study was done until developing stage. The instruments used in this research were validity and practicality questionnaires. Validators of the product were four chemistry lecturers and three chemistry teachers. Both teachers and students in Public School 1 Lubuk Alung responded to practicality questionnaires. Data analyzed with kappa moment showed that discovery learning- based module had high degree of validity (mean score of kappa moment was 0.74), high degree of practicality from teachers' perspective (mean score of kappa moment was 0.74), and very high degree of practicality from students' perspective (mean score of kappa moment was 0.83). It can be concluded that discovery learning – based module was valid, practical and justifiable for high school chemistry instruction.

Index Terms— Buffer solution, discovery learning, module, scientific approach, 4-D Models

1. INTRODUCTION

Buffer solution is a chemistry topic taught in semester 2, Grade X, Senior High School (SMA). According to Curriculum 2013, the topic has two basic Basic Competencies (Kompetensi Dasar, KD). They are analyzing the role of buffer solution in organism (KD 3.13) and designing, doing, concluding and reporting experiment result on buffer solution properties (KD 4.13)[1]. The two KDs are rarely accomplished in teaching and learning process because some important concepts of the topic are difficult to understand. For example, students in public Senior High School (SMAN) 1 Pemalang were reported to experience difficulty on comprehending concepts in Buffer Solution topic[2]. The percentages of difficulty were 35.52% for definition of buffer solution, 26.03% for the calculation of pH and pOH of buffer solution using equilibrium principle, 48.83% for determination of pH of buffer solution with the addition of small amount of acid or base solution, and 68.26% for the role of buffer solution in organism and daily lives. Some factors that contributed to this difficulties were that students did not pay attention during teaching and learning process; students were not prepared for new concepts; teacher did not give ample prerequisite knowledge; teacher neither emphasized the concept in depth nor they gave various types of worked-out examples; and teacher did not use approriate learning strategies.

Anoter case was found in SMAN 1 Sukasada where students had misconception on all concepts of buffer solution. The distribution were 52.44% for buffer solution, 24.50% for acid buffer, 18.62% for base buffer, and 23.10 for pH of buffer solution. The misconception were derived from students, teachers, and learning materials such as worksheet[3]. To solve the problem, learning material that ease students to learn and understand the concepts in Buffer Solution topic is an obligation. Appropriate learning materials will help teachers during teaching and learning process. The materials may include printed-out materials such as *Hand Out*, text book, module, worksheet, brochure, *Wallchart*, and other forms like video/film,VCD, radio, cassette, *audio* CD, photo, picture, computer or Internet- based interactive CD[4].

Module is a printed-out learning material that can be used by students and teachers at anytime and anywhere they want. A module is a comprehensive unit consisting series of emperical learning activities to produce effective learning result in order to achieve the clear and specific goals determined[5]. According to Indonesian Dictionary, a module is a teaching and learning program that allow students to learn the materials with little assistance from teacher, lecturer or instructor[6]. The benefits of module include (1) module creates more efficient, effective and relevant instruction than does conventional learning (2) module gives teacher more time to assist students who need more guide and this in turn helps teachers to know the students' understanding[5].

Based on the background discussed above, module for Buffer Solution topic was thought to be worth developing for senior high shcool instruction.

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The integration of scientific approach in learning instrument such as lesson plan, *Hand Out*, and module was aimed to support learning process in addition to enhance teachers' understanding towards scientific approach as described in Curriculum 2013. Previous research reported that scientific approached-based lesson plan used in problem based learning motivated students and built their internal character[7]. Scientific approached-based module was reliable in Natures' Diversity subject[8]. Scientific approached-based physics module increased students' critical thinking[9].

The integration of scientific approach in learning process and instrument must be accordance with learning model that is suitable with the characteristics of the lesson. Discovery learning model is suitable with materials that contain factual, conceptual and abstract knowledge [10]. Discovery learning is a model that implements active learning through mental processing in inquiring concepts or principles. This model is a type of students' centered learning [11].

It was found that the implementation of discovery learning with scientific approach increased critical thinking skills of high school students in Electrolyte and Non electrolyte Solution topic as much as 28.23% with 0.78 effect size value [12]. Discovery learning model could also increase students' learning activity and cognitive, affective and psychomotor achievement in topic of Buffer Solution [13]. Therefore, this study was aimed to develop a valid and practical discovery learning – based module in Buffer Solution topic for senior high school chemistry instruction.

2. METHODOLOGY

This research belongs to *Research and Development* (*R&D*), a study done to produce certain product and test the effectiveness of the product [14]. The product in this research was discovery learning – based module in Buffer Solution topic for senior high school instruction. 4-D model that consists of defining, designing, developing and disseminating stages [15] was used in this research. This model has several advantages including (1) it is appropriate as a base to develop learning instrument; (2) the developing stage is complete and systematic; (3) experts are always involved in developing stage, thus before tested in practice, the instrument should be revised according to score and suggestion given by the expert [15]. Due to the time constraint and limited resource, this research was done until developing stage.

In defining stage, five analyses namely beginning-end analysis, students analysis, assignment analysis, concept analysis and learning goals analysis were done. Beginning-end analysis was done to emerge and determine the main problems faced by both teachers and students in chemistry learning especially in Buffer Solution topic. Students analysis aimed to identify the students as learning target. Assignment analysis aimed to identify and analyze competencies (either of basic competencies or of materials) , as determined in Curriculum 2013[1], that students have to accomplish.

In order to fulfill basic competencies, concept analysis is an a must-doing step to fulfill the principle of concept building on materials taught [16]. Learning goals analysis is the alteration of assignment and concept analysis into learning goals. This analysis was used to construct discovery learning – based module in Buffer Solution topic.

In designing stage, discovery learning based module was designed into several components including title, competencies to achieve, manual of use, concept map, activities sheets, worksheets, evaluation sheet, and answer key of activities sheet and evaluation sheet[6]. The arrangement of module was suited to sintax of discovery learning model comprising (1) stimulation, (2) problem statement, (3) data collection, (4) Data processing, (5) verification, and (6) generalization [10].

The last stage in this research was developing stage. This stage aimed to produce valid and practical discovery learning - based module for senior high school chemistry instruction. Validation was done by four lecturers of Chemistry Department and two chemistry teachers in SMAN 1 Lubuk Alung. Critics, input and suggestion were used to revise the product. In accordance to Sugiyono[14] at least three judgement experts must be involved in testing the validity of the product. Data obtained were then analyzed with Kappa moment as described in formula 1 and decision category in Table 1 below.

$$\text{Kappa moment(k)} = \frac{\text{P}-\text{Pe}}{1-\text{Pe}} \quad \text{.....(1)}$$

Keterangan:

k = Kappa moment describing validity of the product.

P = Realized proportion; counted by summing the score given by validators and then divided it by maximum total score.

Pe = Unrealized proportion; counted by substracting the maximum total score with the sum of total score given by validator, which then divided by the maximum total score

Table 1. The category of decision based on Kappa moment (k) [17].

Interval	Category
0,81 – 1,00	Very high
0,61 – 0,80	High
0,41 – 0,60	Medium
0,21 – 0,40	Low
0,01 – 0,20	Very low
≤ 0,00	Invalid

Test and trial of the product was done to limited number of students in SMAN 1 Lubuk Alung. This

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was aimed to determine practicality of discovery learning - based module integrated with scientific approach. Practicality test was done to get information about the advantages, the ease of use, efficiency of the product during instruction. This test was done by distributing practicality questionnaire to chemistry teachers and students.

3. RESULT AND DISCUSSION

3.1. Defining Stage

Below are the results of analyses done in this stage.

3.1.1. Beginning-end analysis

The problems faced by teachers and students in chemistry learning were (a) students had difficulty in understanding buffer solution concepts[2], (b) students had misconceptions in almost all of the concepts in Buffer Solution topic[3], (c) teachers had difficulty in implementing scientific approach in teaching and learning process, (d) Curriculum 2013-books published by ministry of education were not available in school, (e) books used in instruction did not follow scientific approach-based ones, (f) teachers did not have module that could help them implement scientific approach. Regardless of the problems, scientific approach should be integrated into learning instrument such as module by using one of learning model suggested by Curriculum 2013, in this case discovery learning.

Discovery learning is a model that directs students to inquire concepts, definition and relation among concepts through intuitive process to get conclusion [10]. This model directs students to actively involve in learning (active learning) and emphasizes more on learning process rather than learning outcome. This model leads pupils to be independent, reflective, enthusiastic, curious, and communicative students [11]. Thus, this model is suitable with the characteristics of chemistry learning including buffer solution topic.

3.1.2. *Students* analysis

Students in grade XI were 17 years old on average, a time of adolescence period[18]. Qualitatively, adolescence period is the last stage of cognitive development where students can make analogy on the concept with abstract things, for example, by using symbols, ideas, abstraction and generalization. Jean Piaget stated that every individual including kids has the ability to construct their own knowledge. Self-obtained knowledge will become meaningful knowledge. On the other hand information told to individual will less likely to become meaningful knowledge. Instead this information lasts shortly and soon be forgetten[19].

Some strategies to implment Piaget theory in learning include (1) use constructive approach; (2) facilitate students to learn; (3) consider knowledge and students' developmental stage; (4) execute continuing evaluation; (5) improve students' intellectual ability; and (6) create class as a space for exploration and discovery [19]. It was hoped that interesting learning instruments made, those that use colourful pictures, tables and exercise problems, tailored to senior high school students' ability would help students to independently construct concepts of buffer solution. Discovery learning that leads students to actively and directly involve in learning will help students to construct their own knowledge and create a meaningful learning.

3.1.3. *Assignment* analysis

Assignment analysis was aimed to identify and analyze competencies that students need to accomplish after learning. The analysis was done by analyzing the content presented in teaching unit as demanded by Curriculum 2013. Derived from KDs analysis (KD 3.13 and KD 4.13), learning indicators[1] were formulated as described below:

a) analyze the definition of buffer solution,
b) determine type of buffer solution
c) calculate the ph and poh of buffer solution
d) provide the example of buffer solution in daily lives
e) determine the properties of buffer solution.

These indicators were used to design learning activities so that the intended competencies could be achieved.

3.1.4. *Concept* analysis

Based on the indicators discussed above, concepts taught or learned in Buffer Solution topic were: definition of buffer solution, types of buffer solution, calculation on buffer solution, and the role of buffer solution[16]. This analysis was then used to design concept map and content of the module.

3.1.5. *Learning* goals analysis

Learning goals of buffer solution topic are:

a) with the use of illustration on the change of pH of buffer solution, students can differentiate buffer solution from non buffer solution.
b) students can explain the characteristics of buffer solution.
c) students can calculate pH of buffer solution.
d) students can give example of the role of buffer solution in daily lives.
e) students can differentiate buffer solution from non buffer solution based on the addition of acid and/or base solution.
f) students can prepare buffer solution in an experimental work.

3.1.6. *Designing* Stage

Module was created with *Microsoft word 2007* using *Times New Roman* font style size 12 and *Papyrus* font style size 14. Blue was chosen as the background of module's cover while white became

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background of the remaining pages of the module. Module contained buffer solution materials referencing some university text books and reliable and relevant senior high school books.

Discovery learning – based module consisted of cover, learning goals, manual of use, students' activities sheet, worksheet, answer key of worksheet, evaluation sheet, and answer key of evaluation sheet [12].

3.1.7. *Developing* Stage

This stage yielded two types of data namely validity and practicality of discovery learning – based module as described below.

a. Validity test of buffer solution module

Validity of module was considered based upon four componenets. They were content validity, language validity, presentation (arrangement & appearance) validity, graphics validity. Table 2 summarizes the score of module's validity on the four components given by six validator.

Table 2. Scores of validaty of the module on four components given by validator.

Aspect of assessment	k(I)	k(II)	k(III)	k(IV)	k(V)	k(VI)	k(VII)	$\bar{X}$
Content	0,89	0,67	0,89	0,67	0,67	0,67	0,89	0,76
Linguistics	0,78	0,71	0,71	0,67	0,71	0,67	0,95	0,74
Presentation	0,70	0,67	0,83	0,85	0,74	0,67	0,86	0,76
Graph	0,87	0,87	0,73	0,67	0,27	0,27	1	0,67
$\bar{X}$	0,81	0,73	0,79	0,715	0,60	0,57	0,92	0,74

k(I), k (II), k (III), k(IV), k (V), k (VI), and k (VII) are mean kappa moment of validator I to VII and $\bar{X}$ is mean score of kappa moment.

It can be seen that the mean score of kappa moment for each component ranged from 0.61–0.80, showing high degree of validity. It can be concluded that (1) content of discovery learning–based module fulfilled the demand of core competencies and basic competencies; (2) language used in module of buffer solution was clear, communicative, interactive and appropriate for the stage of students' development[20]. Due to clear and concise language, students did not get confused when learning the materials; (3) module was designed in proper arrangement and procedure/ steps. The steps meant were scientific ones consisting of observing, asking question, gathering information, associating, and concluding steps[21]. These steps are also used in *discovery learning*; (4) graphically module was complete because it had module detail, cover design, and content design[20]. The font style and size used in module were also clear and appropriate, which made the module capable of attracting students attention and motivating them to study.

To sum up, the discovery learning-based module was valid because it fulfilled the appropriateness of content and construct [22]. The next step was to test practicality of the prodct.

b. Practicality test of the module

Data of practicality was obtained from questionnaire distributed to 25 - grade XII senior high school students (students questionnaire) and 3 chemistry teachers (teacher questionnaire). The data is presented in Table 3.

Table 3. Data of practicality of module gobtained from students and teachers questionnaires.

Subject	Teacher	Student
Mean kappa moment	0,72	0,83

As shown in Table 3, module had high degree of practicality. The module was attractive. It could assist students to understand the materials as well as assisting them to independently study the concepts. The font style used was easy to read and clear. More over, pictures displayed on the module, experiment manual and directing questions in worksheet gave more advantages for students to understand the lesson.

The practicality of the module can also be inferred from data on students' responses to questions in the module (Table 4). On average, the percentage of correct response on some module components was 81.63% leading the module to be justifiable for use. The main factor that contibuted to this fact was the use of scientific approach integrated into discovery learning model employed in the module. Scientific approaches were also used in research activities including data collection (observing and asking), data analysis (associating), and concluding process(communicating).

Table 4. Analysis on students responses on each component of the module

No	Module component answered correctly by students	Percentage (%)
1.	Hypothesis	84
2.	Worksheer	75.5
3.	Hypothesis proving	81
4.	Conclusion	86
Mean percentage (%)		81.63

The five steps of scientific approach were included in all activities sheet in the module. Observing, asking, and doing were included in activities sheets in the module. For example, in activities sheet 1, students were asked to observe pictures of a months-age palatable pinneaple and a days-age leaky one. Associating and communicating were also included in worksheet.

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4. CONCLUSION

Conclusions of the research are:

1. Discovery learning-based module in Buffer Solution topic for senior high school instruction was successfully produced.
2. The discovery learning-based module in Buffer Solution topic for senior high school instruction module had high degree of validity, high degree of practicality from teachers' perspective, and very high from students' perspective.

Although we recommend practitioner to use this discovery learning-based module, a test of its effectiveness is indeed needed beforehand.

5. ACKNOWLEDGEMENTS

Researchers would like to say thank to Prof. H. Ali Amran, M.Pd, M.A, Ph.D., Dr. Mawardi, M.Si., and Syamsi Aini, M.Si, Ph.D. for the advise and sugggestion to this research. Next we want to thank to Fitri Amelia S.Si, M.Si, Zonalia S,Pd, M.Pd, Eriyanti S.Pd, Yuslita, M.Pd, Dra. Murti for being our product validator. Also we thank to Guspatni, S.Pd, MA for language translation of this article. Lastly, we thank to grade XII students in SMAN 1 Lubuk Alung and people who had contributed to the success of this research.

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ISBN 978-602-19877-3-5

ANALYSIS OF STUDENTS MISCONCEPTION OF ATOMIC STRUCTURE IN SMA ADABIAH PADANG

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ABSTRACT

Atomic structure is the basic concept in chemistry. Based on the examination result in X grade of SMA Adabiah Padang, most of student comprehended less than 60% of atomic matters. It will impact the student understanding when they are study at the higher grade because the concept of atom in X grade is the basic concept of atom and the develop concepts will learn in higher grade. Because of that, a study was held to know students misconception, so the teacher can design the proper teaching learning next. The type of this study is qualitative descriptive which explorative and cross sectional approach. The open ended questions were given to 204 students to know their conception about atomic structure. Based on analysis, the concept of atom by Dalton, Thompson and Rutherford stated by analogy and the misconceptions about Bohr atomic model, and also electron configuration of ion were found.

***Index Terms*—**Atomic structures, concept, cross sectional, misconception, open ended questions

1. INTRODUCTION

One way to increase the human resource is by teaching learning. Hamalik [2] said that teaching learning is a combination of humanity, facility, equipment and procedure which are influencing each other to reach the teaching learning purposes.

The purposes of teaching learning are related to general purposes of education The first is basic education purpose that is give the basic intelligence, knowledge, personality, behavior, life skill and follow the higher education. The second general purpose of education is increase the intellegence, knowledge, personality, lifeskill and follows the higher education. [4]. The statement indicates that teaching learning is start using basic knowledge and basic skill which will develop to be better knowledge and skill.

In education institution such as senior high school, the basic knowledge is the basic concept of student as the result of teaching learning in lower grade. The basic concept will be progress to be developing concept until they have the scientific concept. The development of concept will support teaching learning effectively. One of science subject in senior high school is chemistry which is learn the composition, chemical structure and the relation of them with the properties of matter [1]

There are many scientific theories of chemistry that must learn from basic concept and then develop to be scientific concept which are the purpose of teaching learning. Basic concept of chemistry is about atom. Based on the data found from X grade teacher of SMA Adabiah Padang, known that the student have difficulties to understand atomic concept and atomic structure. The difficulty proved by data which shown that the percentage of student who passed the examination was low. The minimum value to pass is 60. The Table 1 below shows the percentage of student who pass the exam in X grade of SMA Adabiah Padang.

Table 1. The percentage of student who pass the atomic structure examination in X grade of SMA Adabiah

Kelas	Percentage of pass student(%)
X-1	47%
X-2	56%
X-3	20%
X-4	27%
X-5	30%
X-6	65%
X-7	25%
X-8	36%
X-9	33%
X-10	22%
X-11	38%
X-12	58%
X-13	40%
X-14	45%
X-15	33%
X-16	46%
X-17	41%
X-18	47%

(Source: Chemistry teacher in X grade of SMA Adabiah Padang)

The data above show that most of students just understand less than 60% concepts about atomic structure in X grade. It means that the concept about Bohr atomic structure which the basic concept to understand chemistry was not understand by the student. It will impact to the competence of student to understand wave mechanic atomic theory as develop concept of atom in XI grade and Radioactive in XII grade. Because of that, the teacher needs to know the students conception and their misconception about atom. The analysis of concept and misconception of

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student in grade X, XI and XII help the teacher to make the better plan of teaching learning that compatible with teaching learning outcome.

2. METHOD AND PROSEDURE

Type of the research is qualitative descriptive which explorative and cross sectional approach. It means, the research describes the fact, the properties and relation between phenomenon systematic, factual and actual without treatment and without manipulation of data. This research analyze the fact that happen to students in different grades but did in the same time.

This research was done to find the conception and misconception of student which held to 108 of X grade student, 54 of XI grade student and 42 of XII grade student in SMA Adabiah Padang. The data about conception and misconception of student was found using open ended questions. This type of question let the student explain about their concept with their own understanding without any clue.

Documentation study was held to know the concept in lesson plan of teacher that is based on curriculum or not. The conception of student known by given them 7 open ended questions, so the researcher can analyze the conceptual development of student. The analysis of the open ended question based on the level of student answer of each questions. The questions and the answer level are shown as follow.

1. Mention the sub particles of atom! (C1)

Level 0 = don't know, false and misconception
Level 1 = positively charges, negatively charges and no charges particles
Level 2 = positively charge nucleus and electrons
Level 3 = electrons, protons and neutrons

2. Mention the definition of atom based on Dalton, Thompson, Rutherford ,Bohr and wave mechanic theory! (C1)

Level 0 = don't know, false and misconception
Level 1 = mention Atom based on the dalton atomic theory
Level 2 = mention Atom based on the thompson atomic theory
Level 3 = mention Atom based on the rutherford atomic theory
Level 4 = mention Atom based the bohr atomic theory
Level 5 = mention Atom based on wave mechanic atomic theory

3. Draw the atomic model of dalton, thompson, rutherford, bohr and wave mechanic based on the definition of each teory! (C2)

Level 0 = don't know, false and misconception
Level 1 = draw dalton atomic model as circle/ ball
Level 2 = draw thompson atomic model as the positively charge ball and the negatively charge were embeded inside.
Level 3 = draw the rutherford atomic model which consist of positively charge nucleus and surrounded by negatively charge/ electron in the same energy level.
Level 4 = draw bohr atomic model which proton and neutron as nucleus and surrounded by negatively charge/ electron in certain energy level.
Level 5 = draw the wave mechanic atomic model which proton and neutron as the nucleus and electrons in the orbital

4. Write the electron configuration of Carbon atom (${}^{12}_{6}C$) based on electron configuration of bohr atomic theory and wave mechanic atomic theory ! (C3)

Level 0 = don't know, false and misconception
Level 1 = electron configuration based on bohr atomic theory
Level 2 = electron configuration based on wave mechanic atomic theory

5. Li atom has atomic notation as ${}^{7}{}_{3}\mathrm{Li}$. Draw the atomic model of this atom based on bohr atomic theory and wave mechanic atomic theory ! (C3)

Level 0 = don't know, false and misconception
Level 1 = student draw Li atomic model based on bohr atomic theory
Level 2 = student draw Li atomic model based on wave mechanic atomic theory

6. Na atom has 11 protons, 11 electrons and 12 neutrons. Write electron configuration of Na^+ ion! (C4)

Level 0 = don't know, false and misconception
Level 1 = student write electron configuration of Na^+ ion based on bohr atomic theory
Level 2 = student write electron configuration of Na^+ ion based on wave mechanic atomic theory

7. Some atomic notations are given as follow : ${}_{7}\mathrm{K}$, ${}_{11}\mathrm{L}$, ${}_{15}\mathrm{M}$, ${}_{35}\mathrm{N}$, dan ${}_{18}\mathrm{P}$
   Determine the atoms that place in the same group and period! (C4)

Level 0 = don't know, false and misconception
Level 1 = student analize the questions using bohr atomic theory
Level 2 = student analize the questions using wave mechanic atomic theory

The analysis of open ended questions was done by classification the students answer according the answer level so that the conception of student of each grade found. Beside, the misconception of student was seen too. So that, the concept that make the student tend to be misconception was identified.

3. RESULT

Based on documentation study ,all X grade and XII grade teacher in SMA Adabiah Padang planed all concept based on the curriculum so the assumption, the teacher teach all the concept of atomic structure what student need. The concepts are subatomic particles, atomic concept, atomic model, electron configuration of atom, electron configuration of ion, period and group. Documentation study was not held to XII grade teacher because the concept about atom

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is not learn in XII grade but the assumption, the concept of XII grade student about atomic structure are same with the student in XI grade because they have the same experiences in learning atomic structure.

Based on the analysis of open ended question, the misconception of student about atomic structure can be identified. The analysis was done for each item of question. For this research the misconception was happened for the question number 2 (atomic concept), 3 (atomic model in the cognitive level C-1, 5 (atomic model in the cognitive level C-3) and 6 (electron configuration of ion). The misconception data is shown in the table 2, table 3, table 4 and table 5.

Table 2. misconception of atomic concept

No	Misconseption	Percentage of student
1	The student said that atom of dalton as ball (analogy)	27.45% (grade X : 23.53%, Grade XI : 2%, Grade XII : 1%)
2	The student said that atom of thompson as pullm pudding (analogy)	38.73% (Grade X : 27.94%, Grade XI : 10.3%, Grade XII : 1%)
3	The student said that atom of rutherford as solar system (analogy)	14.22% (Grade X : 12.25% and Grade XI : 0.5%)

The trends that show in the table 6 aren't the real misconception but many student conception of atom as the analogy. Found that 27.45% of student said that atom of dalton as the ball. The analogy was found in many Chemistry books for SMA, one of them is published by Yudistira which wrote by Sandri Justiana and Muchtariadi page 20. Atom of thompson said as pulm pudding model by 38.73% of student. This analogy also found in some Chemistry book for SMA, even text book of Russo [5]. Atom of rutherford said as solar system by 14.22% of student. This analogy also found in chemistry book for SMA and textbook of Russo [5] that show atom rutherford like solar system which nucleus as the solar and one electron in each trajectory move around the nucleus like planets.

Table 3. Misconception of atomic model in cognitive level C-1

No	Misconception	Percentage of Student
1	Rutherford atomic model : the student draw the electron in trajectory but didn't draw the nucleus	2% (grade X : 0.5%, grade XI : 1.5%)
2	Rutherford atomic model : the student draw the nucleus adn trajectory but didn't draw the electron	2% (grade X ; 1%, grade XI : 0.5%, kelas XII : 0.5%)
3	Bohr atomic model : the student draw the energy level and electrons but didn't draw the nucleus	4.41% (grade X : 4.4%, grade XI : 0.5%)
4	Bohr atomic model: the student draw the nucleus and energy level but didn't draw the electrons	14.22% (grade X : 8.8%, grade XI : 3.9%, grade XII : 2%)
5	Bohr atomic model: the student draw more than 2 electrons in first energy level	5.88% (grade X : 4.9%, grade XI : 0.9%)
6	Bohr atomic model: the student draw less than 2 electrons in first energy level then draw the electrons in the next energy level	7.35% (grade X : 4.4%, grade XI :2%, kelas XII : 0.5%)
7	Bohr atomic model: the student draw less than 8 electrons in second energy level then draw the electrons in the next energy level	0.5% (grade XII)

There are 2 misconception of student about atomic model of rutherford in the cognitive level C-1 that are shown in the Figure 1 and Figure 2.

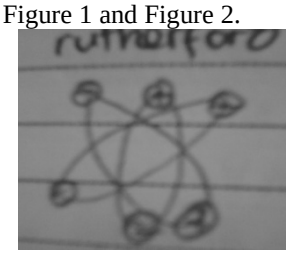

Figure 1. Atomic model of rutherford without nucleus

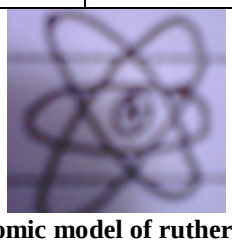

Figure 2. Atomic model of rutherford without electrons.

Based on rutherford atomic theory, atom consists of nucleus which positively charge and surrounded by electron in each trajectory. The trajectories have the same size. The atomic model is shown in Russo [5]

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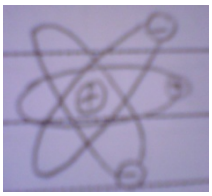
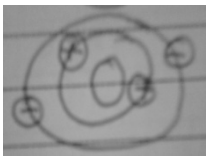


Figure 3. Rutherford atomic model

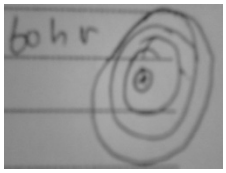
There are 5 misconceptions found for the concept atomic model of bohr. the first misconception is the student draw electrons and energy level (shell) but didn't draw nucleus. The second misconception is the students draw the nucleus and shell but didn't draw the electrons. The third misconception is the student draw nucleus, shell and electrons but draw more than 2 electrons in the first shell. Based on theory, the maximum electrons in the first shell is 2 electrons [5] then the other electron place in the next shell. The fourth misconception is the student draw less than 2 electrons in the first shell but then place the other electrons in the next shell. The correct is just 2 electrons in the first shell then other electrons place in the higher shell. The fifth misconception is the student draw less then 8 electrons in the second shell then they draw the other electrons in the higher shell.

6. Bohr atomic model

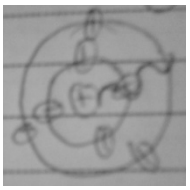
Based on bohr atomic theory, each shell fulfill as $2n^2$ which n is the number of the shell. It means the maximum electrons in the first shell, 8 electrons in the second shell, 18 electrons in the third shell till the highest shell that follow the rule $2n^2$. The misconception of student is shown in the Figure 13 and compare with the correct model based on bohr atomic theory in the Figure 4.



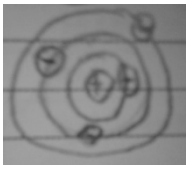
Without nucleus



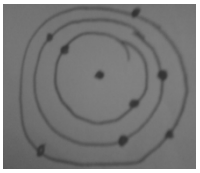
without electrons



More than 2 electrons in the first shell

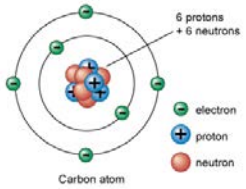


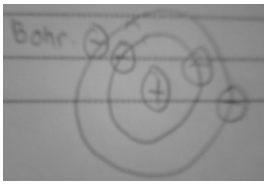
Less than 2 electrons in the first shell



Less than 8 electrons in the second shell

Figure 5. misconceptions of bohr atomic model





Figure

Table 4. Misconceptions of atomic model in the cognitive level C-3

No	Misconceptions	Percentage of student
1	Bohr Atomic theory: the student draw the shell and electrons but didn't draw the nucleus	2% (Grade X : 0.5%, Grade XI : 0.5%, Grade XII : 1%)
2	Bohr Atomic theory: the student draw nucleus and 2 electrons in the first shell but didn't draw the electrons	5.39% (Grade X : 1%, Grade XI : 1.5%, Grade XII : 2%)
3	Bohr Atomic theory: the student draw less than 2 electrons in the first shell then draw the electron in the second shell	0.5% (Grade X)

There are 3 misconception found for the concept atomic model in the cognitive level C-3. The first misconception is the student draw 2 shells and 2 electrons in the first shell and 1 electron in the second

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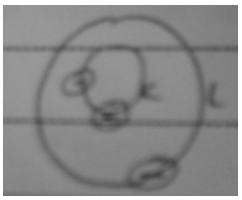
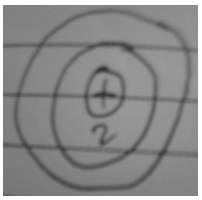
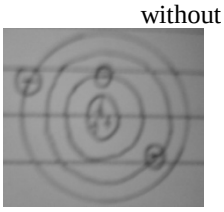
shell but didn't draw the nucleus. The second misconception is the students draw the nucleus and 2 shells but they didn't draw the electrons. The third misconception is the student draw the nucleus and 2 shells but they draw less than 2 electrons in the first shell then draw the electrons in the higher shell. Based on bohr atomic theory Li atomic model drawn as 4 neutrons and 3 protons that arrange the nucleus and surrounded by 2 electrons in the first shell and 1 electron in the second shell. None student draw the proton and neutron but they daw as nucleus which positively charge. The atomic model like they drawn is found in Chemistry book for SMA even textbook of Russo [5]. The misconception about atomic model of Li is shown in the Figure 15 and compare with the correct Li atomic model based on bohr atomic theory in the Figure 7 .



without nucleus



without electrons



Less than 2 electrons in the first shell

Figure 8. Misconception of Li atomic model

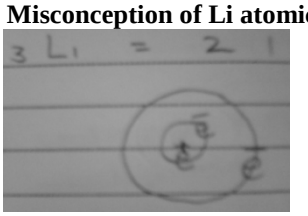


Figure 9. Li atomic model based on bohr atomic theory

Table 5. Misconception about electron configuration of ion

No	Misconceptions	Percentage of student
1	Bohr atomic theory : the student didn't release 1 electron from the third shell for the electron configuration of Na^+	5.39% (grade X)
2	Bohr atomic theory: the student add an electron in the third shell for the electron configuration of Na^+	3.43% (grade X : 1%, grade XI : 1%, grade XII: 1%)
3	Wave mechanic theory : the student didn't release 1 electron in the 3s orbital for the electron configuration of Na^+	1.47% (grade XI : 1%, grade XII : 0.5%)
4	Wave mechanic theory : the student add an electron in the 3s orbital for the electron configuration of Na^+	0.5% (grade XII)

There are 4 misconceptions of student about electron configuration of ion. Two misconceptions based on bohr atomic theory and two misconcepton based on wave mechanic atomic theory. The X grade student didn't release an electron of in the third shell. They wrote electron configuration of Na^+ as 2 8 1. This is the electron configuration of Na. The second misconception about electron configuration of ion is the student add an electron in the third shell of Na so that the electron configuration of Na^+ to be 2 8 2 Based on bohr atomic theory the electron configuration of Na^+ is 2 8 because an electron of Na was released to make it to be Na^+ [5]. The XI grade and XII grade student wrote electron configuration of Na^+ as $1s^2$ $2s^2$ $2p^6$ $3s^1$. This is the electron configuration of Na based on wave mechanic theory. The fourth misconception about electron configuration of ion is the student add an electron in the 3s orbita of Na so that the electron configuration of Na^+ to be $1s^2$ $2s^2$ $2p^6$ $3s^2$. The correct is an electron was release from 3s of Na to make it to be Na^+. So, the correct electron configuration of Na^+ as $1s^2$ $2s^2$ $2p^6$ [1]. From the analysis know that many student didn't understand about the formation of positively ion and negatively ion.

The misconception that was happed for some concepts of atomic structure will impact to the next learning process. So that, all element in school like teacher and headmaster must pay attention to the conceptual development of student and misconceptions of student. the techers must know what will they do to the student or how to teach the concept which hard to understand by student and how to overcome the misconception for certain concepts.

4. CONCLUSIONS

Based on the analysis of 7 open ended question to the student in SMA Adabiah Padang, conclude that the misconception of student happened for the concept of dalton atomic concept, thompson atomic concept, bohr atomic concept, atomic model of rutherford, bohr and wave mechanic. Another misconception is about electron configuration of ion based on bohr and wave mechanic theory.

ISBN 978-602-19877-3-5

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ISBN 978-602-19877-3-5

THE DEVELOPMENT OF GUIDED INQUIRY-BASED WORKSHEET FOR LABORATORY WORK ON TOPIC OF COLLOIDAL SYSTEM FOR SENIOR HIGH SCHOOL INSTRUCTION

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ABSTRACT

Research and Development (R&D) study was done to create aninstructional material on topic of colloidal system for senior high school students. The main goal was to produce a valid and practical guided inquiry-based worksheet for laboratory work for senior high schoolinstruction. The research used 4- D models,a model that comprises four stages including: (1) defining, (2) designing, (3) developing, and (4) disseminating. This research was performed until developing stage in SMAN 14 Padang. Kappa formula was used to examine validity and practicality of the product. Worksheetwasvalid in terms of content, language, graphics, and construct. Mean score of kappa moment for validity was 0.84. The mean score for practicality was 0.80 (for teachers) and 0.93 (for students). Analysis showed that 88% students completed the worksheet appropriately. Onaverage, worksheet for experimental work on colloidal system topic produced had high degree of validity and practicality.

Keywords: inquiry learning, guided inquiry, guided inquiry-based worksheet, research and development, and 4-D model

1. INTRODUCTION

In an attempt to foster the quality of education, ministry of education has currently settled the new curriculum called Curriculum 2013[1].In Curriculum 2013, students are encouraged to think critically, creatively, and innovatively [2]. Learning approach mandated is scientific learning in which students are encouraged to actively inquire knowledge through observing, posing questions, collecting data, associating, and communicating activities[3].

Chemistry is a branch of science that develops from laboratory works resulting concepts, principles, and theories consented throughout the world [4]. As a subject, chemistry entails laboratory work as an essential part in learning[5]. Thus, an experimental-based approach is definitely desired for chemistry instruction at school.

In an experiment, students should be able to apply their understanding to do exercise (problem), solve a problem, and perform scientific skill[4]. However, most experimental works in school laboratories in Indonesia have not yet done optimally. One of the problems is derived from the worksheet used in the experiment. The worksheet merely contains procedures and confirmative information. It does not guide students to develop critical, creative, and innovative thinking.

Inquiry learning is one of learning models that uses experimental methods in learning process. This model emphasizes on the process of critical and analytical thinking to exploreand find the answer of a problem posed [6]. A type of inquiry learning called guided inquiry guides students to explore information with critical (analytical) questions[7]. The questions posed in guided inquiry learning will direct students to build and develop basic concepts of learning[8].Guided inquiry-based experiment will guide students to think critically on why and what they are doing [9]. In any case, guided inquiry-based learning is characterized by the inclusion of five stages of learning including orientation, exploration, concept building (discovery), application, and closure[7].

An appropriate learning instrument is a critical factor for the success of guided inquiry-based learning. One of them could be a guided inquiry-based experiment worksheet. Along with the demand of Curriculum 2013, the worksheet will direct students to observe, pose questions, make conclusion, associate, and communicate during learning process. Several studies on guided inquiry reported that it could increase students' motivation in science learning [10]. Others reported that guided inquiry learning helped students to understand the concepts and thus achieved better learning outcomes [11][12]. Guided inquiry methods increased the confidence of pre-service teachers in learning science**[13]**. Several researchers doing R&D research on guided inquiry-based learning instrument (i.e., worksheet or module) reported that it was valid, and practical and effctive to be used in learning process[14][15].

ISBN 978-602-19877-3-5

Based on the explanations discussed above, researchers wanted to do an R&D research on guided inquiry-based worksheet for experimental work on topic of colloidal system. The research aimed to produce a valid and practical worksheet for senior high school chemistry instruction. It was hoped that the worksheet produced would be a process-oriented one that can be used to help both teachers and students to fulfill the demand of Curriculum 2013.

2. METHODOLOGY

This study belongs to *Research and Development* (*R&D*), a research done to develop a new product or enhance the old one through an accountable action [16].Guided inquiry-based worksheet was designed with Thiagarajan, Semmel and Semmel instructional design model called 4-D model thatconsists of defining, designing, developing and disseminating stages [17].

In defining stage, five analyses namely beginning-end analysis, students analysis, assignment analysis, concept analysis and learning goals analysis were done. In designing stage, guided inquiry-based worksheet was designed for an experimental work on Colloidal System topic. The design was referred to learning cycle of Hanson's guided inquiry (2005) and the writing was in accordance to the guidebook of learning instrument development released by ministry of education in 2008.

In the third stage, validity test, revision, and practicality test were done. In disseminating stage, researchers did socialization of the worksheet and distributed several copies of the worksheet to teachers and students. It was aimed to get the feedbacks from students and teachers on worksheet produced.

Instrument used in this research were validation sheet given to high school teachers and lecturers in Department of Chemistry, State University of Padang, and questionnaire distributed to teachers and students. Validation was done to evaluate the content, construct, language, and graphics used in the worksheet. The questionnaire collected data on practicality of the use of guided inquiry-based worksheet during learning process. The data were then analyzed with kappa moment (k)as described in formula 1 and decision category in Table 1 below.

$$\text{Kappa moment(k)} = \frac{P-Pe}{1-Pe} \quad \text{.....(formula 1)}$$

Where:

k = Kappa moment describing validity of the product.

P = Realized proportion; counted by summing the score given by validators and then divided it by maximum total score.

Pe = Unrealized proportion; counted by substracting the maximum total score with the sum of total score given by validator, which then divided by the maximum total score

Tabel 1. The category of decision based on Kappa moment (k).

Interval	Category
0,81 – 1,00	Very high
0,61 – 0,80	High
0,41 – 0,60	Medium
0,21 – 0,40	Low
0,01 – 0,20	Very low
≤ 0,00	Invalid

3. RESULT AND DISCUSSION

3.1. Result

To accomplish the demand of Curriculum 2013, a guided inquiry-based worksheet for experimental work on Colloidal System topic was produced by using 4-D instructional design model. The following explanations describe the result of this study.

3.1.1. Defining stage

The anaysis done in this stage included beginning-end analysis, students analysis, assignment analysis, concept analysis and learning goals analysis. Beginning-end analysis was done to determine the main problems faced by both teachers and students in chemistry learning. Data showed that teaching and learning process was mainly teacher-centered in practice.Likewise, experimental work was not performed comprehensively at schools.

Students analysis was done towards grade XII senior high school students (whose ages range from 15 to 17 years old). According to Piaget, senior high school students (also called adolescent) are in the stage of operational development where they can already develop a thinking skill[17]. They can think in a logic way, make interpretation, and draw a conclusion. Data revealed that students in this study liked learning instruments that contained pictures and were attractive and well structured.

Assignment analysis was performed on core competencies (Kompetensi Inti, KI), basic competencies (Kompetensi Dasar, KD), and learning topics. As a result, three learning indicators were obtained. They were : a) distinguishing solution, colloid and suspension from each other based on their characteristics, b) explaining the synthesis of colloid by condensation and dispersion process with data from experimental work, c) describing the stability and adsorption properties of colloid and their use.

Concept analysis was executed to analyze main concepts to be taught. They included the differences of mixtures (solution, colloid, and suspension), types of colloid, characteristics of colloid, and synthesis of colloid (condensation and dispersion)[19].Learning goals analysis is the alteration of assignment and concept analysis into learning goals**.** The analysis yielded three learing goals which then were used to design the product intended. The learning goals were included in three points just like those of learning indicators stated above.

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3.1.2. Designing stage

Guided inquiry-based worksheet for experimental work was designed based on guided inquiry learning cycles developed by Hanson. Format of the writing was suited to the guidebook of learning instrument development released by ministry of education in 2008. The steps included in this stage were:

a. Determining the topic ofworksheet for experimental work.
b. Determining KI and KD of the topic.
c. Specifying learning indicators from KI and KD.
d. Formulating learning goals from the indicators[They would be the goals of the experiment].
e. Deciding prerequisite knowledge and information for students to formulate hypothesis.
f. Designing procedures for the experiment
g. Designing table of observation and key questions to guide students in finding the concepts from experiment's data. On the same page, related information was given to assist students to find the answer.
h. Providing questions and problems for the practice (application)
i. And lastly, directing students to make conclusion.

3.1.3. Developing stage

In this stage, inputs and suggestions from validator were used to revise the worksheet. The stage included validation, revision, and practicality test.

3.1.3.1 Validation

Validation of the worksheet was done on four components namely content, construct, language, and graphics components. Those components were validated by expert validators (judgment experts), which consisted of three chemistry lecturers and two chemistry teachers. The validation on guided inquiry-based experiment worksheet is presented in Table 2.

Table 2. Score of validity on four components given by validator I to V

Components	k(1)	k(2)	k(3)	k(4)	k(5)
Content	0,96	0,88	0,79	0,79	0,60
Construct	1	1	0,80	0,80	0,79
Language	1	0,84	0,84	0,75	0,84
Graphics	1	1	0,75	0,92	0,67
Decision given by validators	Valid with revision	Valid with revision	Valid with revision	Valid with revision	Valid with revision

Note : k (I)=kappa moment of validator I ; k (II)kappa moment of validator II ; k (III)= kappa moment of validator III ;k (IV)= kappa moment of validator IV ; k (V)= kappa moment of validator V

3.1.3.2. Practicality test

Data of practicality was obtained from questionnaire distributed to 25 students and chemistry teachers (presented in Table 3). Practicality of the product can also be inferred from data on students' responses to questions in the worksheet. The result is presented in Table 4.

Table3. Data of practicality of guided inquiry-based worksheet from teachers' and students' questionnaire

Subject	Teacher	Student
Mean kappa moment	0,80	0,93
Practicality category	Very high	Very high

Table 4. Percentage of students who correctly answered questions in guided inquiry-based worksheet

No	Category	% of students	% of mean
1	Formulating hypothesis	84	88
2	Filling table of observation	92	
3	Answering key questions	89	
4	Doing exercises	89	
5	Inferring conclusion	92	

3.2. Discussion

Judgment experts were asked to validate the worksheet on content, construct, language and graphics components [16,17]. Data were then analyzed with Kappa Cohen formula. On average, guided inquiry-based worksheet produced had high degree of validity. Several components needed to be revised as suggested by the validators. Yet again, the product could be said valid as it had appropriate content and construct [20].

Several suggestions from validators were taken to revise the worksheet. First, we formulated the design of the experiment in more precise way and then connected it with the observation anticipated. Then, we added more references, added table of content page, and added more information to help students in answering the key questions. The revised worksheet was then tested to determine its practicality in learning (experimental work).

3.2.1. Practicality analysis from teachers' questionnaire

Shown that Table 3, the mean score of practicality of the worksheet was 0.8 It means that the worksheet had high degree of practicality. Therefore, guided inquiry-based worksheet for experimental work on Colloidal System topic was suitable for use in teaching and learning process at school.

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Practicality is a fundamental aspect that a learning instrument should possess. Practicality can be seen from how easy it is to be used and interpreted[21]. Worksheet for experimental work that produced could direct students to find concepts and relate the facts obtained during experiment with theories behind it. The key questions, given had created a students-centered learning where teachers functioned as a facilitator and motivator.

3.2.2. Practicality analysis from students' questionnaire

Table 3 shown that, the mean score of kappa moment from students' perspective was 0.93 it indicates that the worksheet had very high degree of practicality in learning process. The worksheet was easy to use, effective, and attractive to students during learning process [21].

Data in Table 4 shows that on average, 88% of students could fill in the worksheet correctly. This suggests that the worksheet could direct students to connect the facts obtained in the experiment with theories provided in the information section. It could also help students answering the key questions to help them find the concepts, use it to do problems (exercises) and make conclusion. Researchers cannot deny that the use of color and design in the worksheet indeed attracted students to study [23].

To sum up, guided inquiry-based worksheet for experimental work on Colloidal System topic could direct students to find concepts and helped them to understand the lesson.

4. CONCLUSION

A guided inquiry-based worksheet for experimental work on Colloidal System topic for senior high school instruction was successfully produced. The worksheet had high degree of validity and was practical in learning process.

5. ACKNOWLEDGEMENTS

Researchers would like to say thank to Dr. Usman Bakar, M.Ed.St., Dr. Latisma Dj, M.Si., Drs. Zul Afkar, MS., Dra Sri Yuningsih, and Ermayulis S.Pd. for being our product validators. Also we thank to Guspatni, S.Pd, MA for language translation of this article. Lastly, we thank to participating students and teachers and all of the people who had contributed to the success of this research.

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ISBN 978-602-19877-3-5

TRACE METALS ACCUMULATION IN VEGETABLES FROM SOME AREAS IN WEST SUMATERA

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ABSTRACT

The vegetables are important source of essential trace elements for the people and constituted the lowest cost of main food for majorityof people in developing countries. Especially, the content of Cu and Zn in vegetables is important for human nutrition. Cu and Zn were determined in five selected sites from four locations for each of vegetables in west sumatera. These vegetables are cabbage,carrot, cauli flower and potatos. The Cu concentration varied from 0,2729 – 0,4141 mg/L and the Zn Concentration are 0,5181 – 1,6509 mg/L. The obtained Cu and Zn contents showed that vegetables from this part of globe could serve as good dietary sources for essential trace metals and the levels are within safety baseline content for human consumption in the province

Index Term---Cu, trace metals, vegetables, and Zn

1. INTRODUCTION

Vegetables constitute essential components of the dietby contributing vitamins and minerals, other nutrients which are usually in short supply. Vegetables are one of holticultura commodity and it potentially as source of national income. Consumtion of vegetables every years increase because of customer care to product quality and helath. One of major problem in food production is quality and safety aspect. Vegetables quality inconsistently and high contamination level bringing loss of trade of this commodity. Hence, higenity and safety of consumed vegetables is important in order to prevent health problem. However, theseplants may contain both heavy metals such as lead (Pb), Cadmium (Cd), and mercury (Hg) at a wide range of concentrations. Some of metals at low concentration contribute to biochemical process in human body such as iron (Fe), zinc (Zn), and copper (Cu) and they are needed in enzymatic activity.

Heavy metals are metal and metalloid elements which has atomic density above 4g/cm^3.Transisition metal and high mass number metal of group III and V in periodic system are heavy metals. Low concentration of these metals become toxic substance to plat, animals, and human. Agrochemical materials such as pesticide and chemical manure contain heavy metal especiallyCu and Mn. It is well known that plants take up metals by absorbing them from contaminated soil as well as from deposits on parts of the plants exposed to the air from polluted environments. Hence, we must be wary with contamination of agrochemical materials toward agriculture soil resource in central of production of food and vegetable plants.

West Sumatera supply vegetables to its neighbouring provinces and become big one of producerin Sumatera. Quality of supplied vegetables must good. Study of determination of metal in vegetables has been done by Arisa (2011): determination of heavy metals Cu, Cd, and Pb in potato (*Solanum tuberosum L*) using AAS. The conclusion of this study is potato contain these heavy metals but it still not out of bonds.Subukola et al (2010) conduct the content of heavy metals in fruits and vegetables in some supermarket at Lagos Nigeria and the result is these fruits and vegetables contain Pb, Cd, Cu, Zn, Co, and Ni still not out of bonds.

The aim of this research was to determine the Cu and Zn contents of some vegetables commonly grown in West Sumatera province. This research also aimed at providing a baseline data on Cu and Zn levels in some vegetables for this province.

2. MATERIALS AND METHOD

The four sampling sites were selected for eachvegetable samples from West Sumatera: Kabupaten Tanah Datar, Kabupaten Agam, Kabupaten Solok dan Kota Padang Panjang. The vegetables are: cabbage, carrot, cauliflower, potato, and mustards green.Each of vegetables is taken from five different point in each region.

20 ml HNO3 was added to 10.0 g of the sample and allowed to stand for 15 min. The mixture was heated until the liquid reduced to 5 ml. After cooling, 20 ml HNO3, 10 ml H2SO4 and 8 ml H2O2 were added and the contents were evaporated to 5 ml. After cooling, to eliminate residual acid, 10 ml deionized H2O was added and the mixture was boiled for 10 minutes. This

Was repeated twice. After cooling, the digest was filtered into 25 ml volumetric flask and made up to mark with deionized H2O. The digestion solutions were subsequently analysed for Cu and Zn using an Atomic Absorption Spectrophotometer.

ISBN 978-602-19877-3-5

3. RESULT

Heavy metals is one of the parameters of pollution of water, soil, air, and food. In vegetables, heavy metals are in relatively accumulative small concentrations, it give an impact in the long term. In the vegetable heavy metals are in the form of organo-metallic so that the analysis of heavy metals in vegetables are destructed to wet destruction using HNO_3 as a solvent.

Destruction aimed to changing the analytes in complex sample matrices to be simpler so easily analyzed. The use of HNO3 is based on a large nitrate salt solubility in water so expect the metals to be analyzed not undergo precipitation .

a. Determination of metals in samples of vegetables per location

3.1.1 Solok

Sampling site is in BatuBagiriakAlahanPanjang, LembahGumanti district, Solok Regency. Samples were taken at five (5) points are expected to represent the distribution of heavy metals in vegetables each district . Data from the measurement of the concentration of heavy metals in vegetables in Solok can be seen in Figure 1.

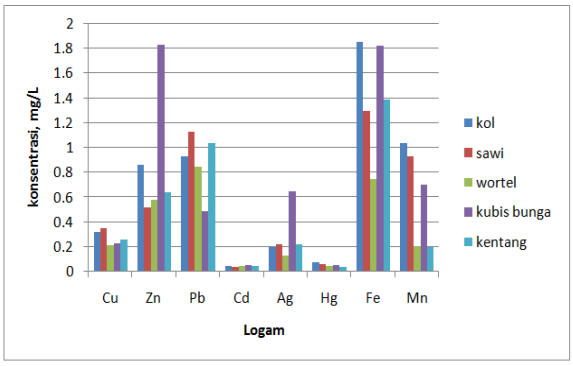

Figure 1.Heavy metals concentration in vegetable samples at Solok.

From the picture, it can be seen that the source of vegetables have no effect on the distribution of heavy metals . In general,toxic metals such as Cd (0.04162 to 0.05488 mg / L) and Hg (0.04141 to 0.07752 mg / L) present in relatively low amounts of other metals . Likewise Ag (approximately 0.2 mg / L except the cabbage flower contained around 0.6459 mg / L) . The average content of each vegetable is high in Fe and Zn as a mineral that humans need of consuming vegetables . While one of the metals Pb toxic contained in a relatively large amount of around 0.4878 to 1.1229 mg / L .Pb exposure is probably derived from motor vehicle fumes . Even so the concentration is still below the threshold of normal plants ranged from 0.5 to 3 mg / L.

For Cu, the concentration range in all the vegetables ranged at 0.21536 mg / L (in carrots) - 0.3535 (in mustard . Normal concentration of these components in soil ranges from 20 mg / L with a degree of mobility is very slow because of a strong bond with the organic material and clay minerals. Copper contamination in foodstuffs initially occur due to the use of fertilizers and pesticides excessively. Nonetheless , the effect of the processing will be able to affect the status of the presence of copper in foodstuffs (Charlene , 2004) . Director General of Food and Drug Monitoring (POM) RI has set a maximum threshold of heavy metal contamination of copper in fresh vegetables is 50 mg / L . However, copper must be present in the human diet and is needed by the body (Acceptance Daily Intake / ADI = 0.05 mg / kg body weight)

3.1.2 Tanah Datar

The content of heavy metals in vegetables in Tanah Datar is not much different in Solok . The highest average concentration in each of the vegetables is dominated by metallic Fe in the range of 0.7082 to 1.8142 mg / L, Zn in the range of 0.503 to 1.8271 mg / L and Pb in the range of 0.48784 to 1.1782 mg / L. Cu , Ag and Mn quite high, in the range of 0.2041 to 0.3008 mg / L for Cu , 0.1991 to 0.64594 mg / L for Ag and 0.20686 to 0.9162 mg / L for Mn . For metals Cd and Hg is within the range that is low enough that 0.04414 to 0.04762 mg / L and 0.01773 to 0.0834 mg / L respectively for Cd and Hg.

Distribution of heavy metals in vegetables in Tanah Datar can be seen in Figure 2.

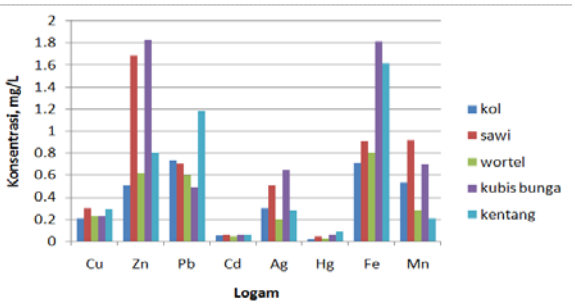

Figure 2.Heavy metals concentration in vegetable samples at Tanah Datar.

Types of vegetables does not affect the distribution of heavy metals contained in. In general, the heavy metal content of Cu, Zn, Pb, Cd, Ag, Hg, Fe, and Mn are still below the minimum threshold required for vegetables.

3.1.3 Padang Panjang

For Padang Panjang, content of heavy metals in vegetables tested can be seen in Figure 3.

ISBN 978-602-19877-3-5

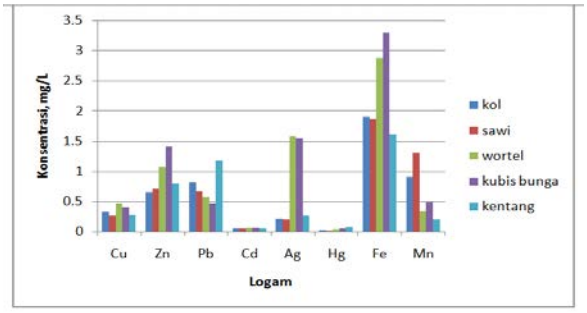

Figure 3.Heavy metals concentration in vegetable samples at Padang Panjang.

From the picture above it can be seen that the Fe content is generally higher than other heavy metal content is in the range of 1.61764 to 3.3036 mg / L. The content is still safe because below the threshold required for foodstuffs which is 425 mg / kg vegetable samples. (FAO / WHO - Codex commission alimentations , 2001 in Nenman , Daniel Victor et al , 2012). While metals Cd and Hg average content in general for each type of vegetable lowest is 0.0539 to 0.0699 mg / L for Cd and 0.02188 to 0.0834 mg / L for Hg.

3.1.4 Bukittinggi

For Bukittinggi, mustard samples was taken at Sariak, Agam regency. cauliflower at Sungai Pua, Agam regency , cabbage in KubangPutiah, Agam regency , carrots in Balingka, Agam regency . Data distribution of heavy metals in Agam District can be seen in Figure 4.

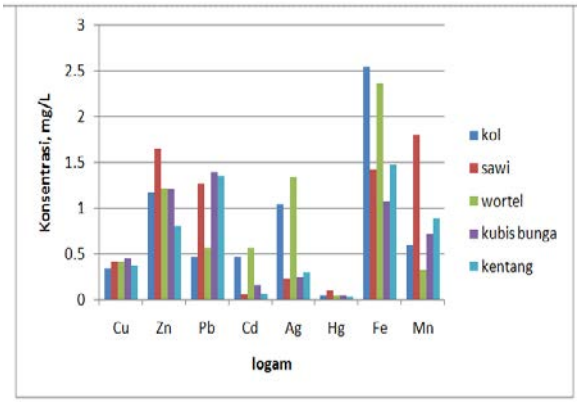

Figure 4. Heavy metals concentration in vegetable samples at Padang Panjang

Just as in other locations , the average content of heavy metals in each vegetable is still within safe limits each metal. The content of the highest average achieved by the metal Fe is 1.0824 to 2.5508 mg / L. Mineral Fe is one of the minerals intake is restricted, because an excess can be detrimental to health, which is at risk of pro - oxidant activity , thus stimulating the formation of free radicals. Fe mineral deficiency can cause anemia or less blood (erythrocytes).

The presence of heavy metals in vegetables can be sourced from farms or from contamination of smoke from factories and motor vehicles . The content of heavy metals in agricultural soil can reduce agricultural productivity and the quality of agricultural products than can be harmful to human health through the consumption of food produced from soil contaminated with heavy metals (Subowo , 1999) . Vegetable crops are grown in media contaminated with heavy metals can accumulate in high concentrations of metals , causing serious health risks to consumers (Long , 2010).

4. CONCLUSION

From the research that has been done can be concluded as follows :

a. The average concentrations of Cu , Zn , Pb , Cd , Ag , Hg , Fe and Mn in various types of vegetables and various locations within the range from 0.2041 to 0.4717 mg / L for Cu , 0.503 to 1.8271 mg / L for Zn , 0.4662 to 1.5229 mg / L for Pb , 0.04162 to 0.5621 mg / L for Cd , 0.1277 to 0.6459 mg / L for Ag , from 0.01773 to 0 , 09 274 mg / L for Hg , from 1.61764 to 3.3036 mg / L for Fe and 0.20686 to 1.8501 mg / L for Mn metal .
b. In general of samples that have been analyzed , Hg and Cd concentrations were in the lowest average while the average metal concentrations highest in each of the vegetables is Fe.
c. Types of vegetables and sampling sites does not affect the distribution of heavy metals .

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ISBN 978-602-19877-3-5

SODIUM – DIETHYLDITHIOCARBAMATE AS A COMPLEX AGENT FOR PRECONCENTRATION AND TRACE ANALYSIS OF Cd(II) BASED ON FLOW INJECTION ANALYSIS (FIA)

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ABSTRACT

Preconcentration is the process of increasing an analyte's concentration before it's analysis without addition standard's process. In this research, preconcentration based on flow injection analysis (FIA). FIA based on injection of a liquid sample into a moving unsegmented continuous stream of a suitable liquid. Preconcentration with XAD-16 minicolumn.. Amberlite XAD-16 polimeric adsorbent issued to adsorb hydrophobic molecules from polar solvent. Cadmium (II) can be complexed with Sodium Diethyldithiocarbamate (DDTC) at pH 7 formed Cd(II)-DDTC complex. This research focused on retained-elution Cd(II)-DDTC complex using amberlit XAD-16, observed how the effect of eluent, pH, selective of methods, volume of eluent, retention capacity of amberlite XAD-16. Time saturated of minicolumn was 23,1 second with time stream 2mL/minutes. The research shows that retention capacity of amberlite XAD-16 is 0.003 mg Cd(II)-DDTC per g XAD-16. The precision for this method expressed as coefficient variation for concentration 50 ppb is 3.46 % and for concentration 100 ppb is 2.20 %. The sensitivity and limit of detection obtained was 0.40 ppb and 1.61 ppb, respectively. The linier range can be attained between 10 ppb until 100 ppb with a correlation coefficient is 0.966. This method has a good accuracy according to % recovery > 90 %. EF point is 3.09, CE point is 0.18 minutes^{-1} , and CI point is 7.5mL. The study of analytical performance showed this method can be used to analysis Cadmium (II) on a trace concentration in water sample.

Index Terms----Preconcentration, trace analysis, flow injection analysis, Amberlite XAD-16, Cadmium (II)

1. THE BACKGROUND OF STUDY

Heavy metals (such as cadmium, copper, mercury, lead) proved toxic element in a relative small trace levels and potentially cause disruption to humans. As the main source of these heavy metals is from water and food, then it is very important to control the content of the heavy metal in the water. Contamination by metal cadmium in the environment is generally lower than 5ngmL^{-1}, so that it is necessarily needed a sensitive technique in its determination (Ilton, 2004).

Cadmium (Cd) is an abundant element that ranks 67 most of in the earth's crust. It is placed in group II on the periodic table with atomic number 48, atomic weight 112.4, density of 8,46g / cm^3, 320,90C melting point and boiling point of 767^{0}C. Form metal is soft, silvery (Sunarya, 1980).

Cadmium is mainly used in Ni-Cd batteries manufacturing, as pigments, stabilizers, fabric coatings, alloys and electronic compounds suc h as cadmium telluride (CdTe) as the semiconductor. Cadmium is not an essential element for the human body. Humans can absorb the element of cadmium into the body through breathing or food, while the absorption through the skin is not generally done. The total of cadmium absorbed by the body is 2% to 6% from all the cadmium entering through food.

Cases of chronic pollution caused by cadmium poisoning have occurred in Japan along the river *Jitsu*, known as "*Itai-itai*" (it means screaming because of sudden illness). Patients have great disorders of the kidneys, liver and bone which sometimes lead to death. This pollution arises from industrial waste mining cadmium, zinc and lead. The industries discharge wastewater into *Jitsu.* In downstream area, farmers use the water to irrigate their fields. They do not realize that diseases which arise in the area come from the water contaminated by the industrial waste. The situation known only after Dr. June Kobayashi from agricultural faculty of Okayama University analyze bone and other tissues of the victims, it is known that there is a damage to the kidneys and bone demineralization caused by cadmium. Cadmium is absorbed by the pulse from the water consumed by the patient. Symptoms caused by cadmium poisoning, occur after a few years the body absorbs these elements.

Cadmium is also accumulated in the water, in the sea as much as 70-110 ng / L and 2-960 ng / L in tasteless water. The concentration of trace cadmium in samples has been determined by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) method, liquid chromatography, electrochemical methods, and Graphite Furnace Atomic Absorption Spectrometry (GFAAS). The concentration of cadmium in water is very low so it is

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essentially needed preconcentration techniques, such as solvent extraction, ion exchange, and electrodeposition to improve the sensitivity in the analysis (Yoshihiro, 2001).

One of the obstacles in analyzing the methods above is the very low concentration of cadmium in the environment, so these methods are less sensitive and require a very high cost.

In this study, it will be studied some conditions that affect the success of preconcentration and spacies analysis of Cd (II) in sample, which includes the type of eluent, pH, selectivity method, the volume of eluent, the retention capacity of the adsorbent. The study was based on the reaction of Cd (II) complexed with diethyldithiocarbamate Sodium (Na-DDTC). The complex formed then experienced preconcentration. P reconcentration method used is based on the mechanisms of retention-elution complex Cd (II) -DDTC using amberlit XAD-16. The analytical method developed is based on the technique of Flow Injection Analysis (FIA) with Atomic Absorption Spectrophotometer (AAS) as a detector.

Flow Injection Analysis (FIA) technique is a technique which is based on injection of the sample solution into a continuous flow. This analysis technique has several advantages such as, short analysis times, a little of amount reagent needed as well as high-value measurement of reproducibility (Fang, 1993).

1.1 The Objective Of The Study

This study aims to develop and evaluate preconcentration technique and trace analysis of Cd (II) with Na-DDTC as complex based flow injection analysis using amberlit XAD-16.

2. RESEARCH METHODOLOGY

2.1. Place and time of the study

The study was conducted at the Chemistry Laboratory of Technology Institute of Bandung.

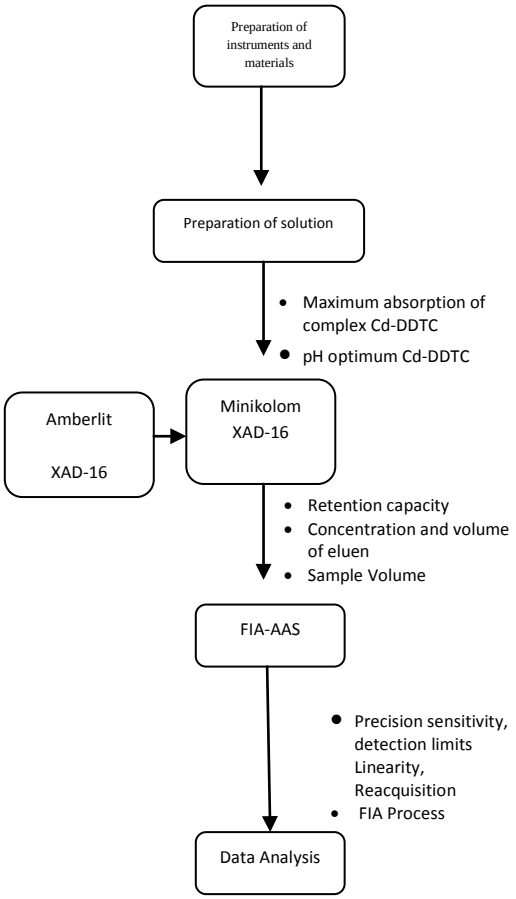
2.2. Instruments

Instruments used in this research: UV-Visible spectrophotometer (Diode Array Spectrophotometer, HP®-8452A), a peristaltic pump (Ismatec®), pHmeter (Hanna®), magnetic stirrer, minikolom, pipe tygon®), injection valve, Atomic Absorption Spectrophotometer (AAS) (GBC® 902), glass tools commonly used in analytical chemistry laboratories, among others: a beaker, flask, pipette, rod stirrer, pipette volume, a measuring pipette, measuring cup, spray bottle

2.3. Materials

The materials used in this study had a purity level of pro analyst (pa), except others stated. The materials are Cd $(NO_3)_2.4H_2O$, Sodium-diethyldithiocarbamate (Na-DDTC), HNO_3, methanol, NaOH, amberlit XAD-16 Aqua demineralization

2.4. Flowchart of research



2.5. Research Protocols

2.7.1. Research introduction

The preliminary study included determining the ratio of the maximum complex Cd (II) -DDTC, the effect of pH on the formation of complexes Cd (II) -DDTC, and determining of the retention capacity of complex Cd (II) -DDTC by using amberlit XAD-16 which has been prepared by the batch method.

2.7.2. Determining of Wavelength Maximum complex Na-DDTC

Created Na-DDTC solution with various concentrations, measured by UV-Vis spectrophotometer, then observed maximum wavelength produced.

2.7.3. Determining of Optimum Complex Comparison of Cd-DDTC

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Created complex solution of Cd-DDTC in the flask 25 mL with a variety of mole ratio of Cd-DDTC by pipetteing a solution of Cd (II) in certain concentration then added complex Na-DDTC in certain concentration, in order to obtain a mole ratio of Cd-DDTC (1: 1, 1 : 5, 1:10, 1:15, 1:20). The absorbance t hen was measured by using UV-Vis spectrophotometer.

2.7.4. The Effect of pH to Complex Formation of Cd-DDTC

Created 25 mL solution of complex Cd (II) of 0.5 ppm-DDTC 4.4 x 10-5M then adjusted the pH variation between 5-10 complex solution by adding HNO3 or NaOH. By using *batch* complex solution is then combined with amberlit XAD-16, stirred for an hour. Complex combined in amberlit XAD-16 was determined by measuring the absorbance using atomic absorption spectrophotometer.

2.7.5. Retention capacity complex of Cd-DDTC to XAD-16

It was made a complex solution of Cd-DDTC with various concentrations of Cd 0.125 to 2 ppm in 25 mL volumetric flask and concentration of Na-DDTC ie 4.4 x 10-5, at optimum pH. For each complex solution included 0.2 g XAD-16, stirred for an hour, then the filtrate was measured by using Atomic Absorption Spectrophotometer.

2.6. Advance research

Minicolumns used are made of Polytetrafluoroethylen (PTFE) with length about 5 cm long, 0.5 cm in diameter, containing 0.2 grams amberlit XAD-16 which has been prepared. Charging is done by using *slurry* method. Carrier flow rate, sample and eluent are permanent, namely 2 mL /min. This further research includes the determining of retention capacity of amberlit XAD-16 and the effect of eluent concentration, eluent volume, sample volume toward the measurement.

2.7.1. Amberlit retention capacity of XAD-16 toward Cd (II) -DDTC In Flow

Created solution of Cd (II) of 0.5 ppm and then complexed with DDTC 0.1% at optimum pH conditions. The solution is then poured into minicoloum with flow rate of 2 mL / min, until the resulting peak is in the detector signal (minicoloum no longer able to retain complex of Cd (II) -DDC). The time is needed to reach peak measured, converted to the flow rate to obtain the maximum volume of complex Cd (II) -DDC combined, so capacity of retention amberlit XAD-16 toward complexes Cd (II) -DDTC can be calculated.

2.7.2. Preconcentration by flow injection-SSA analysis

This analysis method of Species Cd (II) used preconcentration technique with atomic absorption spectrophotometer detection. Injection - minicoloum pumps and SSA are directly connected by using 0.5 mm diameter hose. The investigation on this study includes the volume of eluent, analytic performance and the performance of FIA. Minicoloum circuit - based flow injection analysis can be seen in Figure 1.

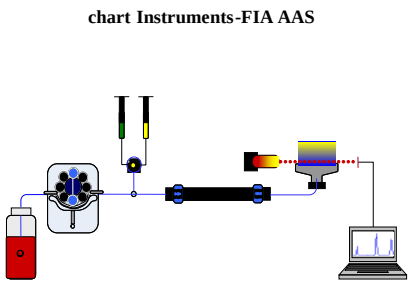

Figure 1. Circuit Flow Injection Analysis

2.7.3. Determining of eluent Concentration

Standard solution of Cd (II) 100 ppb which has been complexed with Na-DDTC 4.4 x 10^{-5}, and regulated pH complex 7 then pumped into minicoloum with a flow rate of 2mL / min. Analyte retention then eluted with HNO_3 start from 0.1 M - 3M for a concentration. From the high data signal obtained and determined the eluent concentrations to elute complex Cd (II) –DDTC well.

2.7.4. Determining of Minimum Eluent Volume

Standard solution of Cd (II) 100 ppb which has been complexed with Na-DDTC 4.4 x 10^{-5}, and regulated pH 7 and then pumped into minicoloum as much as 5 mL in 2 mL / min at flow rate. Analyte retention then eluted with eluent from 0,1mL-2mL. From the height data signal obtained and determined the eluent concentrations used to elute the complex of Cd (II) –DDC well.

2.7.5. Determining of samples Volume

Standard solution of Cd (II) 100 ppb which has been complexed with Na-DDTC 4.4 x 10^{-5}, and regulated pH complex 7 then pumped into minicoloum with 0,5ml-8ml variations of sample volume, flow rate 2mL / min. Analyte retention then eluted with 1M HNO_3. From the height data signal obtained

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and determined the good sample volume to the next retention

2.7.6. Precision Signal

Solution of Cd (II) -DDC 50 ppb is repeatedly measured with the same measurement conditions, and then height signal is measured. Precision signal is indicated by percentage (%) of variance Coefficient.

2.7.7. Determining of linearity

Linearity is determined by making a calibration curve. Created a standard solution of Cd (II) at several concentrations, from 10 to 100 ppb, and then added a solution of complex Na-DDTC 0.1%. Absorbance was measured at FIA-AAS construction

2.7.8. Sensitivity

Sensitivity is determined by using a solution of 10 ppb. It is calculated then how much concentration that can provide absorbance changes.

2.7.9. The detection Limits

The detection limit is determined by measuring the uptake smallest price which can still be distinguished by a blank. The detection limit is stated as a standard signal ratio (S) to the blank signal (N) or S / N = 3

2.7.10. Matrix Influence and Recovery

It is needed to analyze the samples of water by applying *Spike* method in order to determine the accurate method and notice the effect of matrix on the analysis. Samples analyzed were water of Citarum River. First of all samples already complexed were directly measured by passing into the column, in order to obtain the absorbance of the sample. Prepared flask 50 mL, spiking is done into the flask to create a standard solution of Cd (II) 40 ppb, added a complex DDTC solution as much as 0.1%, and then diluted with samples up to mark boundaries. The results obtained are compared to the original sample (without additional standard solution).

2.7. FIA performance

FIA performance assessed included: Enrichment Factor (EF), Concentration Efficiency (CE), and consumptive Index (CI).

2.7.1. Enrichment Factor (EF)

Signal solution of Cd (II) 80 ppb after preconcentration based on flow injection analysis is compared to 0.25 ppm signal with direct measurement on SSA detector.

2.7.2. Concentration Efficiency(CE)

Concentration efficiency (CE) is stated per minute, namely the comparison between EF solution of Cd (II) 100 ppb and the frequency of analysis per every minute.

2.7.3. Consumptive Index (CI)

A total volume of reagents required in a time sequence analyzes.

3. FINDING AND DISCUSSION

3.1. Characterization Of Complex Cd (II) –DDTC

3.4.1. Condition of Optimum concentration Sodium-diethyldithiocarbamate Used

Cadmium when reacted with sodium-diethyldithiocarbamate will produce a white deposition or produce turbidity. To get a good complex Cd (II) -DDTC is necessary to do an experiment to notice the optimum absorbance of Sodium diethyldithiocarbamate appropriately used to complex certain metals

Based on measurement of data (Appendix 1) showed that good absorbance measurements can be done if it is used a concentration arround 7.5 x 10^{-5} M Sodium-diethyldithiocarbamate. At concentrations above 7.5 x 10^{-5} M, it will give a white deposition and the absorbance obtained by using spectrophotometry UV-Visibel to exceed the linear range expected around 0.2 to 0.8. If the concentration is used, it will produce a deposition and disturb the analysis process.

3.4.2. Conditions of the optimum ratio complex of Cd (II) -Natrium- diethyldithiocarbamate, (Cd (II) -DDTC)

Having been obtained the optimum concentration of sodium-diethyldithiocarbamate, it is necessary to determine the ratio between complexer and complexed metal in order to obtain optimum conditions of metal complexes as well. Based on the experiment, it will be conducted the variation of mole ratio between metal cadmium and complex sodium-diethyldithiocarbamate. The determination of the optimum complex ratio is calculated using *job'method*. So it can be obtained results that can be observed in Figure 2.

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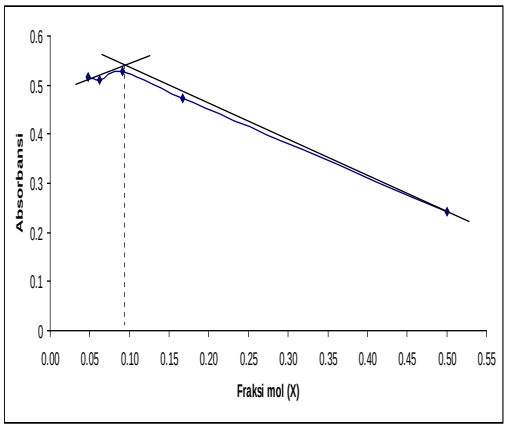

Figure 2. Determining of complex mole ratio of Cd (II) –DDTC

From the absorbance values obtained in a mole ratio of Cd (II) with sodium-diethyldithiocarbamate, it is obtained the optimum ratio in which the ratio (1:10) mole.

3.2. Effect of pH on the retention capacity of complex Cd (II) -DDTC toward amberlit XAD-16

pH affects the complex formation between cadmium and complex metal sodium-diethyldithiocarbamate. From the data obtained was observed the relation between retention capacity to complex solution pH as in Figure 3.

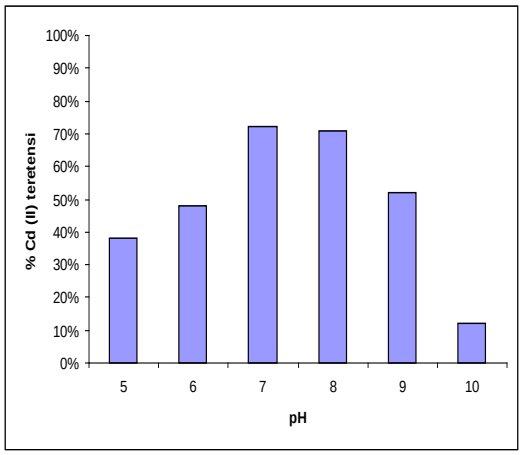

Figure 3. Effect of pH on the formation of complexes Cd (II) –DDTC

Cadmium ion is optimally restrained at pH 7, with retention capacity 70%. Retention capacity a pH 7 below is 38% this shows incomplete formation of Cd (II) –DDTC complex. It is also observed at pH 8 above, in which pH is very alkaline hydroxide, there is a possibility of formation that will be more dominant so the complex formed is incomplete.

3.3. Capacity Retention Complex Cd (II) -DDTC Toward Amberlit XAD-16

Determining of the retention capacity of XAD-16 toward the complex solution of Cd (II) concentration range - DDTC 4.5 x 10^{-5} M with optimum pH 7, as much as 25ml has been done. The results can be seen in (Appendix 4). On figure 4 shows the complex retention of Cd (II) -DDTC at various concentrations use 0.2gr amberlit XAD-16. From the research conducted which showed that 0.2 g of XAD-16 is only capable to restrain a maximum retention complex solution as much as 0.5 ppm Cd (II) - DDTC 4.5 x 10^{-5} M in other words it is obtained retention capacity as much as 0,054 mg Cd (II) - DDTC / g XAD-16.

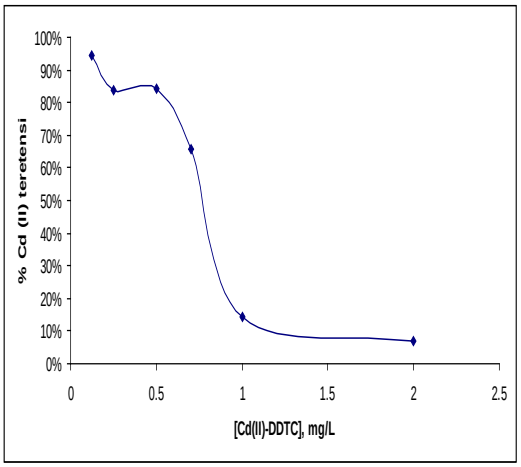

Figure 4. Retention complex of Cd (II) -DDTC at various concentrations using 0.2 g amberlit XAD-16

3.4. Advanced Research

3.4.1. XAD-16 Retention Capacity

Complex Cd (II) -DDTC has little non polar properties so it is selected as filler minicoloum, namely amberlit XAD-16. Additionally, amberlit XAD-16 is selected as the filler material minicoloum for not showing the development or shrinkage symptoms, it is strong enough to withstand steeper linear flow rate passing through the column, it can be repeatedly used, and stable in most organic solvents. Homogeneous pore size distribution which allows the material XAD-16 is a good adsorbent. Retention capacity of amberlit XAD-16 analysis has been carried out. This capacity is a measure of capability of amberlit XAD-16 to restrain the complex Cd (II) -DDTC. The more the number of molecules absorbed, the greater the retention capacity of the column. Retention capacity amberlit of XAD-16 analysis to Cd(II)-DDTC is conducted by using flow method. At concentration of Cd (II) -DDTC = 0.5 ppm, with a flow rate = 2 mL / min, obtained saturation time of minicoloum as much as 23.1 seconds. Based on the calculation (Appendix 6) shows that amberlit XAD-16 is able to restrain the complex of Cd (II) -DDTC as much as 0.03 mg per gram amberlit XAD-16. Following is amberlit XAD-16 saturation profile toward the signal generated.

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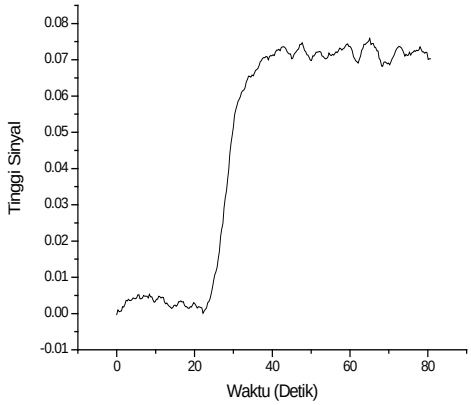

Figure 5. Profile time XAD-16 against complexes Cd (II) –DDTC

3.4.2. Preconcentration With Flow Injection Analysis – SSA

a. Variation of eluent concentration

Eluent is a very important part in the preconcentration and in analytes separation. Concentration of the good eluent which is able to elute analytes can be seen from the height data signal obtained for variant concentration of the eluent. High concentration of eluent producing the most excellent signal is an optimum concentration to use. Eluent used in this study is the Nitric acid. it is chosen as the acid which is strong enough to be able to elute metal ions bounded to the resin.

By passing 1 mL solution of Cd (II) 100 ug / L -DDTC 4.4 x 10^5 into minicoloum, then eluted nitric acid with concentration (0.1 to 3) M.

Based on the signal profile obtained, it can be seen that the concentration of nitric acid (1-3) M did not show a significant difference. The optimum concentration of nitric acid is chosen concentration of 1 M. The concentration of 0.1M and 0.5M nitric acid cannot be used because there is still the possibility of Cd (II) metal ions has not perfectly eluted yet, whereas concentrations above 1M, nitric acid can also not be used as it is too dense and it is possible to allow the degradation of the polymer material resin. In addition, the concentration of 1 M is good enough to elute perfectly the metal ions Cd (II) bounded to the resin so it is not necessary needed more concentrated nitric acid concentration to make efficient use of materials. Therefore, the concentration of nitric acid used for the next research step is 1 M.

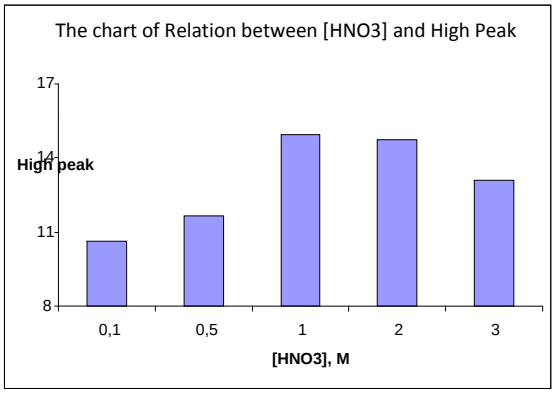

Figure 6. Effect of concentration of HNO3

b. Variation of Eluent Volume

The Determination of eluent volume is used to determine the minimum volume of eluent required to elute an analyte quantitatively that has been restrained on minicoloum. Height signal on analyte is affected by the eluent volume. In this case, the volume of eluent is too little, so the components of analytes are not restrained at all, some are still lagging in the column, and it can degrade the height signal.

To determine the minimum volume of eluent which is required to restrain an analyte, elute analyte will be done with eluent volume as much as 0.1 mL to 2 mL . Eluent volume of 0.1 mL provides low height signal, whereas the eluent volume of 0.2 mL is a little higher, so is the volume of eluent (0.3 to 0.4) mL that was still happening increase in analyte height signal. The eluent volume of height signal is almost constant from 0,5 mL to 2mL. It shows that until 0,4mL the volume of eluent has not been able yet to elute all complex restrained in minicoloum of XAD-16, whereas the eluent volume of 0.5 mL was able to elute the compound Cd (II) -DDTC well which is restrained in minicoloum. So, to elute the analyte, it is then used the eluent volume as much as 5 mL.

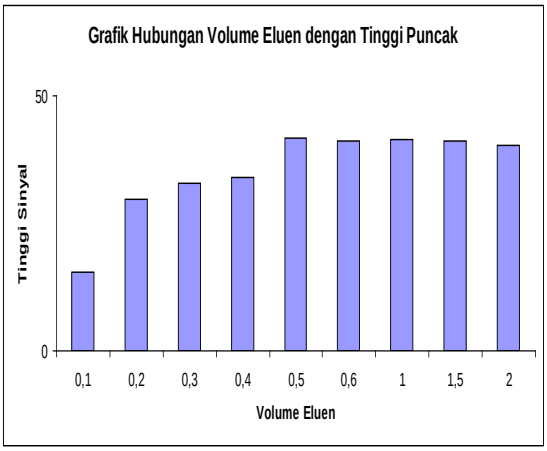

Figure 7 Effect of eluent volume to high crest

c. Variation of Sample Volume

Determining of the sample volume of solution is used to determine the optimal volume of sample required for analysis. In this study the solution used is a complex solution of Cd (II) 100 ug / L -DDTC 4.4 x

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105 M flowed into the mini column containing XAD-16 with some variation of the volume used ranging from 0.5 mL to 8 mL. Elution was carried out by using nitric acid 1 M. Based on the signal profile obtained, it can be concluded that the more solution volume of Cd (II) applied, the higher the signal obtained. The highest signal is showed at Volume 5 mL. For further analysis, the amount of volume of solution used is as much as 5 mL of standard solution of Cd (II) -DDTC.

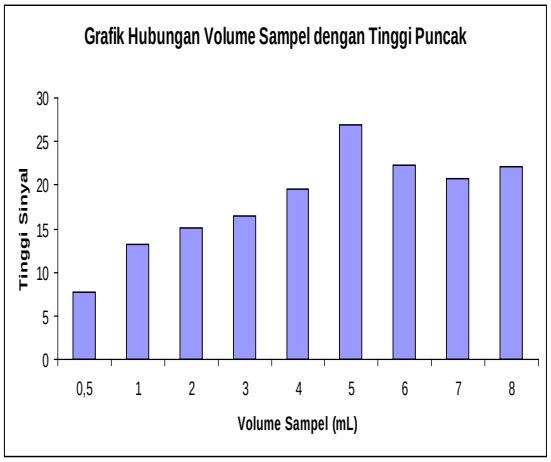

Figure 8. Effect of volume solution of Cd (II) –DDTC

d. Precision

Precision describes a reproducibility of a measurement, namely the closeness between the value of the data and other data obtained with the same conditions and the way of measuring. In general, the precision of measuring can be determined by measurement repeatability. Precision is usually stated as standard deviation, variance, and coefficient of variance. An acceptable criterion for precision depends on the type of analysis. For pharmaceutical analysis, control precision is better less than 1%, for biological samples a precision is better less than 15%, whereas for environmental samples, precision depends on the sample matrix, analyte concentration and analytical techniques, which can vary between 2 to 20%. Association of Official Analytical Chemists (AOAC) provides table with estimates of precision as a function of the concentration of the analyte, as shown in table 1.. (Huber, 2001)

Table 1. The analyte concentration on precision

% Analit	Unit	%KV
0,0001	1 ppm	11
0,00001	100 ppb	15
0,000001	10 ppb	21
0,0000001	1 ppb	30

The results showed that this method gives precision as a coefficient of variance of 3.46% at a concentration of 50 ppb and 2.20% at a concentration of 100 ppb. Referring to manual AOAC, it can be stated that the precision of preconcentration methods with SSA detection based flow injection analysis is very good and able to fulfill the analytical dock. Precision analysis signal profile to the concentration of 50 ppb can be observed in Figure 9 and in figure 10, it can be observed the relation of precision toward height signal.

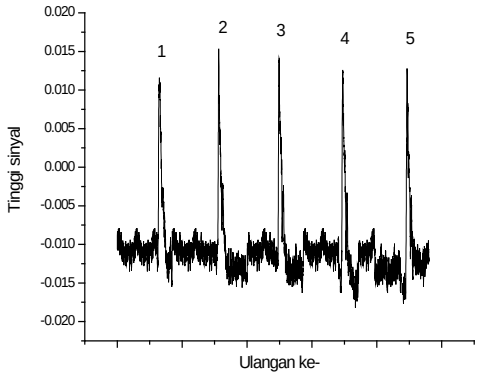

Figure 9. Profile precision signal Cd (II) -DDTC 50 ppb

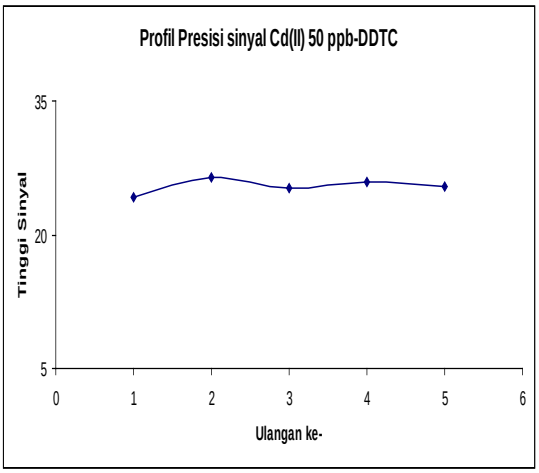

Figure 10. Precision Cd (II) -DDTC 50 ppb

Precision analysis signal profile to the concentration of 100 ppb can be observed in Figure 11 and the relation of precision towards height signal can be observed in Figure 12.

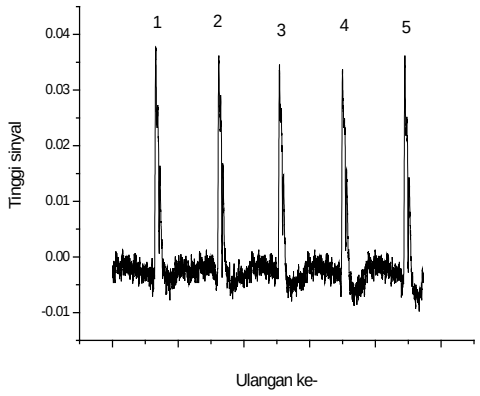

Figure 11. Profile precision signal Cd (II) -DDTC 100 ppb

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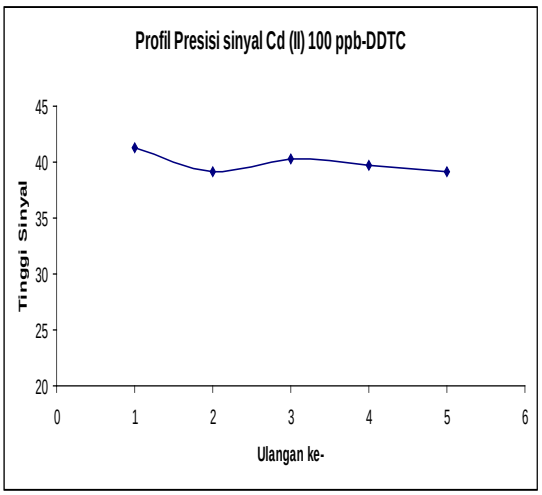

Figure 12. Precision Cd (II) -DDTC 100 ppb

e. linearity

The linearity of an analytical method is the ability to obtain a good and proportional mathematical transformation between analyte concentrations in the range of sample area given. Linearity is determined by some series of standards in which the concentration ranging from 80 to 120% from the areas of sample concentration expected. Linear regression equation obtained must have an intercept which is not significantly different from zero. If the intercept is not zero significantly obtained, the accuracy of the method is difficult to obtain. Linearity is usually graphically evaluated or mathematical evaluation, namely the plot between the height signal or analyte peak area as a function of the concentration of the analyte, which is called the graph or calibration curve.

Based on the result analysis of measurement calibration curve, as can be seen in Figure 13, straight-line equation y = 0,4164X + 2.8967, with a correlation coefficient 0.966. Thus the linear range of preconcentration method with SSA detection is in the area 10 ppb to 100 ppb.

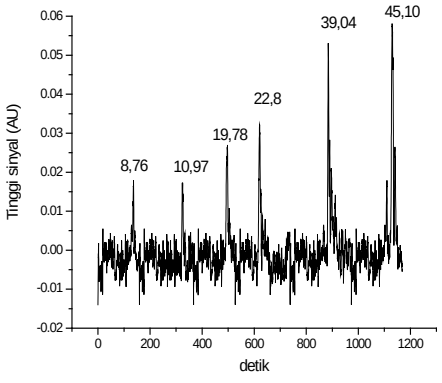

Figure 13. Profile of complex calibration curve uptake of Cd (II) –DDTC

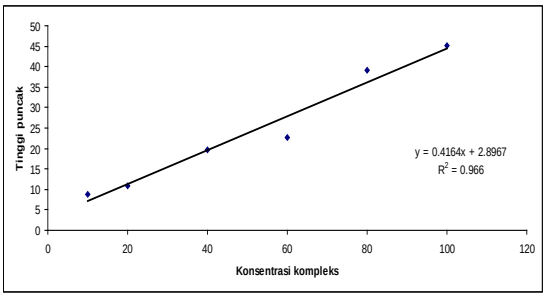

Figure 14. The calibration curve complex uptake of Cd (II) -DDTC using SSA

f. Sensitivity

A method of sensitivity analysis is a method of measure of the ability to differ between small differences of analyte concentration. The parameter used to determine the method of sensitivity is the slope of the calibration curve and precision of the method. The sensitivity method involves an absorption measurement or based on *Lambert-Beer* Law is changing of concentration which is able to produce absorbance changes as much as 0.0044. From the analysis, the sensitivity value of these methods achieves 0,40ppb.

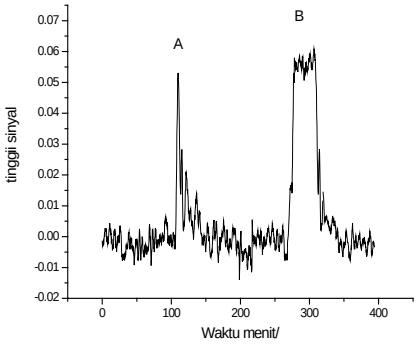

Figure 15. The height signal profile Cd (II) 80 ppb-DDTC with preconcentration technique (A) compared with the height signal Cd (II) 250 ppb (B) without preconcentration.

The increased sensitivity with preconcentration method can be illustrated in Figure IV.15. Comparative analysis with and without preconcentration method aims to determine the effectiveness of the method that has been used. The analysis was performed by comparing the measurement of Cd (II) 80 ppb through preconcentration technique with Cd (II) 0.25 ppm without preconcentration techniques. An increase in signal of Cd (II) -DDTC with preconcentration as much as 3.09 times compared without preconcentration. This indicates that the preconcentration technique is able to provide significantly increased sensitivity analysis.

g. Detection Limits

The detection limit is stated as a ratio of a standard signal (S) toward the blank signal (N) or S / N = 3. Another definition of the detection limit is a concentration or minimum analyte mass which is still

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detectable by the high level of confidence. The results showed the detection limits obtained was 1.61 ppb, while the minimum mass of detection is 8.05 ng.

h. The influence of Matrix and recovery (% recovery)

The accuracy of an analytical method can be obtained in several ways. One alternative method that can be used is to compare the results of the proposed method with the reference method, assuming that the uncertainty of the reference method has been known. In this study, to test the ability of method offered in analyzing the content of analyte and to determine the influence of matrix on the measurement, it is conducted an analysis toward the samples by using *spike*. Sample used as test material in this study is the water of *Citarum River*. It aims to determine the percentage of recovery by using *spike*.

i. Flow Injection Analysis Performance

Flow injection analysis performance examined included enrichment factor (EF), concentration efficiency (CE), and consumptive index (CI).

3.5. Enrichment Factor (EF)

Enrichment Factor's value is simply determined by comparing the peak height before and after preconcentration. Enrichment Factor is useful to determine a sensitivity of a flow method if it is used for analysis of analytes in trace concentration. The obtained Enrichment Factor's price is 3.09 times from the ratio signal of direct measurement to the SSA without preconcentration.

3.6. Concentration Efficiency (CE)

Concentration Efficiency (CE) is stated in per minute, in which the ratio of Enrichment Factor with a frequency analysis is in every minute or in a certain time till generated an increasing signal at certain measurement frequency. In this study, the frequency of 17 to every 60 minute resulted in CE 0.18 min-1. It means to generate one signal takes around 0.18 minutes. The measurement frequency of 17 per hour in addition showed that the time of method analysis growing fast, so it is properly used for routine analysis with a lot of samples.

3.7. Consumptive Index (CI)

Consumptive Index (CI) claimed that the efficient samples associated with *carrier* volume and eluent are analytically used. Sequence analysis in one route is as follows: carrier - sample - carrier - eluent. CI value obtained is 7.5 mL, which means that for one time sequence analysis to generate one signal required minimum of 7.5 mL reagent, if the sample volume is 5 mL.

4. CONCLUSION

4.1. Conclusion

Research on the preconcentration technique and trace species Cd (II) analysis which is previously complexed with diethyldithiocarbamate Sodium based flow injection analysis which is developed and evaluated showed that the optimum condition of the formation complexes of Cd (II) -DDTC is at pH 7 and the optimum ratio of Cd (II) is (1:10) mol. The material XAD-16 can be used as minicoloum filler which is able to retain complex Cd (II) -DDTC, with a retention capacity of 0,003 mg Cd (II) -DDTC per g XAD-16 well. 1 M nitric acid with volume 0.5 was used as an eluent to release the complex Cd (II) -DDTC retained in amberlit XAD-16. The optimum sample volume used is 5 mL.

Analytical performance in this method showed good results. Precision values which are indicated by CV percentage were obtained at 3.46% for concentration of 50 ppb and 2.20% for concentration of 100 ppb. Sensitivity reached 0.40 ppb, with a detection limit 1.61 ppb. Linear are obtained between 10 ppb to 100 ppb with the coefficient relation 0.966. The accuracy of this method is good enough, with a recovery value percentage > 90%. FIA performance contributes a significant value of EF concentration namely 3.09 times, with CI of 7.5 mL and CE value 0.18 min-1. Referring to the performance indicated, the preconcentration and analysis technique can be used for selective analysis of species Cd (II) in water samples at μgL-1 concentration level.

4.2. Suggestions

For the continuance of this research, it is necessarily conducted for the development and evaluation of preconcentration to analyze trace metals based FIA-AAS by doing complexing metal using types of dithiocarbamates and observing its optimum condition

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ISBN 978-602-19877-3-5

ASSESSMENT OF TRACE PB (II) IN SLUDGE FROM BATANG ANAI RIVER'S PADANG

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ABSTRACK

The concentration of trace Pb (II) in sludge samples from Batang Anai River's Padang were investigated in this study. The samples collected from three location and each location consist of three point sampling. In this study, Pb(II) were determined in some sludge samples after development $Al(OH)_3$coprecipitation procedure using flame atomic absorbtion spectrometry (FAAS). Trace amounts of Pb (II) were quantitatively coprecipitated with $Al(OH)_3$ at pH 6 and the coprecipitant could be easily dissolved with 1 mol dm^{-3} nitric acid. The proposed method was successfully applied to determination of lead in sludge samples.

Index Terms---coprecipitation, lead, FAAS, sludge

1. INTRODUCTION

Lead (Pb) is a common metal that is largely consumed in indrustrial fields. However, the emission of Pb to atmospheric and aquatic environments is stricly controlled under some regulations for enviromental protection, since it has high toxicity for animals and human beings. Analysis for Pb in enviromental samples has been performed by many techniques and methods. Since the concentrations of Pb in enviromental water samples are extremely low, sensitive instruments suc as ICP-MS, neutron activation analysis and electrochemical analysis have been used for the determination.

Coprecipitation is widely used for concentration of trace metals prior to various determination techniques including flame atomic absorption spectrometry. However, the coprecipitation is sometimes troublesome and time-consuming during filtration, which is frequently used for collection of precipitate. Some techniques such as flotation have been used to alleviate the weak points; a rapid coprecipitation technique is also one of the most useful ways.

This paper describe the fundamental conditions for the coprecipitation of trace amounts of lead in water with aluminium hydroxide and for the determination of these ions by flame atomic absorption spectrometry.

2. EXPERIMENTAL

2.1 Apparatus

A flame atomic absorption spectrometer AA1009M013 with Hitachi lead hallow-cathode for Atomic Absorption measurement. The optimum operating conditions, which were studied using a solution obtained by coprecipitation according to the recommended procedure from distilled water containing 100 ng of lead, are summarized in table 1. For pH measurement, a Hitachi-Horiba Model M-5 glass electrode pH meter was used.

2.2 Reagents

Lead Solution. A solutions containing about 1 mg cm^{-3} of lead was prepared by dissolving guaranteed reagent-grade metal nitrate in small amount of concentrated nitric acid and diluting with distilled water. The concentrations of lead were determined by complexometric titration using murexide as indicators.

Alumunium Hydroxide. About a 15 mg cm^{-3} alumunium solution was prepare by dissolving alumunium nitrate in distilled water. The alumunium concentration was determined at pH of about 2 bycomplexometric titration using xylenol orange as an indicator. All other reagents used were of guaranteed reagent grade.

2.3 Recommended procedure

To a sample solution (up to 200 cm^3) containing up to 100 ng of lead, 4 mg of aluminium is added, exactly, and the pH of the solution is adjusted to about 9.5 with a 0.1 mol dm^{-3} sodium hydroxide solution. To settle the produced precipitate, the solution is allowed

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to stand for a few minutes; the precipitate is then collected on a Toyo Roshi PTFE membrane filter (pore size 0.5 μm, diameter 25 mm), filtered by suction, washed with a small amount of distilled water, and dissolved with 0,5 cm^3 of 1 mol dm^{-3} nitric acid. The atomic absorbances of lead were measured under the operating conditions given in Table 1. A blank using distilled water was rum according to the same procedure as that for the sample solution. In this work the blank could be neglected in most instances because it was extremely small.

If it is difficult to make up the final volume to 0.5 cm^3 with good reproducibility, the following measurement is recommended: taking 10 mm^3 of the final solution, the amount of lead in it (M_1 ng) is measured byflame atomic absorption spectrometry under the operating conditions given in Table 1. Taking another portion of the solution (Vmm^3), the amount of aluminium in it (S mg) is measured by complexometric titration using Xylenol Orange as an indicator. A blank is also run using distilled water as a sample solution. The content (M_0 ng) of lead in the original sample solution is calculated using the following equation:

$M_0 = M_1$ x (V/10) x (4/S)

Table 1. Operating conditions for the atomic absorption spectrometer

Analytical wavelength	217,0 nm
Lamp current	10 mA
Slit width	1,0 nm
Measurement time	3,0 s
Flame type	Air/acetylene
Air flow	3,5 L/min
Acetylene	1,50 L/min
Burner height	0,0 mm

2.3.1. Calibration curves

Straigh lines passing through the origin were obtained up to 100 ng of lead in te final solution using the recommended procedure. The relative standard deviations obtained from five repeated determinations were 4.7 %. For 50 ng of lead, respectively. The detection limits (signal/noise=2) were 5.0 pg cm^{-3} of lead in 200 cm^3 of the initial sample solution.

2.3.2. Interferences

According to the recommended procedure, the effect of 27 foreign ions on the determination of 50 ng of lead was examined. Table 2 show that large amounts of sodium, potassium, magnesium, and calsium did not interfere for both determinations. No other ions tested produced any serious enterference effect, even at a concentration 500-times the mass of lead present.

3. RESULTS AND DISCUSSION

The first year of the study consisted of two phases, namely :

a Determination of the optimum conditions coprecipitationPb 2+ ions with coprecipitant$Al(OH_3)$simultaneously measuring analytical performance.

b Finding the influence of other ions such as Cu^{2+} , Cd^{2+}, Zn^{2+}, Co^{2+}, and Ni^{2+} on the determination of Pb^{2+} and preconcentration using $Al(OH)_3$ as coprecipitant .

In principle, preconcentration using coprecipitation using colloidal adsorption properties of precipitant, $Al(OH)_3$ is used. When in a solution containing the analyteAl^{3+},NaOH added, then formed colloidal $Al(OH)_3$ negatively charged. These colloids will adsorb positive ions of metal, and when dicentrifuge will precipitate together, as can be seen in the illustration in Figure 1.

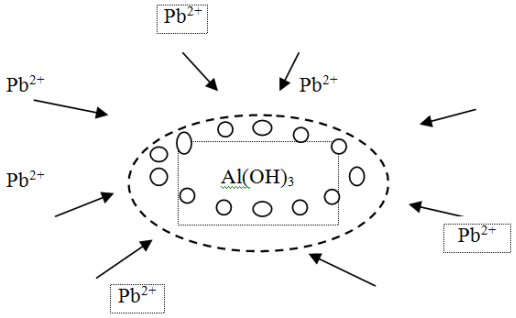

Fig 1. Pb^{2+} ion adsorption scheme by Coprecipitant

$Al(OH)_3$ chosen as coprecipitant because of its Ksp value which is smaller than the analyte (Ksp $Al(OH)_3$ = 5 x 10^{-33}) that will form the hydroxide first and then adsorbs metal ions. Because of the ability of adsorbed almost the same, then the influence of other metals in the determination of Pb 2+ important to know. Therefore, the optimum condition of ions bullies need to be known to be anticipated interruption of the metal ions .

Study of the optimum conditions for coprecipitant Effect of the pH on coprecipitation. The effect of the pH on coprecipitation with aluminium hydroxide was studied with a solution containing 40 mg lead. The maximum and almost constant recoveries were obtained in te pH range of 5.0 – 9. The precipitate aluminium hydroxide, obtained as mentioned above, at a pH 6.0 was bulky, and hence easily handled. Therefore, the pH was adjusted to about 6.5 with a 0.1 mol/L sodium hydroxide solution in further experiments.

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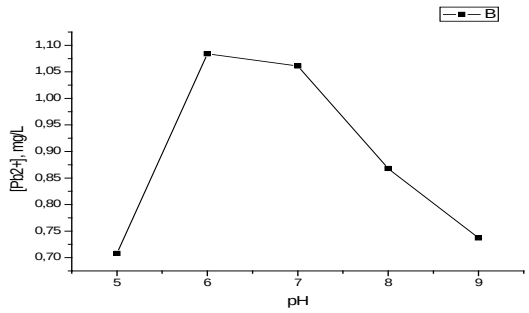

Fig 2. Effect of the pH on recovery of lead

Effect of the amount of coprecipitant. According of the recommended procedure, the necessary amount of aluminium for coprecipitation was examined with a sample solution (up to 500 mL) containing 10 ng of lead. The required amount of alumunium for quantitaive coprecipitation increase along with increasing the sample volume, and 25 mg alumunium was needed for at least up 500 mL of the sample solution. Since the atomic absorption of lead was not affected by the presence of up to 74 mg of alumunium in the final sample solution (5 mL)

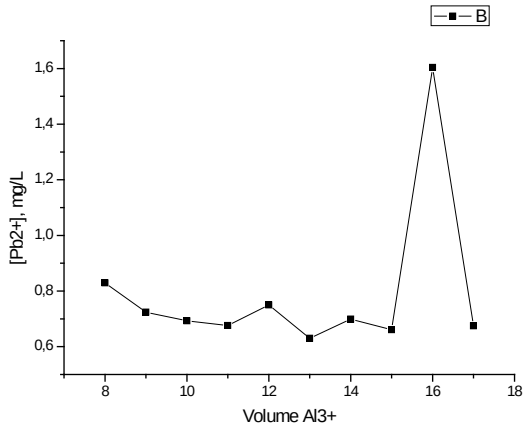

Fig 3. Effect of alumunium on recovery of lead

Contact time. Contact time duration associated with Pb^{2+}coprecipitation process by $Al(OH)_3$ which can be seen in Figure 4.

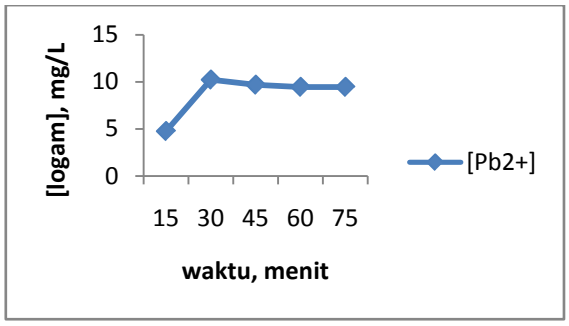

Fig 4.Effect of contact time on the coprecipitation of metal ions on $Al(OH)_3$.

From the picture it can be seen that the coprecipitation process occurs in a relatively long time is 30 minutes. Over a period of 30 minutes, quit stable metal ions adsorbed on the surface of colloidal shown by the metal concentrations were *measured* at the time of contact 45-75 minutes relatively constant (9.437 to 9.67 mg / L) and not too much less than at the time of contact 30 minute concentrations of metals 10.214 mg / L.

Eluent Volume. Metal ions adsorbed on the surface of colloidal $AL(OH)_3$ can be detected by using AAS after eluted with HNO_3. HNO_3 volume variation is used to elute the metal ions adsorbed can be seen in Figure 5.

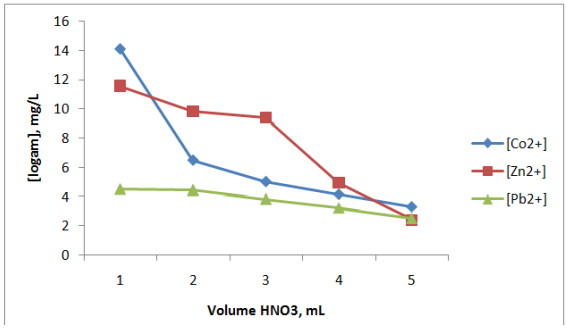

Fig 5.Effect of HNO3 volume as the eluent to coprecipitation of metal ions on $AL(OH)_3$.

HNO_3 is used as the eluent related to the solubility of nitrate salts of each metal are great in the water. Of the three metal ions adsorbed by $Al(OH)_3$, decreased due to the dilution factor. The smaller the volume of eluent more metal ions are detected because the larger the concentrated factor.

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ISBN 978-602-19877-3-5

SCREENING OF ANTIMICROBIAL ACTIVITIES OF THE ENDOPHYTIC MICROBES ISOLATED FROM ASAM KANDIS (*Garcinia diocia* Blume)

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ABSTRACT

Endophytes are microbes which live inside plant tissue, without *causing* any harm to host plant. They produce a variety of secondary metabolites for various biotechnological applications. *Garcinia diocia* Blume is one of endogenous plants that its fruits are used as spice, candied fruit, and fish preservative. The fruit extract presents antioxidant and antimicrobial activities. The aim of this study was to isolate the antibacterial activities of endophytic microbes from roots, stems and leaves of *G. diocia* Blume**.** The isolated endophytes were assayed against 10 food spoilage and food-borne pathogenic bacteria with disc diffusion method. The number of endophytes from roots, stems, and leaves of *G. diocia* Blume were 10, 14, and 21 colonies, respectively. A total of forty five endophytes were isolated, including 21 bacteria and 24 fungi colonies. Eighteen bacterial colonies revealed antibacterial activity against about 7-8 bacteria tested, 2 colonies (BND5, BNB1) against 9 bacteria tested, and only 1 colony (BND3) against 10 bacteria tested**.** The antibacterial activities of twenty four endophytic fungi were promising because most of them (88%) inhibited the growth of all bacteria tested, except for colonies of JPD1, JNA2, and JPD5. Their antibacterial activities were higher than endophytic bacteria, where the mean zones of inhibition were found to be 2.175-25.700 mm (fungi) and 0.295-2.728 mm (bacteria). The isolated fungi from *G. diocia* Blume were potential sources of antibacterial compounds and could be further develop for natural food preservative agents.

Index Terms—endophytic microbes, antibacterial activity, *Garcinia diocia* Blume

1. INTRODUCTION

Endophytic microorganisms are to be found in the living tissues of the host plants and have a range of relationships from mutualistic symbiosis to latent phytopathogenesis. These endophytes are a rich and reliable source of novel secondary metabolites for using in the pharmaceutical industry, agriculture, and in environmental applications[1,2].

There are approximately 300.000 plant species on earth and each individual plant is the host to one or more endophytes, however only a few species of them have been studied. As a result, researchers have a great chance to find new and unique endophytes from plants in different ecosystems [3].

Garcinia is one of genus from *Clusiaceae* family which spreads in Asia, Africa, New Caledonia and Polynesia [4]. Based on review of literature and observation of herbarium specimens, Indonesia has 64 species of *Garcinia,* where 25 species of *Garcinia* are found in Kalimantan island [5]. Some endophytic bacteria and fungi have been isolated from *Garcinia.* For instance, seventy fungal species from five *Garcinia* plants have antimicrobial activities on pathogenic microorganism. [6]. Fungal endophytes of *Garcinia mangostana* displayed a stronger antibacterial effect on Gram-positive bacteria [7], whereas the fungal extracts from *Garcinia* spp revealed their potential as a source of antioxidant, anti-inflammatory and antimicrobial inhibitors [8]. Other research reported that the endophytic bacterium *Bacillus cereus* isolated from *Garcinia xanthochymus* was able to synthesize silver nanoparticles with potential antibacterial activity [9].

In Indonesia, leaves and fruits of *Garcinia diocia* Blume are well known as spices. However, the Dayak and Malay people who live in West Kalimantan Province have been used dried fruits not only for flavoring dishes, but also for preserving fresh fish. The ability of fruits to preserve fish is due to the presence of substances that have antimicrobial and antioxidant properties.

The phytochemical analysis of the ethyl acetate soluble fraction of methanol fruit extract of *G. diocia* Blume showed positive result for phenolics, alkaloids, saponins and flavonoids. The antimicrobial activity of the ethyl acetate fraction was found significantly higher as compared to the other solvent fractions. Also, the total phenolic content of this fraction was 28,83 ppm [10,11].

The biological activities of *G. diocia* Blume may have been caused by endophytes. Therefore our work goals was to isolate the endophytic microorganisms of *G. diocia* Blume and evaluate their antibacterial against some food spoilage and food-borne pathogenic bacteria.

ISBN 978-602-19877-3-5

2 MATERIALS AND METHODS

2.1 Collection of sample

Plants material were collected in March 2015 from healthy plants in the plantation field that located in Sei Sengkuang village, district of Sanggau Kapuas, Sanggau Regency in West Kalimantan (Figure 1). The different parts of tree such as leaves, roots, and stems were kept in sterile plastic bag in ice box. The fresh samples were brought to the laboratory and processed on the next day.

Figure 1. *Garcinia diocia* Blume

2.2 Isolation of endophytic microbes

Samples were washed under running tap water for 10 minutes and then drained. The cleaned samples were sterilized by immersing them sequentially in 70% ethanol for 1 minute and 5% sodium hypochlorite for 3 minutes [9,12]. Thereafter, samples were rinsed with sterile distilled water three times and dried on sterile paper filter before they were cut into small pieces (2cm in length) using sterile cutter.

Sample pieces were inoculated on two different media, potato dextrose agar (PDA) containing chloramphenicol (50µg/mL) and nutrient agar (NA) with nystatin (0.1g/L). The plates were incubated at room temperature for 2-7 days. The growth of endophytes were observed, isolated, and transferred onto new medium. Pure cultures were obtained by several times sub culturing.

2.3 Preparation of endophytic culture filtrate and antibacterial assay

The culture broth of endophytic microbial isolates were prepared as described by with minor modification [13,14]. Pure culture of endophytic bacteria and fungi were cultivated into 100 ml Erlenmeyer flasks containing 50 ml nutrient broth(NB) for 2 days and in potato dextrose broth (PDB) for 15 days, respectively. The cultures were incubated at room temperature with 100 rpm shaking. Before being tested for antibacterial, broth cultures were centrifuged to obtain cell-free extract.

Antibacterial activities of fungal and bacterial culture broths were determined based on modified disc diffusion technique [15]. Filter paper discs (7mm) were soaked in cell-free extracts. The discs were placed onto the surface of the agar that has been inoculated with bacterial testing in an exponential growth phase (10^8 CFU/mL). The plates were incubated at 37^{o}C temperature for 48 hours and bacterial growth inhibition was measured. All assays were performed in triplicate.

Test-bacteria in this assay was *Escherichia coli, Bacillus cereus, Staphylococcus aureus, Citrobacter freundii, Pseudomonas aerogenosa, Vibrio choleraea, Salmonella sp. Klebsiella pneumonia, aeromonas hydrophylla, and Bacillus subtilis.*

3. RESULTS AND DISCUSSION

3.1 Isolation of endophytic microbes from *G.diocia* Blume

Plants and microbes compose a primary source of natural compounds with desirable bioactive properties. Endophytic plants can produce numerous chemicals and they have attracted considerable attention for invention of new pharmaceutical drug, agrochemical lead compound, and industry. In addition, they also can be used as food preservatives agent for the control of food spoilage and food-borne diseases [16].

In this work, we have isolated 45 endophytic colonies. Some of the endophytic morphology colonies are showed in Figure 2.

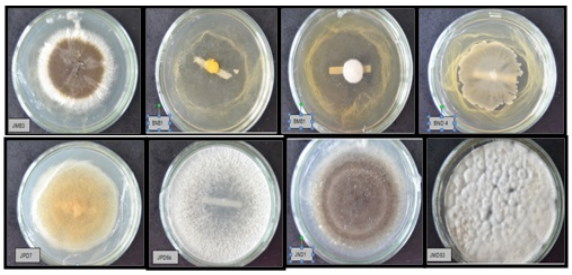

Figure 2. Colony morphology of some endophytic microbes associated with *G. diocia* Blume

In total, 45 culturable endophytes were obtained from three different tissues of *G. diocia* Blume. Among them, 21 bacterial endophytes were found in roots (7), stems (7) and leaves (7). Whereas, 24 fungal endophytes were found in roots (3), stems (7), and leaves (14) (Figure 3). The number of endophytic populations were higher in leaves than

ISBN 978-602-19877-3-5

Table 1. Premilimanary antibacterial activity of bacterial endophytes from *G. diocia* Blume

S.No	Isolates	Test- bacteria									
		Escherichia coli	*Bacillus cereus*	*Staphylococcus Aureus*	*Citrobacter freundii*	*Pseudomonas aerogenosa*	*Vibrio choleraea*	*Samonella sp*	*Klebsiella pneumonia*	*Aeromonas hydrohilla*	*Bacillus subtilis*
1	BNDs	+	+	+	+	+	+	-	+	-	+
2	BND5	+	+	+	+	+	+	+	+	-	+
3	BNB3	-	-	+	+	+	+	+	+	+	+
4	BPA1s	-	-	+	-	+	+	+	+	-	+
5	BNAs2	+	+	+	-	+	+	+	+	-	+
6	BNB1	+	+	+	+	+	+	+	+	+	-
7	BMD3	+	-	+	+	+	+	-	+	+	+
8	BMAs2	+	-	+	+	+	+	+	+	+	+
9	BPDs1	+	-	+	+	+	+	+	-	+	+
10	BMBs2	+	-	+	+	+	+	-	-	+	+
11	BNAs3	+	-	+	+	+	+	-	-	+	+
12	BNB4	-	+	+	-	+	+	+	-	+	-
13	BMDs2	+	+	+	+	+	+	+	-	+	+
14	BMD2	-	+	+	+	+	+	+	-	+	-
15	BNAs1	-	+	+	+	+	+	+	-	-	+
16	BNA6	+	+	+	+	+	+	+	-	+	-
17	BNB3s	-	+	+	+	+	+	+	-	+	-
18	BMB1s	-	-	+	-	+	+	+	-	-	-
19	BPB1s	-	+	+	+	+	+	+	-	+	+
20	BND3	+	+	+	+	+	+	+	+	+	+
21	BNAs	-	+	+	+	-	+	+	-	-	+

(+) active to inhibited growth of bacteria;

(-) Not active to inhibited growth of bacteria

Table 2. Antibacterial activity of bacterial endophytes from *G. diocia* Blume

S.No	Isolates	Test- bacteria, Zone of Inhibition (mm) ± Deviation Standard (SD)									
		Escherichia coli	*Bacillus cereus*	*Staphylococcus aureus*	*Citrobacter freundii*	*Pseudomonas aerogenosa*	*Vibrio choleraea*	*Samonella sp*	*Klebsiella pneumonia*	*Aeromonas hydrohilla*	*Bacillus subtilis*
1	BNDs	0.617±0.02	0.526±0.30	0.648±0.15	1.724±0.35	1.045±0.84	0.477±0.17	0	0.405±0.01	0	0.51±0.15
2	BND5	0.813±0.15	1.633±0.19	0.778±0.14	1.974±0.40	0.379±0.04	0.428±0.06	0584±0.08	0.409±0.03	0	1.19±0.42
3	BNB3	0	0	0.500±0.11	2.568±0.20	0.587±0.15	0.576±0.33	0.643±0.04	0.606±0.01	0.696±0.45	0.495±0.09
4	BPA1s	0	0	0.698±0.23	0	0.915±0.45	0.418±0.12	0.578±0.13	0.609±0.12	0	0.754±0.15
5	BNAs2	0.699±0.01	1.038±0.69	0.672±0.14	0	0.666±0.10	0.568±0.08	0.653±0.03	0.541±0.09	0	1.046±0.11
6	BNB1	1.089±0.04	1.493±0.14	2.260±0.00	0.918±0.29	1.818±0.43	0.454±0.04	0.912±0.43	0.876±0.32	1.013±0.19	0
7	BMD3	0.582±0.04	0	0.838±0.08	0.829±0.16	1.023±0.44	0.405±0.05	0	0.587±0.25	0.886±0.27	1.088±0.51
8	BMAs2	0.450±0.08	0	2.728±0.00	1.164±0.78	1.765±0.80	0.597±0.09	0.807±0.33	0.445±0.04	0.978±0.54	0.711±0.03
9	BPDs1	0.591±0.14	0	1.094±0.09	0.508±0.72	0.586±0.16	0.745±0.45	1.0056±0.21	0	0.510±0.03	1.026±0.73
10	BMBs2	0.550±0.08	0	0.533±0.07	0.936±0.33	0.766±0.20	0.813±0.77	0	0	1.508±0.36	0.335±0.47
11	BNAs3	0.778±0.07	0	1.257±0.11	0.665±0.10	0.888±0.01	0.419±0.25	0	0	0.498±0.10	0.843±0.35
12	BNB4	0	0.466±0.41	1.080±0.25	0	0.962±0.01	0.295±000	0.905±0.04	0	0.648±0.04	0
13	BMDs2	0.756±0.14	0.578±0.21	0.517±0.02	0.643±0.07	0.758±0.14	0.329±0.13	0.589±0.22	0	0.811±0.11	0.482±0.11
14	BMD2	0	0.598±0.01	0.611±0.02	0.929±0.07	1.320±0.34	0.353±0.10	1.165±0.48	0	0.864±0.18	0
15	BNAs1	0	1.024±0.20	0.516±0.26	1.238±0.47	1.536±0.60	0.383±0.12	1.615±0.18	0	0	1.915±0.54
16	BNA6	0.657±0.02	1.623±0.53	2.141±0.21	1.052±0.47	1.895±0.47	0.373±0.10	2.619±0.172	0	1.060±0.35	0
17	BNB3s	0	0.451±0.01	2.234±0.21	1.043±0.19	1.711±0.18	0.423±0.17	0.688±0.18	0	1.128±0.01	0
18	BMB1s	0	0	0.938±0.07	0	1.091±0.53	0.395±0.13	0.798±0.13	0	0	0
19	BPB1s	0	1.438±0.29	1.188±0.27	0.897±0.27	2.728±0.00	0.432±0.00	1.523±0.37	0	1.153±0.07	1.084±0.18
20	BND3	0.635±0.05	0.649±0.12	0.555±0.01	1.746±0.54	1.125±0.12	1.514±0.48	0.596±0.04	0.370±0.00	0.810±0.10	2.721±0.39
21	BNAs	0	0.444±0.14	0.535±0.07	1.393±0.52	0	0.489±0.31	1.666±0.54	0	0	0

other parts of plant. Similar results have been observed in the endophytes of *Acalypha indica Linn* [17]. Each tissue has a particular combination of genes in its microbiome [17] and a specificity in many situations, where communities from woody tissues frequently differ from those in roots or leaves [18].

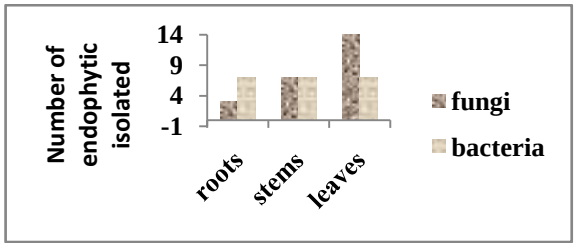

Figure 3. Distribution of fungal and bacterial endophytes from three different parts of *G. diocia* Blume

3.2 Antibacterial activity of endophytic microbes from *G. diocia* Blume

The isolated endophytic bacteria and fungi from *G.diocia* Blume were studied to determine their invitro activities against some food spoilage and foodborne pathogenic bacteria (*E.coli, B.cereus, S. aureus, C. freundii, P. aerogenosa, V.choleraea, Salmonella sp., K.pneumonia, A.hydrohylla,* and *B. subtilis* (Table 1-4).

Our data noticed that 18 isolates of bacterial endophytes (86%) have inhibitory effect at least 7-8 on the test bacteria and the remaining 3 isolates (14%) can inhibit 9-10 test-bacteria, being BND5, BNB1, and BND3. Most bacterial isolates have

ISBN 978-602-19877-3-5

Table 3. Premilimanary antibacterial activity of fungal endophytes from *G. diocia* Blume

S.No	Isolates	Test-bacteria									
		Escherichia coli	*Bacillus cereus*	*Staphylococcus Aureus*	*Citrobacter freundii*	*Pseudomonas aerogenosa*	*Vibrio choleraea*	*Samonella sp*	*Klebsiella pneumonia*	*Aeromonas hydrohilla*	*Bacillus subtilis*
1	JPD1	+	+	+	+	-	+	+	+	+	+
2	JND8	+	+	+	+	+	+	+	+	+	+
3	JND1	+	+	+	+	+	+	+	+	+	+
4	JND2	+	+	+	+	+	+	+	+	+	+
5	JMB1	+	+	+	+	+	+	+	+	+	+
6	JPD4	+	+	+	+	+	+	+	+	+	+
7	JPB5	+	+	+	+	+	+	+	+	+	+
8	JNA1	+	+	+	+	+	+	+	+	+	+
9	JMB6	+	+	+	+	+	+	+	+	+	+
10	JPB4	+	+	+	+	+	+	+	+	+	+
11	JPD2	+	+	+	+	+	+	+	+	+	+
12	JNA2	+	+	+	+	-	+	+	+	+	+
13	JPA4s	+	+	+	+	+	+	+	+	+	+
14	JPD5	+	+	-	+	+	+	+	+	+	+
15	JMD5	+	+	+	+	+	+	+	+	+	+
16	JPD5s	+	+	+	+	+	+	+	+	+	+
17	JPB3	+	+	+	+	+	+	+	+	+	+
18	JMB3	+	+	+	+	+	+	+	+	+	+
19	JMD4	+	+	+	+	+	+	+	+	+	+
20	JMDs3	+	+	+	+	+	+	+	+	+	+
21	JMD6	+	+	+	+	+	+	+	+	+	+
22	JPD3	+	+	+	+	+	+	+	+	+	+
23	JPD6s	+	+	+	+	+	+	+	+	+	+
24	JMB2	+	+	+	+	+	+	+	+	+	+

(+) active to inhibited growth of bacteria; (-) Not active to inhibited growth of bacteria

Table 4. Antibacterial activity of fungal endophytes from *G. diocia* Blume

S.No	Isolates	Test- bacteria, Zone of Inhibition (mm) ± Deviation Standard (SD)									
		Escherichia coli	*Bacillus cereus*	*Staphylococcus aureus*	*Citrobacter freundii*	*Pseudomonas aerogenosa*	*Vibrio choleraea*	*Samonella sp*	*Klebsiella pneumonia*	*Aeromonas hydrohilla*	*Bacillus subtilis*
1	JPD1	4.700±0.00	6.625±0.03	7.900±0.00	6.475±0.95	0	7.313±0.80	3.163±0.02	5.475±0.60	9.063±0.97	6.300±0.14
2	JND8	3.688±0.72	4.950±0.06	4.913±1.01	7.350±1.06	5.600±0.21	6.600±0.71	6.225±0.74	9.913±0.80	4.025±0.25	8.288±0.55
3	JND1	5.038±0.41	4.138±0.12	4.313±0.94	20.563±0.23	4.825±0.04	6.700±0.07	3.550±1.06	7.050±1.59	3.850±0.46	5.363±0.65
4	JND2	3.788±0.27	11.130±1.56	6.125±0.11	13.850±1.20	7.600±0.71	5.230±0.66	5.100±1.66	5.613±1.50	7.013±0.37	7.763±1.11
5	JMB1	3.538±0.69	4.888±0.05	6.738±0.23	17.783±0.61	4.800±0.07	5.600±0.21	5.063±0.72	14.938±0.76	6.275±0.60	7.413±0.12
6	JPD4	4.650±0.35	6.100±0.92	4.800±0.28	3.350±0.28	6.013±0.44	5.088±0.97	4.625±0.81	8.588±0.34	5.663±1.22	8.075±0.95
7	JPB5	3.850±0.49	5.775±0.39	4.838±0.65	5.400±0.28	6.838±0.12	10.650±0.78	6.275±1.94	10.288±0.14	4.888±0.05	9.500±1.56
8	JNA1	12.925±0.74	23.20±0.00	8.700±0.14	14.688±0.16	6.775±0.04	16.875±0.53	7.550±0.42	10.15±0.14	11.363±0.62	10.513±0.37
9	JMB6	5.338±0.30	6.338±0.19	7.125±0.18	5.300±0.28	6.925±0.11	7.300±0.64	9.025±0.64	6.663±0.44	4.350±0.11	5.875±0.46
10	JPB4	4.688±0.72	4.675±0.32	3.850±1.06	5.325±0.39	7.450±0.49	6.175±0.95	5.150±1.48	4.963±1.11	5.138±0.27	9.500±0.71
11	JPD2	3.552±0.10	5.400±0.57	4.925±0.74	3.925±0.74	6.513±0.87	20.625±0.32	7.750±0.0	5.075±0.71	4.900±0.57	6.663±0.58
12	JNA2	4.688±0.80	6.825±0.11	4.725±0.95	7.450±0.42	0	25.700±0.21	23.788±1.04	18.035±0.73	7.513±0.37	7.373±0.00
13	JPA4s	4.425±0.64	5.225±0.53	5.475±0.67	7.500±0.71	6.450±0.00	8.725±0.04	3.538±0.69	8.575±0.04	9.05±0.11	6.563±0.55
14	JPD5	4.188±0.12	7.063±0.05	0	13.250±0.35	7.00±0.14	7.350±0.35	3.450±0.92	7.963±1.18	10.975±1.38	6.225±0.74
15	JMD5	3.638±0.12	7.`175±1.10	7.513±0.76	8.700±0.99	5.900±0.64	6.700±0.14	5.575±0.11	8.588±0.72	13.663±0.87	7.100±1.13
16	JPD5s	3.950±0.21	5.350±0.42	5.425±0.07	17.450±0.28	18.450±0.42	6.075±0.39	4.950±0.64	10.725±0.18	6.200±0.64	7.413±0.69
17	JPB3	2.175±0.00	7.150±0.99	6.463±0.58	23.050±0.71	6.375±0.04	5.875±0.67	5.063±0.12	9.525±0.88	4.963±0.37	7.275±0.39
18	JMB3	3.925±0.81	5.088±0.69	6.100±0.53	17.700±0.64	7.488±0.83	6.500±0.21	3.950±0.07	10.00±1.06	4.213±0.23	6.250±0.21
19	JMD4	5.025±0.25	5.588±0.16	5.238±0.37	8.125±0.46	5.625±0.18	12.575±0.60	5.338±1.15	9.050±0.42	4.625±0.53	7.413±0.80
20	JMDs3	2.913±0.02	5.588±0.58	6.513±1.04	8.825±0.88	7.725±1.17	15.663±0.44	3.525±0.95	9.838±0.42	8.45±1.34	7.150±0.18
21	JMD6	3.300±0.57	4.863±0.23	6.775±0.35	8.800±1.20	7.300±0.07	14.575±0.25	4.825±0.92	4.453±0.42	6.55±0.42	9.900±1.13
22	JPD3	4.200±0.49	4.575±0.53	7.200±0.81	8.250±0.28	12.450±0.64	7.800±0.64	3.615±0.76	6.70±0.92	6.60±0.99	12.350±0.14
23	JPD6s	4.738±0.62	15.140±0.09	5.138±0.51	8.850±0.42	10.325±0.25	22.425±0.04	3.888±0.05	27.717±0.86	6.55±0.14	4.838±0.12
24	JMB2	7.288±0.80	6.538±0.69	8.900±0.92	16.780±1.10	6.875±0.18	14.650±0.64	4.175±0.18	10.255±0.35	9.525±0.25	6.838±0.12

weak activity on *K.pneumonia* and *E coli.* The percentage of the bacterial endophytes that were able to inhibit the growth of three Gram-positive and seven Gram-negative bacteria with inhibitory zone diameter more than 1mm were 33 and 23%, respectively. They produced zones of clearance 0.295 to 2.728 mm in diameter. Although, the averages of zone inhibitions were relatively small, but more than 93 per cent of them showed antibacterial activity toward *V.choleraea, P. aerogenosa, C. freundii, and S. aureus.* Among the active isolated BNB1 and BND3 displayed the strongest inhibit against most of pathogenic bacteria.

All fungal endophytes displayed strong bioactivity against both of Gram-positive and Gram-negative bacteria test, except for JPD1 and JNA2 against *P.aerogenosa* and JPD5 against *S. aureus*. Their antibacterial activities were significantly higher compared to bacterial isolates, where they can produce zones of clearance with range from 2.175 to 25.700 mm.

Furthermore, most fungal isolates exhibited highest antibacterial activities against to C. *freundii, V.choleraea* and *K.pneumonia* with the average of inhibitory zone values were 10.76, 10.53, and 9.59 mm, in order. Whereas, 73 per cent of fungal isolates have weak antibacterial activities on *E coli* with zone inhibition approximately 4.59 mm. This result indicated that endophytic fungi of *G.diocia* Blume were more interesting than fungal endophyes from *Garcinia* species such as *Garcinia atrovidis, Garcinia dulcis, Garcinia mangostana, Garcinia nigrolineata,*

ISBN 978-602-19877-3-5

and *Garcinia scortechinii* that have no antibacterial activity toward *E.coli* [6].

The fungal endophytes from *G. diocia* Blume play an necessary role in the antibacterial of this plant. They are an important resources for antibacterial substances and as promising candidates for novel metabolite secondary compounds.

4. CONCLUSION

These results suggest that the endophytic fungi isolated from *G. diocia Blume* possessed strong antibacterial activity against ten different strain of bacteria tested. Therefore, further study is needed to purify the active compounds. Their safety and efficiency should be performed for use as pharmaceutical drugs or food biopreservative agents.

5. ACKNOWLEDGEMENTS

We acknowledge our gratitude to the Ministry of Research, Technology and Higher Education of the Republic of Indonesia, for fully supporting this research activity through competitive research with contract number 046/SP2H/PL/ Dit.Litabmas/II/2015 on 5 February 2015.

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ISBN 978-602-19877-3-5

PHOTOELECTROSPLITTING WATER MECHANISM AT CARBON ELECTRODE SURFACE USING INDOOR LIGHTS

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ABSTRACT

This research aims to investigate process and mechanism of splitting water by illumination copper oxide using indoor lights. We report here an innovative approach, in which the lights are used from low energy and rarely never using in general photovoltaic system. The illumination is monitoring with high resolution CMOS Camera, 13 MPixel of OPPO X9006, to capture image of spliiting water. Splitting of water to produce hydrogen due on the Carbon (Graphite) electrode surface with electricity current from Cu_2O/Al PV Cell and Na_2SO_4 electrolyte. Tandem of PV cell and Electrolysis Cell (PV-EC) produce Hydrogen gas, in which electric current is 4.27 Voltage and 0.920 mA in Na_2SO_4 0.5 N optimal condition. PV Cell use Cu_2O/Al as electrode with surface area 0.003711 m^2. With eleven PV cell series arrangement (surface area = 0.018555m^2), produce voltage 4,27V (this voltage was exceed minimum voltage for water splitting with voltage 4,27V) and current 0.910 mA. The process of water splitting observed at initiation of formation H_2 gas and H_2 release at carbon surface. After 1 hour and 50 minutes, H_2 gas volume produced reach 0.00281 mL.

Index Terms—*Mechanism, Photoelectrosplitting, Indoor Lights, Hydrogen*

1. INTRODUCTION

Technology of Photovoltaic has growing rapidly, such as organic Cell, DSSC, and the polymer solar cell (1). Some effort has done to develop reactor, to design a reactor container, reflector for light collectors, absorbers reflection or anti reflector, and n-p junction connecting systems. The other modification, solar panels as a sandwich layer and electrodes used models. All these efforts are intended to improve the conversion of photovoltaic cells(1; 2).

Sunlight energy does not have negative impacts like fossil fuel. Its converting sun's energy was not have waste product so it is one of clean energy resource. Therefore, solar energy has great potential to become the future energy resource, with abundant stock and environmentally friendly(3). Its potential energy reaches 1000-1369 Watt/m^2 or about 3.9 x 10^6 EJ (1 EJ = 10^{18} J) from one year total energy (4; 5) and only about 5-12 % (6).

Research of photocell always emphasizes the utilization of direct sunlight that has a high intensity. The reactor was placed in an open space and designed to be able to interact with the maximum of Solar Cells reactor. Meanwhile, the reactor that can work in room light has not been widely studied. This is because room light has relatively low light energy and solar panels that can work effectively is still not developed. Another factor is the difficulty to directly transform the low-intensity light energy to commercial energy and direct storage such as batteries(7).

Development of photocells reactor that can use energy from room light with low intensity to another intermediate energy forms as a carrier, in the formation of hydrogen gas continuously, it becomes an attractive option. Room light was used is sunlight coming into the room and the irradiation from lamp, like a neon (8).

The conversion process can be done by making a tandem photovoltaic cells and electrolysis cells(PV-EC) to transform indoor light energy into electrical energy that adequate for the electrolysis of water (1,47 V) into hydrogen gases(9; 10). In this study conducted a study on the mechanism of water splitting into hydrogen gas, by using video-image capturing and modeled through calculation assumptions hydrogen gas bubbles on the Carbon Electrode surface.

1.1 Experimental

1.1.1 Materials and tools

The tools was used in this research are Oppo F7a X9009, multimeter (Heles), Lightmeter (integrated with android of OPPO), SEM-EDX (Hitachi S-3400N), XRD, neon Lamp (Philip 10 watt), paper, carbon paper, Furnace, analytical balance, and glass tools.

Materials was used in this research are glass (PT Asahimas), glass glue, Cu plate (PT Metalindo Sejahtera), Al Plate, Natrium sulfat (Na_2SO_4) (Merck), gelatin, chloroform (Merck) and aquades.

2. METHOD

2.1 Copper Oxide electrode preparation

Copper Oxide electrode was prepared by calcinating Cu plate on various temperature 300, 350, 400, 450

ISBN 978-602-19877-3-5

and 500°C, for 1 hour. The resulting Copper Oxide plate was caracterized with SEM EDX and XRD.

2.2 Photovoltaic cell preparation

Design of Photocell has developed by Rahadian et al (2015) and preparing by designing like figure 1.

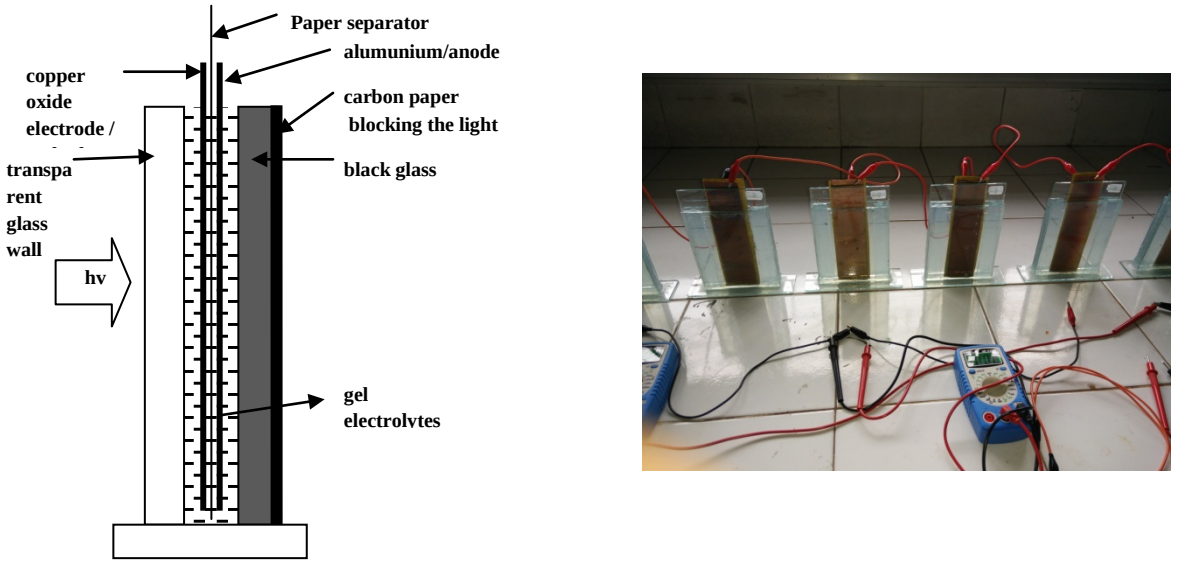


Figure 1. Design of Photocell (a) (7) and Pv building block cell (b)

2.3 Natrium Sulphate (Na_2SO_4) gelatin electrolyte preparation

3,6 gram $Na_2SO_4$was diluted with 100 mL water. Then, the solution was added 0,5 gram gelatin powder. The mixture was stirred and heated until boiling and become clean. After that was added some drops of chloroform and then solution was filled to cells directly.

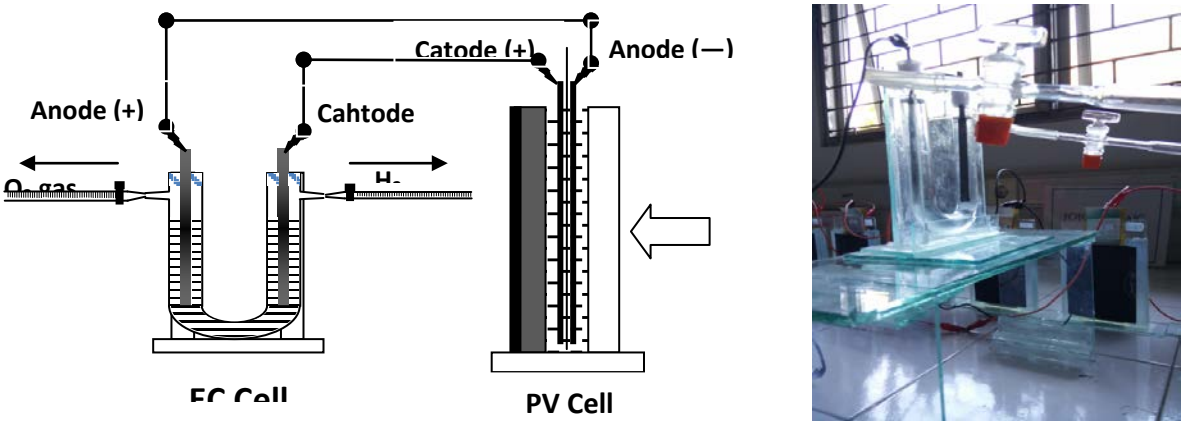
2.4 Current and voltage of PV cells measurement

Each PV cell was filled by natrium sulfate gelatin, then illumiation under room lights and neon lights. Current and voltage from cells was measured with multimeter.

2.5 Tandem Reactor of Photo-Electro-Cell Arrays

Tandem reactor of Photo-Electro-cell arrays was designed like scheme on picture 2 (7)

.



(a) (b)

Figure 2. Scheme of design tandem reactor of Photo-Electro-cell (a) dan Photo-electro-cell arrays (b)

2.6 Measurement of Video-Image Capturing and Calculation Model of H_2 Gas Bubble

The formation of Hydrogen gas bubble at cathode in electrolysis cell was captured using Oppo X9006 (high resolution camera CMOS 13 megapixel). Measurement and calculation was done by using 50

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time zooming for initial capture and record the mobility of bubble was observed with video capturing at surface of carbon electrode during splitting water into hydrogen takes place. This process was conduct for studying the mechanism of photoelectrospliting water into Hydrogen gas.

3. RESULT AND DISCUSSION

3.1 PV Cell Arrays

3.1.1 The Making of Electrode at PV Cell and Characterization by SEM-EDX-XRD

Plate of Copper with specification (thickness 0,27mm, and size 36,5 cm x 120 cm, and weight 1,2 kg) was cut with size 4 cm x 12 cm. Plate was calcinated at 400 and 500^{o}C. The best performance was obtained with plate after calcinate at 400^{o}C. Copper oxide plate was used as cathode in PV cell. Meanwhile, for anode was used allumunium plate.

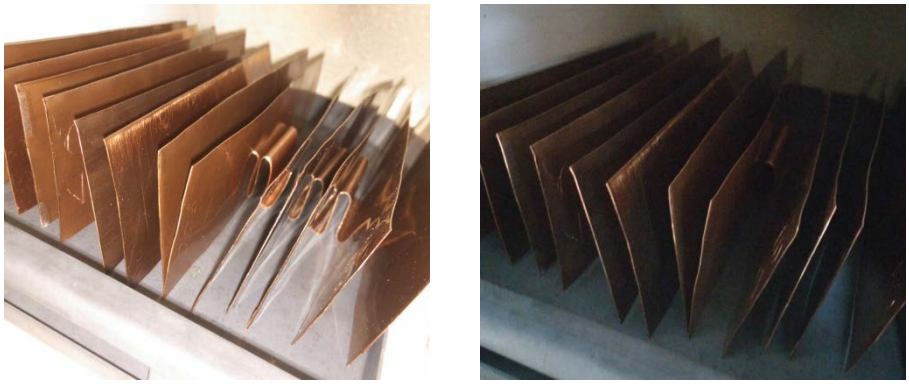

Figure 3. Photo of electrode plate (a) Copper before calcinations (b) Copper after calcination

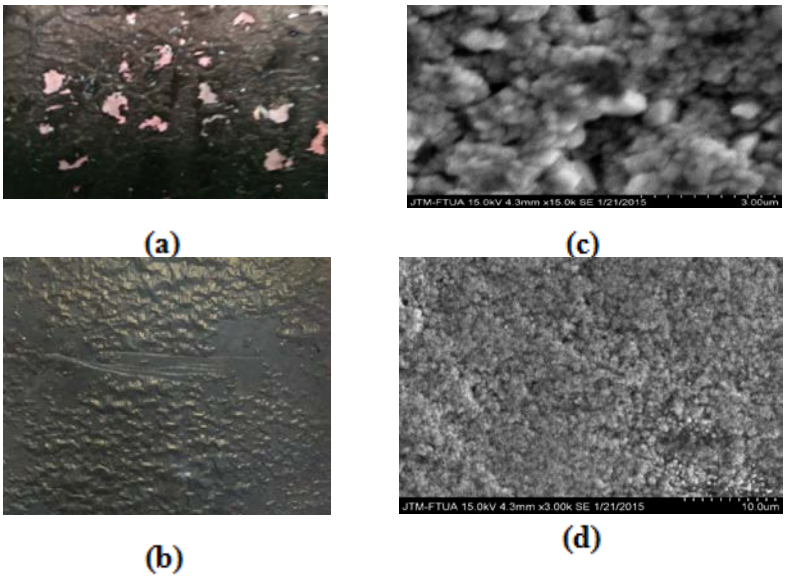

Figure 4. Image of oxide copper plate surface at 500^{o}C calcinations (a) CMOS Camera (b) SEM with 15.000 times enlargement (c) image of plate at 400^{o}C calcinations temperature and (d) SEM with 3.000 times enlargement

The formation of oxides on the surface by calcinating Copper plate has shown in Figure 4. The higher of calcination temperature, the oxide layer is formed more and more. This is due to the increasing number of reaction between oxygen atoms at the surface of the copper plate. From the camera catches Oppo X9009, visible changes on the surface of the copper plate before and after calcination.

The EDX analysis show the amount of oxygen on the surface of the Cu plate which originally 1.22%. After calcination at 400oC was obtained percent oxygen is 16.5%. and 500oC percent oxygen on the surface of the Cu plate is 15.27%(7). Increasing of oxygen on the surface of the plate, will lead to an increase in the photocatalytic ability of the semiconductor material, since the formation of the conduction band(11).

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Analysis of XRD for copper oxide plate after calcination at 400oC, there two kind of oxides have formed, copper (I) oxide and copper (II) oxide with percentage 26.7% of copper (II) oxide (CuO) and 73.3% of copper (I) oxide (Cu_2O)(7). Formation of copper oxide under 1000^oC, that is mixture of Cu_2O (firstly) and CuO (secondly) compound(12).

3.2 The Result of PV Cell Power Measurement

PV Cells has made the anode with plate Al, and Copper oxide as a cathode. The power PV cells was measured using multi tester and the result as shown in Table 1. Increasing the ability of PV cells is because the nature of aluminum plates such as n-type junction that provides electron more than plates Cu that are p-type junction(13). Therefore, plate Al causes a potential difference greater PV cell so as to produce greater power (7)

.

Table 1. Power of Cu_2O/Al photocell (7).

Photocell ($CuO.Cu_2O$/Al)	Room lights (I = 71.91 ftc, flux = 774)			Neon Lights (I = 184.75 ftc, flux = 1989.5)		
	Current (μA)	Volt (mV)	Power (μWatt/m^2)	Current (μA)	Volt (mV)	Power (μWatt/m^2)
average 10 PV Cell	337.2	509.8	46322.97	318.3	438.7	37628.19
Seri 11 PV Cell	497	3010	40311.78	517	3430	47785.23

3.3 I-V Characteristic Measurement

I-V characteristic measurement on photocell Cu_2O/Al shown in figure 5. The Photocell produce maximum power about 1.7331 mWatt, with 3.43 Volt and 0.513 mA. Measurement was occurred at 590 flux and 54.81 ft candle of neon lights.

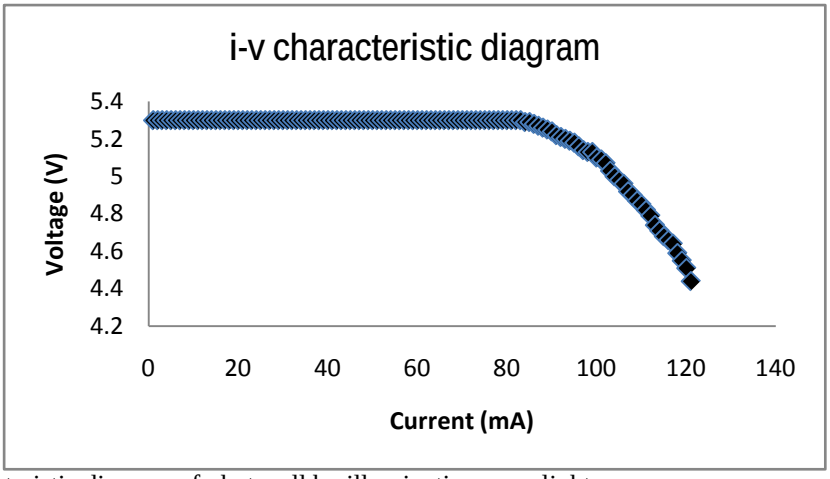

Figure 5. I-V characteristic diagram of photocell by illuminating neon lights

3.4 Analysis of Capturing Image Scale Measurement

Images of Carbon electrodes was taken with 13 Mpixel CMOS Oppo F7a X9009 done capturing image magnification and printed with HP Laser Jet printer. Size magnification to capture images was measured by comparing the scale of the actual size of the carbon electrode as a benchmark to get the actual size of the gas bubbles.

Results of measurement of the cross section of carbon electrode obtained the following results. Height/thickness of the carbon electrode (graphite) is 2 mm, a width of 5 mm and height of 140 mm. Measurement scale hydrogen gas bubbles using a cross-sectional measurements in the vertical position on the wide position electrode C is 5 mm. Photos printed electrode interface and conducted comparative measurement scale with the size of the cross section of carbon electrodes.

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Table 2. Measurement of bubbles scale for gas H_2 gas (Big = x B, Medium = x S, and Small = x K) (7).

H_2 gas	Image Capturing		Real		H_2 diameter bubbles (mm)
Sizes	x (mm)	y (mm)	x (mm)	y (mm)	
Big	3	22	x B	5	0.68182
Medium	2	22	x S	5	0.45455
Small	1	22	x K	5	0.22727

Based on the measurement scale camera capturing, hydrogen gasbubbleshave formed classified into three groups, i.e, large bubble (x B), medium bubble (x S) and small bubble (x K), with the size of each bubble are 0.68182 mm, 0.45455 mm and 0.22727 mm. The formation of gas bubbles are monitored by camera catches, and shift of bubble in buret scale. However, the formation of H_2 gas bubbles growth slightly, the method of measurement was done with a video recording on the surface of the carbon electrode for 5 hours and 45 minutes. Results recorded video capture on the surface of the carbon electrode was analyzed to get accurate results about the mechanism of formation of H_2 gas bubbles (7).

Analysis of Video Capturing at Carbon Electrode Surface

We observe the capturing video for 5 hours 45 minutes, reported by calculating the scale on the image 13 MP (Scheider certified professional camera)/50 Mega Pixel Photo Impresive Capturing from Oppo F7a X9006, when gas bubbles are formed and obtained by the real size scale comparators in image capturing. In this study actually gained diameter of each is 0.681818 mm for large size, 0.454545 mm for medium-size and 0.227273 mm for the small size.

The investigation of formation H_2 gas bubble was reported Rahadian *et al* (2015). Bubble formation occurs at minute 10, characterized by the formation of small bubbles (NBT) and the same time the formation of large bubbles (NBT). After 20 minutes, a bubble is formed again 1 large bubble (NBT) and 1 medium bubble (NST). Meanwhile, the release of gas bubbles occurred after 50 minutes of the release of 2 large bubbles (NBL). 8 minutes later, one huge bubble of H_2 gas (NBL) was released from suface of elctrode. The counting process can be seen in Table 3.

The process of the formation and transport of gas takes place at the time to 39:34 (39 minutes 34 seconds) is the No. 3 gas bubbles smaller gas bubbles move closer No. 4 larger. In the 45th minute, H_2 gas bubbles in point 4 was releasedform electrode surface. H_2 gas bubble migration reaction was observed in the recording surface of the Oppo F7a. 26 seconds later, the initiation point reappear in the same location, namely point 4. H_2 gas bubble nucleation No. 4 getting bigger and the same size as the gas bubbles No. 3 at minute 53. Both of these gas bubbles is approximately 5 mm and engaged with each other approaching at minute 53, second to 13.

At the time of 01:10:57 (1 hour: 10 minutes: 57 seconds), both the bubble (No. 3 and 4) has migrated to the surface of the electrolyte from the electrode surface. 4 minutes later, point 3 and 4 re-emerged, and the process of formation of H_2 gas re-occur. This process was observed for 5 hours 45 minutes of 0915 until 15:00 pm. The formation of gas bubbles as tabulated in Table 3. The term NBT, NST, HCV, respectively explain the large number of gas bubbles formed to size Large, medium and small. The term L, for the bubbles apart.

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Table 3. The formation H_2 gas bubbles at the cathode, NBT = number of large-size H_2 bubbles formed, NBL = number of H_2 large gas bubbles escaping from the cathode surface, S = medium, K = small, t = formed, L = apart (7)

time	Minute	N Bt	N BL	N St	N SL	N Kt	N KL	Σ bubbles	Total H_2 Volume
9:15	0:00	0	0	0	0	0	0	0	0
9:25	0:10	1	0	0	0	1	0	2	0.000172
9:35	0:20	2	0	1	0	1	0	4	0.000387
9:45	0:30	4	0	1	0	1	0	6	0.000719
9:55	0:40	4	0	2	0	2	0	8	0.000775
10:00	0:45	4	0	2	0	3	0	9	0.000781
10:05	0:50	4	2	1	0	2	0	9	0.001058
10:13	0:58	4	3	2	0	2	0	11	0.001273
10:25	1:10	4	3	3	0	1	0	11	0.001316
10:31	1:16	3	4	4	0	0	0	11	0.001359
10:36	1:21	3	4	4	0	1	0	12	0.001365
11:00	1:45	3	4	4	0	1	0	12	0.001365
11:15	2:00	3	4	5	0	0	0	12	0.001408
11:30	2:15	3	5	4	0	0	0	12	0.001525
11:40	2:25	3	6	3	0	0	0	12	0.001642
11:50	2:35	3	6	3	0	2	0	14	0.001654
12:00	2:45	3	7	3	0	1	0	14	0.001814
12:25	3:10	3	8	2	0	1	0	14	0.001931
12:45	3:30	3	8	3	0	2	0	16	0.001986
13:00	3:45	3	9	3	0	1	0	16	0.002146
13:25	4:10	3	9	3	0	2	0	17	0.002152
13:30	4:15	3	9	3	0	4	0	19	0.002164
14:00	4:45	3	9	4	0	3	0	19	0.002207
14:20	5:05	2	12	4	0	1	0	19	0.002527
14:35	5:20	0	14	4	0	1	0	19	0.002527
14:45	5:30	0	14	4	0	2	0	20	0.002533
15:00	5:45	0	16	3	0	1	0	20	0.00281

From Table 3 have seen that the formation of gas bubbles occur is continuous for 5 hours and 45 minutes. Hydrogen gas bubbles after the point is established, then the bubble is enlarged on the surface of the electrode (cathode) and finally detached from the cathode surface to the water surface.

Nucleation point H_2 gas bubbles begin to form after the tandem PV-EC work for 10 minutes 5 seconds. Based on the observations, H_2 growing gas bubbles with a diameter of 0.68 mm as shown in Figure 5. Determination of H_2 gas volume is formed by the following formula (assuming a spherical bubble of H_2 gas). The volume of gas bubbles H_2 = V = $(4/3)^3$. Where r = radius of H_2 gas bubbles (r = ½ diameter). Hydrogen gas bubbles are large in diameter 0.681818 mm, then his fingers can be calculated, ie r=½ mm x 0.681818 = 0.340909 mm. Thus, the volume of H_2 gas bubbles are generated is 0167mm^3.

Table 4. Sizes and bubbles model of H_2 gas

Bubbles	d (mm)	r (mm)	V (mm^3)	V(cm^3)
Big	0.681818	0.340909	0.166027	0.000166
Medium	0.454545	0.227273	0.049193	4.92E-05
Small	0.227273	0.113637	0.006149	6.15E-06

On the Figure 6 have seen that H_2 gas bubbles is formed with variation sizes. There is three variations sizes, that small, medium and big, depend on H_2 gas bubbles diameter on sectional electrode surface.

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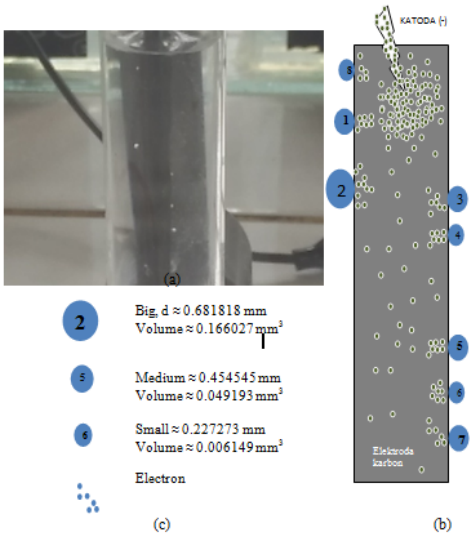

Figure 6. Gases bubbles image and models, (a) at carbon surface with 13 MPixel/50 time enlargement, (b) illustration of Hydrogen gas bubbles has formed in interface of Carbon electrode depend on electron distribution theory and (c) representation of H_2 gas bubbles has formed.

Theory of Hidrogen Gas Bubbles Formation

Process of H_2 bubbles formation on reaction taking place in water *splitting* at cathode surface.

Cathode (-) : $2H^+ + 2e \rightarrow H_2$
Anode (+) : $4OH^- \rightarrow O_2 + 2H_2O + 4e$

Analysis of the formation of hydrogen gas on the surface of elektroda.Tahapannya is convection, migration and diffusion. The movement of electrons in the inner electrode is a process of convection currents generated from the electrolyte galvanic cell. In the electrolysis cell, the process of convection is the movement of electrons occurs towards the electrode surface. After the formation of hydrogen gas electrochemically, the movement of gases on the surface of the electrode is a migration process in translation. Gas will be shifted and eventually leave the surface of the electrode as the process of migrating from the liquid phase to the surface of the electrolyte solution. Finally, the movement of gas through the electrolyte to diffuse from the surface of the output pipe, toward the end of the gas storage.

Various factors affect the electrochemical transport period is a surface electrode, electrolyte environmental conditions, in addition to the main factor is the current and potential. The type of electrolyte used very effectively influence the migration process. Migration in acidic, alkaline and salt will have differences. Because of differences in the atmosphere of the electrolyte, affecting the conductivity of the solution. On the electrode surface, convection process is highly dependent on the structure of the electrode surface, which raises the style of style to the style of convection and gas formation on the electrode surface. Surface electrodes that are not symmetrical cause polarization on the electrode surface, as illustrated in Figure 7 (7).

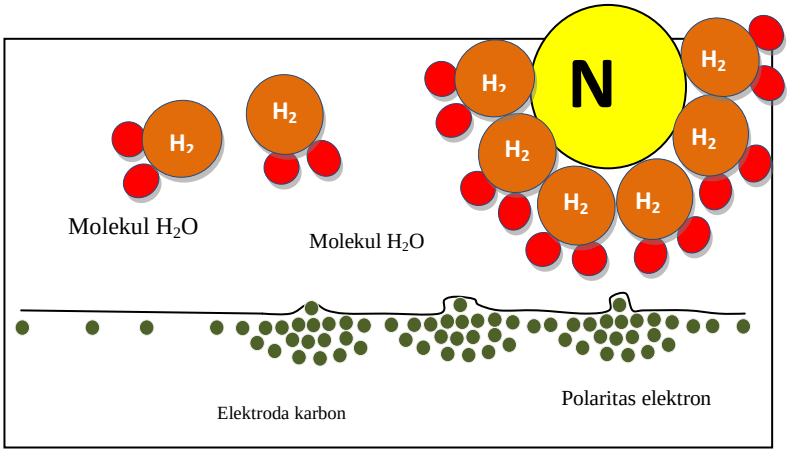

Figure 7. Schematic of electron polization on carbon electrode interface(7).

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The phenomenon of the formation of hydrogen gas at the electrode surface was observed with the following stages. Initiation stage, which is the starting point of the formation of hydrogen gas. This point occurs on the surface of the effective where the convection of electrons on the surface of the electrode is more optimum and at this point there is also an effective collision of H_2O with the active C interface electrode surface.

Reactions that occur at the initiation stage is the culmination point with the achievement of the activation energy so that the current that flowed on the surface of the carbon electrode (C), allows for the course of the electrochemical reaction of the hydrogen atoms that exist in H2O in the electrolyte solution. The electrochemical process, is a process of reduction at the cathode where the flow of electrons from the electrode surface to the hole point of the reactant species. At the same time, the oxidation reaction occurs at the anode where the reactant species that carry electrons give electrons to the hole area (+) on the surface of the C electrode (anode).

Its reaction :

Cathode (-) : $2H^+_{(aq)} + 2e \rightarrow 2H_2 \rightarrow H_{2(g)}$

Anode (-) : $4OH^-_{(aq)} \rightarrow O_2 + 2H_2O_{(l)} + 4e$

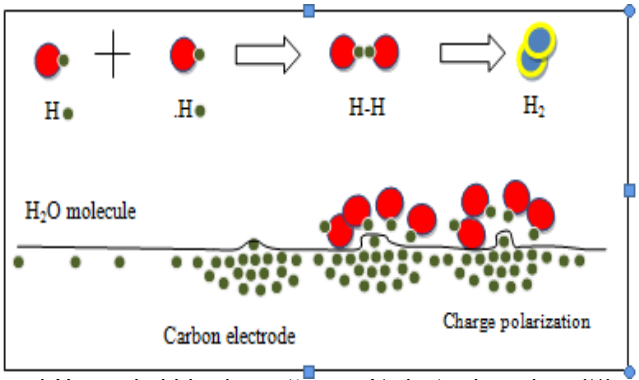

Figure 8. Scheme of H_2 gas bubbles formation on C electrode surface (7).

The second stage is the formation of gas bubbles on the surface of the carbon electrode on the active side. This process was observed by the formation of small dots on the surface of the electrode that eventually become small bubble size diameter of 0.2 mm to 0.67 mm. The starting point of the formation of gas bubbles called nucleation sites on the electrode surface. This gas bubble formation will inhibit the electrochemical processes at the electrode surface until H2 gas bubbles regardless of nucleation points (7). Phenomenon that occurs in the formation of H2 gas bubbles are:

1. The spontaneous formation of gas bubbles at nucleation sites. After the gas bubble diameter of 0.6 mm, the bubbles is separated from the surface so that the electrochemical processes can walk back. During the nucleation process until the moment the release of H2 gas bubbles, the electrode surface has blocked for core nucleation reaction of H2 gas.

2. The movement of the electrode surface after nucleation of H2 gas formed at the adjacent position (about 1-3 mm) with some movement patterns. The movement of the point of H2 gas bubble size is very small tend to be attracted or moving closer to larger gas bubbles. The second movement of the other is moving closer to each other bubbles to form larger bubbles. The process of movement on the surface of the electrode runs translational and when the bubble is getting bigger, the next process is the process of release of H2 gas bubbles from the electrode surface.

On the electrode surface nucleation sites that are far away from each other, point 7 and 8 in the scheme of H2 gas bubble formation, the H2 gas discharge becomes difficult to occur. This can be overcome with the vibration of the electrode so as to increase the momentum of H2 gas bubbles and the gas transport leaving the electrode surface.

Rate of H2 gas production at cathode is 1.72 x 10-5 ml/minute in time range of first 10 minute, and its will increase in 1 hours after that, about 2.19 x 10-5 mL/minute, thus finally decrease until 1.17 x 10-5 mL/minute after 1 hours 50 minute. From table 3, has been showed that after 6 hours, Hidrogen gas was achievely produced 0.00281 mL.

3. CONCLUSION

Mechanism of H_2 gas bubble formation occurs at the Carbon electrode surface with initiation process by nucleation point under indoor lights. We can make tandem photo-electro- cell has produced 3010 mV voltage (room lights) and 3430 mV voltage (neon light). Both of them can produce H_2 gas bubbles with 2 step, which spontaneously bubble formation and nucleation-accumulation bubble formation. H_2 production rate is 1.17 x 10^{-5} mL/minute.

ISBN 978-602-19877-3-5

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ISBN 978-602-19877-3-5

SYNTHESIS AND CHARACTERIZATION OF ZNO NANOPARTICLES BY SOL-GEL METHOD WITH VARIOUS ADDITIVES

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ABSTRACT

Preparation of zinc oxide (ZnO) nanoparticle with various additives by sol-gel process has been studied. ZnO nanoparticles were obtained by using zinc sulfate heptahydrate as the precursor, ethanol as the solvent. Ethylene glycol and urea were used as the additives by the addition of potassium hydroxide solution to adjust the pH value. The powders were formed by drying in the temperature of 105 ^{o}C for 60 minutes and after heating at 500 ^{o}C for ± 1 hour. The products were obtained in white powders. The synthesized ZnO were characterized by X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM). The XRD patterns showed ZnO forms were produced generally in hexagonal structure (*wurtzite*). Crystallite sizes of ZnO were estimated by using Scherrer equation. The particle size of ZnO prepared by using ethylene glycol and urea obtained in the range 18-70 nm and 26-75 nm respectively. SEM micrograph of ZnO shows agglomeration of hexagonal nanoparticles and the the distribution size is 0.1-1.0 μm approximately.

Index Terms— *ZnO nanoparticle; additive; hexagonal; sol-gel; agglomeration*

1. INTRODUCTION

Zinc oxide (ZnO) is one of the pupular of semiconductor that have a wide band gap of 3.37 eV with large exciton binding energy of 60 meV[1,2]. ZnO have extensive application doe to its electrical and optical properties. ZnO can be applied in many applications, including gas sensors[3,4], generators[5], field emission transistors[6], ultraviolet photodetectors[7], in biomedical systems[8], biosensors[9], electric materials[10], light emitting diode[11], solar cells[12] and piezoelectric tranducer[13].

There are several ways to produce ZnO nanoparticles such as thermal decomposition14,15, carbothermal reduction process16, solid sate method17, hydrothermal process18, sonochemical methods19, chemical vapor deposition (CVD)2, 20,21, metal organic chemical vapor deposition (MO-CVD)11, polymerization method22, precipitation process223,24, and sol-gel method25,26,27. Sol-gel process is one of the simplest and lowest cost (inexpensive)28.

Here, the synthesized ZnO nanoparticles prepared by sol-gel method. Zinc sulfate heptahydrate was used as precursor, ethanol as solvent, and potassium hydroxide as pH adjuster. The various additives were used in this research including ethylene glycol and urea. Sol-gel method has a number of advantages over other methods such as inexpensive equipment, will produce small particle size and uniform distribution particle with highest homogenity.

2. MATERIAL AND METHODS

2.1. Material

All the reagents were analytical reagent grade and were used without further purification. The various additives used in this research were ethylene glycol and urea, zinc sulfate heptahydrate ($ZnSO_4.7H_2O$) as the precursor. Ethanol (pa) was used as the solvent and potassium hydroxide was used as pH adjuster.

2.2. Synthesis of ZnO nanoparticles

In a typical process, 0.5 M zinc sulfate heptahydrate ($ZnSO_4.7H_2O$) was dissolved in appropriate amount of ethanol at room temperature. Aqueous solution of ($ZnSO_4.7H_2O$) was kept on magnetic stirrer for 1.5 hour and 2.0 mL ethylene glycol was added and followed by addition of KOH solution drop-wise till the turbidity occurred (pH=8) for 3 hours. Thus, the white precipitations were formed and which were washed several times with distilled water. The samples were allowed to dry in an oven at 105 ^{o}C for 60 minutes and followed with calcinations in a furnace at 500 ^{o}C for 1 hour. Finally, the dried powder was ground in agate mortar. The synthesized ZnO nanoparticles were analyzed by using X-ray Diffraction (XRD) with a diffractometer by using monochromatic CuKα with λ = 1.5406 and morphological study was carried out by Scanning Electron Microscopy (SEM).

3. RESULT AND DISCUSSION

3.1. Sol ZnO preparations

Table 1. Observation data of sol ZnO with various additives

Additives	Observation
Ethylene glycol	Zinc sulfate heptahydrate was easily dissolved in ethanol, after addition of 2

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	mL ethylene glycol produced homogenous sol and followed by addition of KOH solution approximately 10 drop wises, addition of KOH solution followed until the pH value reached 8.	
Urea	Zinc sulfate heptahydrate was easily dissolved in ethanol solvent, after addition of 1.0 g of urea produce homogenous sol of ZnO and followed by addition of KOH solution around 12 mL will produce milky white solution, the pH solution reached 8.	

3.2. Characterization of ZnO nanoparticles

3.2.1. XRD patterns

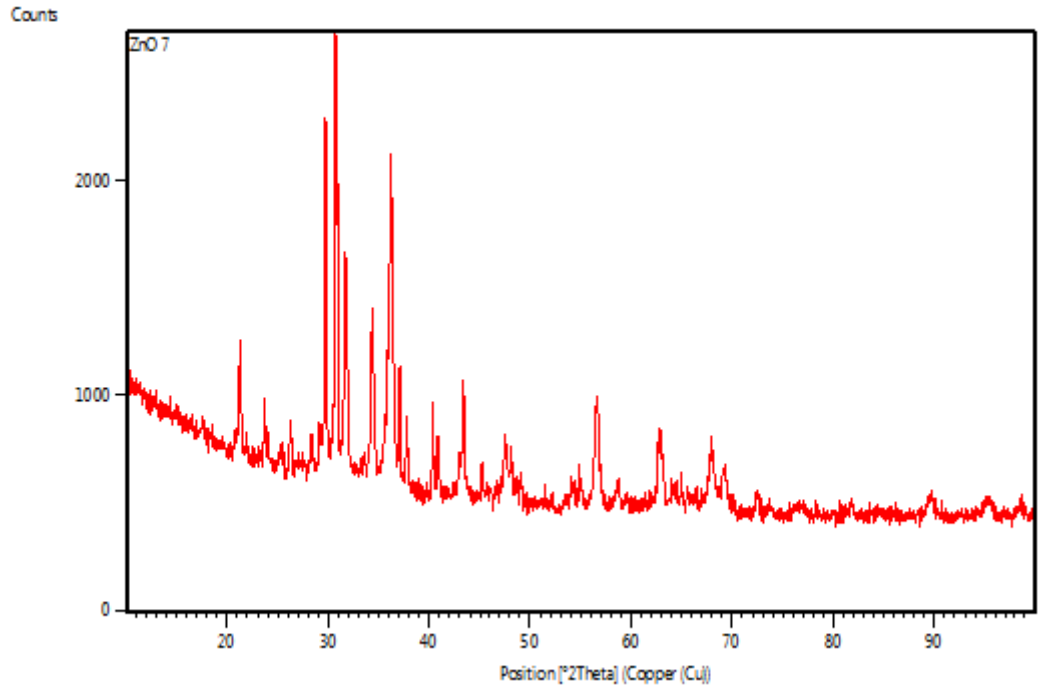

Fig.1. XRD pattern of ZnO nanoparticle synthesized by using ethylene glycol as additive

The X-ray diffraction pattern of the ZnO synthesized by using ethylene glycol as additive was shown in Fig.1. This data clearly shows distinct peaks at 2θ = 31.72; 34.42; 36.25; 47.54; 56.58; 62.82; 67.90 and 69.23. The peaks have been identified as peaks of hexagonal ZnO (*wurtzite*) crystallites with various diffracting planes [100], [002], [101], [102], [110], [103], [112] and [201], respectively. ZnO nanoparticle posses a high crystallinity since all the peaks was very sharp. All of the reflections in this pattern can be readily indexed to a hexagonal phase of ZnO which is in good agreement with the literature result(Pdf Card No. 01-078-2595). The other peaks observed at an angle 2θ of 21.30 and 30.74 which have been identified as potassium sulfate (Pdf card No. 00-005-0613). The average crystalline size of the synthesized ZnO nanoparticle prepared by using ethylene glycol as additive was calculated by using Scherrer to be about 18- 70 nm (Table 2).

Table 2. XRD data of ZnO nanoparticle prepared by using ethylene glycol as additive

Angle (2θ)	Height (counts)	FWHM	d-value [Å]	Relative intensity (counts)	Crystallite size (nm)
31.72	1056.69	0.1279	2.8209	50.68	63.9
34.42	813.74	0.1791	2.6056	39.03	46.0
36.25	1550.09	0.2558	2.4779	74.35	32.6
47.54	277.82	0.2558	1.9125	13.33	33.6
56.58	507.10	0.1279	1.6266	24.32	69.9
62.82	355.78	0.3852	1.4792	17.06	23.9
67.90	304.83	0.2558	1.3803	14.62	37.0
69.23	179.22	0.5117	1.3572	8.60	18.7

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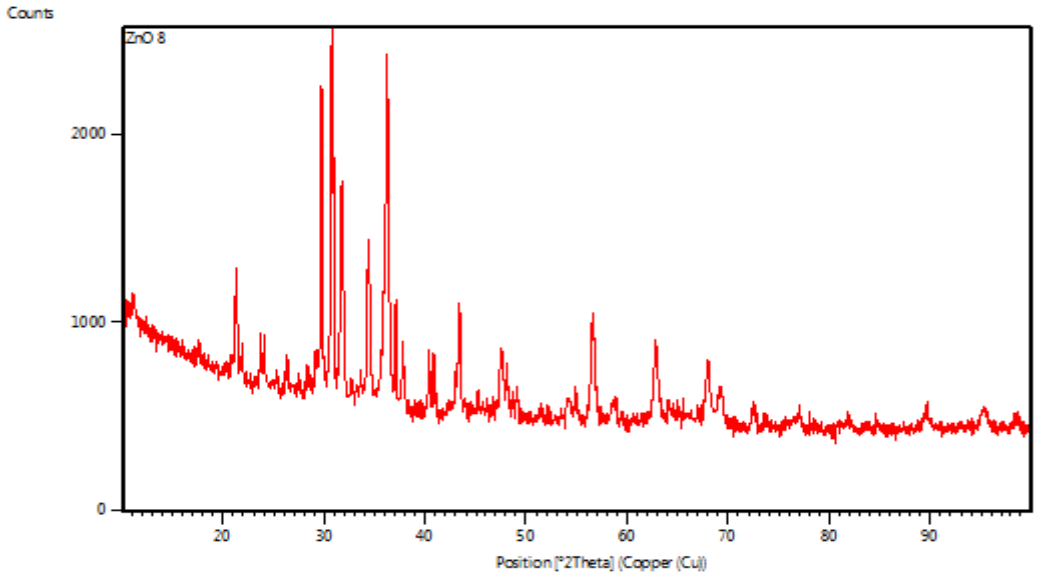

Fig.2. XRD pattern of ZnO nanoparticle synthesized by using urea as additive

The crystallinity and phase of the products were examined by X-ray Diffraction. The X-ray diffraction pattern of the product synthesized was shown in Fig.2. This data clearly shows distinct peaks at 2θ = 31.78; 34.43; 36.28; 47.55; 56.62; 62.82; 67.94 and 69.36. The peaks have been identified as peaks of hexagonal ZnO (*wurtzite*) crystallites with various diffracting planes [100], [002], [101], [102], [110], [103], [112] and [201], respectively. ZnO nanoparticle posses a high crystallinity since all the peaks was very sharp. All of the reflections in this pattern can be readily indexed to a hexagonal phase of ZnO with space group *P63mc* which is in good agreement with the literature result (Pdf Card No. 01-078-3322). The other peaks observed at an angle 2θ of 21.32 and 30.74 which have been identified as potassium sulfate (Pdf card No. 00-044-1414).The avarage crystalline size of the synthesized ZnO nanoparticle prepared by using urea as additive was calculated in the range of 26-75 nm (Table 3).

Table 3. XRD data of ZnO nanoparticle synthesized by using urea as additive

Angle (2θ)	Height (counts)	FWHM	d-value [Å]	Relative intensity (counts)	Crystallite size (nm)
31.78	1121.55	0.2047	2.8154	59.18	39.9
34.43	848.27	0.2303	2.6047	44.76	35.7
36.28	1724.93	0.2303	2.4764	91.01	35.9
47.55	346.74	0.2558	1.9121	18.30	33.5
56.62	577.46	0.1535	1.6255	30.47	58.2
62.82	450.98	0.1279	1.4793	23.80	72.0
67.94	302.06	0.3582	1.3798	15.94	26.5
69.36	199.03	0.1279	1.3548	10.50	74.9

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3.2.2. SEM images of ZnO nanoparticles

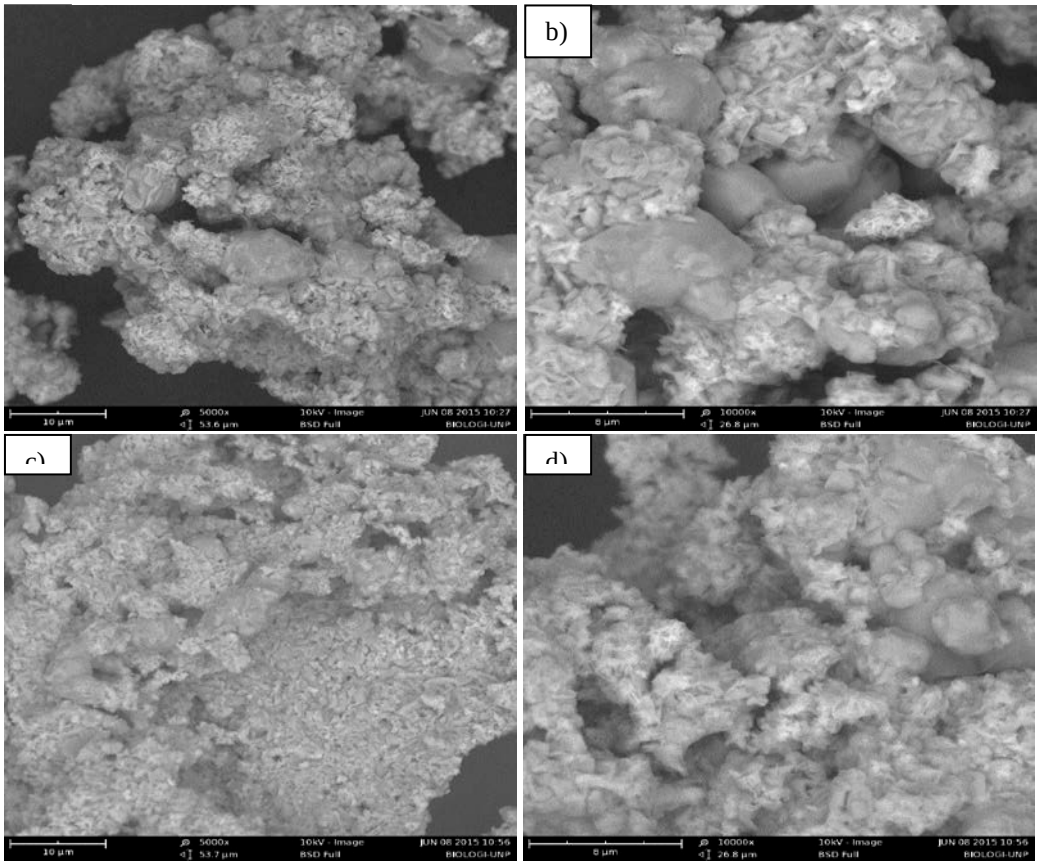

Fig.3. SEM images of ZnO nanoparticles synthesized by using a) and b) ethylene glycol as additive, c) and d) urea as additive

Fig. 3 depicts the representative SEM micrographs of ZnO nanoparticles. The effect of various additives was studied in order to obtain the smallest particles size of ZnO. The synthesized ZnO nanoparticle prepared by using ethylene glycol (Fig 3.a and b) exhibited a small agglomeration of hexagonal nanoparticles. ZnO nanoparticles were prepared by using urea (Fig 3.c and d) shows agglomeration of hexagonal nanoparticles. The additives have been influenced to the structure and the particle size of the synthesized ZnO.

4. CONCLUSION

ZnO nanoparticles were successfully prepared by sol-gel method with various additives. The additives play a significant role on the crystalline size and morphology of the ZnO nanoparticles. XRD data for ZnO prepared by using ethylene glycol shows the hexagonal (*wurtzite*) structure of ZnO with crystalline sizes in the range of 18-70 nm. The structure of ZnO prepared by using urea as additive shows the hexagonal (*wurtzite*) structure of ZnO with crystalline sizes in the range of 26-75 nm. SEM images of the synthesized ZnO confirmed the agglomeration of hexagonal nanoparticles. Ethylene glycol is the best additives for preparation of ZnO nanoparticles.

5. ACKNOWLEDGEMENTS

The authors would like to thank Ministry of Education and Culture, Indonesia for providing financial support through research decentralization, *Hibah Bersaing Grant*, contract No. 023.04.1.673453/2015.

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ISBN 978-602-19877-3-5

ISOLATION AND CHARACTERIZATION OF FLAVONOID FROM GAMBIER PLANT LEAVES (*Uncaria gambir* R.)

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ABSTRACT

Gambier plant leaves (Uncaria gambir R.) is a medicinal plant of the Rubiaceae family which distributed in many area in Indonesia such as west Sumatera. This study was aimed to isolate and characterize a flavonoid compound obtained from the gambier plant leaves. The isolation and characterization of flavonoid from ethyl acetate fraction of Uncaria gambir R has been done. The compound was extracted by maceration, purified by column chromatography, and characterized with spectroscopic methods. The flavonoid isolate is brownish yellow powder which decomposed at 177,7-178,8 ^oC. Based on ultraviolet and infrared spectra analysis, it is predicted as dihydroflavonol with hydroxyl groups at C_6 dan C_7.

Index Terms— *column chromatography, flavonoid, maceration, thin layer chromatography, Uncaria gambir R.*

1. INTRODUCTION

Indonesia as a tropical country rich in natural resources of various types of plants that have certain active ingredients that are beneficial for health. The active ingredients contained in the plant the form of primary and secondary metabolites obtained through metabolic processes. The existence of secondary metabolites is dependent on the plant species [1]

Secondary metabolites have an important role for the survival of plants for the production plant itself, such as the defense of life and others. According to the phylogenetic analysis and systematic based on the character macroscopically and microscopy stated that the secondary metabolites contained in a member of the plant family of compounds having similar structures [2].

Flavonoids are phenolic compounds that have been isolated from many plants and more than 8000 kinds of flavonoids known structure. Flavonoids including the type of secondary metabolites showed a high diversity of structures, both as a carbon skeleton and functional groups while providing diverse bioactivity properties. Flavonoids act as antioxidants, antimicrobials, photoreceptors, visual attractors, feeding repellants and light screening. Flavonoid compounds also show biological activity such as hypo-allergenic, antiviral and antiinflamantory [3].

One of the plants containing flavonoids and can be used as a drug is a plant gambier (Uncaria gambier R.). Gambier plants usually grow wild in the woods and other places that landed slightly askew and getting enough sunlight and rainfall evenly every year. Gambir plant is believed to have efficacy for drugs, especially the leaves. Traditionally, other than as a complement to eat betel generally gambier leaves used as medicine burns, diarrhea, dysentery, ulcers, skin pain, gingivitis, sore throat, cough and ulcers. But in modern, gambier leaves has been used as raw material for pharmaceutical and food industries [4].

Based on research Idris (1997), on the pathogen Fusarium sp cause klusena plant leaf spot disease can be controlled by using a pesticide plant extract derived from the leaves of gambier. This shows that the leaves of gambier contained bioactive components that act as anti-microbial.

The chemicals contained in the leaves of gambier is flavonoids, alkaloids and saponins. It is what lies behind the research to isolate and characterize flavonoids from the leaves of gambier.

2. EXPERIMENTAL SECTION

2.1. Materials

Basic materials used include leaves of gambier that has been dried, organic solvents such as methanol, ethyl acetate and n-hexane technical distilled and other chemicals such as acetic anhydride, concentrated sulfuric acid, sulfuric acid 2 N, iron trichloride, chloroform, hydrochloric acid , ammonia, sianidin test reagents, reagent slide for UV-visible spectroscopy and silica gel 60 (Merck).

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2.2. Instrumentation

The equipment used is glassware commonly used to study organic chemistry natural materials, rotary evaporator heidolp WB in 2000, a capillary tube, plate TLC (silica gel 60 F), column chromatography conventional UV lamps for whistleblower stains models of UV GL-58 UV 254 nm and 365 nm, the melting point apparatus (Gallenkamp), Ultraviolet spectroscopic Agilent 8453 UV-Vis, IR and FT-IR spectroscopy Jasco 460 plus.

2.3.SamplePreparation

8.4 kg of samples taken in the area Pancahan Village, District Rao, Pasaman, West Sumatra and identified in the Herbarium Department of Biology, Faculty of Mathematics and Natural Sciences, University of Andalas. Samples to be isolated cleaned and finely chopped.

3. ISOLATION AND PURIFICATION

Dry samples that have been mashed (8.4 kg) is extracted by macerated in methanol. The extract obtained was concentrated by rotary evaporator and then fractionated using n-hexane and ethyl acetate-water. Each fraction was collected and concentrated. Stationary phase column of silica gel prepared with suspending in n-hexane. Then the suspension is packed into a chromatography column bottom was lined with cotton. Eluent n-hexane allowed to go down while the column wall-tap tapped the creation of air voids, and silica packed well. Samples (10 g) was first mixed with silica gel and then stirred until homogeneous, and then inserted into the stationary phase column that had been prepared.

Elution was performed using a gradient elution system of terraces (SGP, step gradient polarity) starting from n-hexane eluent non polar, followed by semi-polar eluent, namely by adding ethyl acetate. The eluate is collected in a volume of 10 mL vial and monitored by TLC. The eluate which has the same stain patterns are combined to obtain 7 fractions (A-G). Fraction B was monitored by TLC in order to obtain 14 fractions. Flavonoid fractions containing purified by recrystallization to obtain pure compounds.

4.CHARACTERIZATION OF COMPOUND

Characterization of physical properties and chemical purification of the compounds include melting point testing, reagent color, chromatography, UV spectrum examination by sliding reagent test and inspection FTIR spectrum.

5. RESULT AND DISCUSSION

Preliminary phytochemical test gambier leaves indicate the content of secondary metabolites, alkaloids, flavonoids and saponins. Extracted using a solvent such as methanol concentrated extract as much as 434 g. Then the ethyl acetate fraction obtained viscous reddish orange as much as 36.2262 g. Results of column chromatography with ethyl acetate fraction SGP system using ethyl acetate-methanol eluent composed of 7 fractions. Based sianidin test, a positive fraction B contains flavonoids. Further to the purity fraction B test using thin layer chromatography with a variety of mobile phase showed a single spot so that it can be concluded that the fraction B is a pure form of brownish-yellow powder with a melting point of 177.7 C - 178.8 C. Qualitative test showed that flavonoid class of compounds are compounds flavonols (positive with 10% NaOH, concentrated H2SO4, and Mg-HCl). KKt-2A results indicate this compound is dihidroflavonol group, it is seen from a single yellow stains with 365 nm UV light. Noda is located at the bottom left of the chromatogram with Rf 0.425 with BAA and 0.5875 with 15% acetic acid eluent [6].

Figure.1 shows UV-VIS spectrum of isolated compounds in methanol gives absorption at a wavelength of 280 nm , UV-VIS spectral pattern similar to the pattern spectrum dihidroflavonol group [5]. To determine the position of the hydroxyl group on the aromatic ring in the compound purified flavonoid, sliding reagent is added and the UV spectrum shift seen that happen. The addition of NaOH sliding reagent gives absorption at a wavelength of 290 nm, means showing OH in ring A [6]. The addition of a sliding reactants AlCl3 gave absorption at a wavelength of 279 nm (band II) and after the addition of HCl gives absorption at a wavelength of 281 nm (band II) there is a shift that is not so significant in the second band of the spectrum. It showed no OH at C5 [5] (Figur 2).

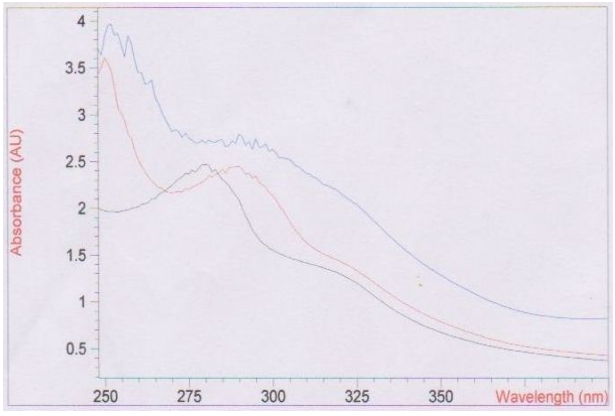

Figure 1. UV-VIS spectrum flavonoid isolated with MeOH solvent and the addition of reagents sliding NaOH

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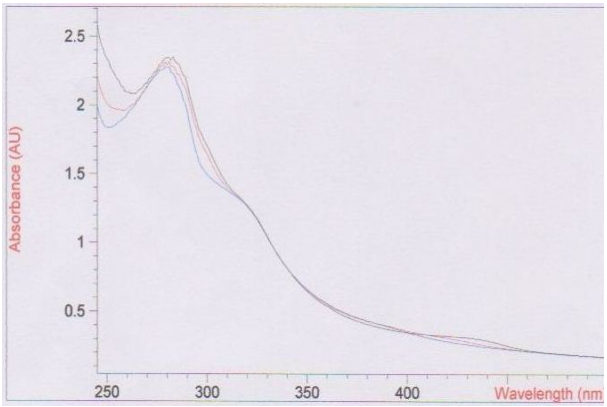

Figure 2. UV-VIS spectrum flavonoid isolated with MeOH solvent and the addition of reagents sliding $AlCl_3$/HCl

Figure 3 shows the addition of a sliding reagent NaOAc provide absorption at a wavelength of 280 nm (band II), there is no significant shift only strength is reduced, this indicates that the group is sensitive to alkaline (6.7 or 7.8 in OH). When replenishment H3BO3 provide absorption at a wavelength of 281 nm (band II) a small shift towards MeOH, which indicate the presence of OH in ring A (6.7 or 7.8) [6].

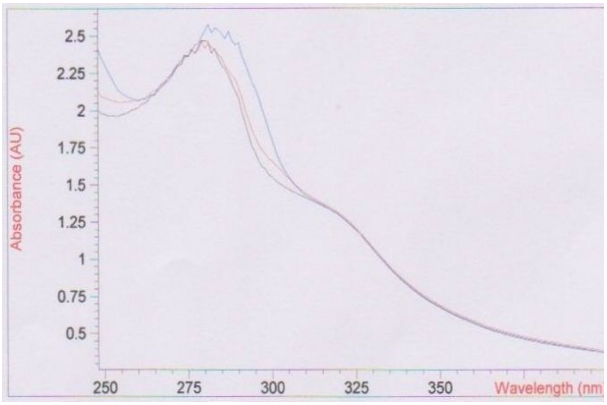

Figure 3. UV-VIS spectrum flavonoid isolated with MeOH solvent and the addition of reagents sliding NaOAc/H_3BO_3

FTIR spectrum of fraction B in Figure 4 below provide important information about the uptake of functional groups contained in the results of purification of flavonoid compounds. Absorption at 3199.22 cm wave number comes from OH stretching vibration. OH uptake is also supported by the COC stretching absorption at 1287.30 cm.Serapan ether at 1519.99 cm area indicates aromatic groups C = C and C = C alkenes in the area of 1622.12 cm [6].

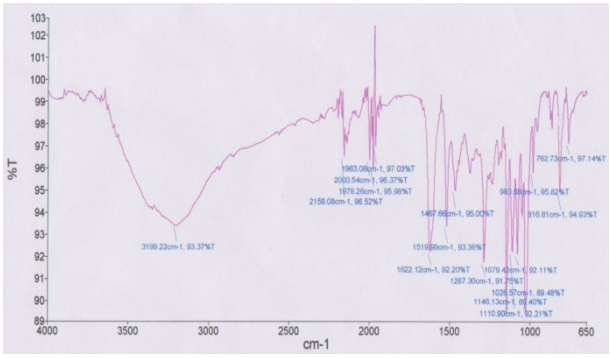

Figure 4. Infrared spectrum flavonoid isolated.

Based on the analysis of UV spectra using reagent slide and FTIR spectra can be concluded that the isolates obtained an dihidroflavonol compound which has hydroxy group at C6 and C7.

6. CONCLUSION

Compounds isolated from ethyl acetate fraction are flavonoid compounds are based on data from the UV spectrum, UV and FTIR sliding reagent, is dihidroflavonol which has a hydroxy group at C6 and C7.

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ISBN 978-602-19877-3-5

SYNTHESIS OF COPPER OXIDE THIN FILM VIA SOL-GEL DIP-COATING ROUTE FOR SPECTRALLY SELECTIVE ABSORBER MATERIAL

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ABSTRACT

Copper oxide thin film coatings have been successfully coated on reflective aluminium substrates via facile sol–gel dip-coating route for spectrally selective absorber (SSA) application. For quantitatively analysis, the reflectance spectra obtained from UV-Vis-NIR and FTIR equiped with the integration spheres were used to measure the absorptance and emitance values, respectively. To optimize the performance, relevant parameters such as the concentration of sol precursor and the dip-drying cycle were investigated. The increase of the concentration of copper sol precursor in range of 0.1 - 0.3 M increased the absorptance value, likewise with the increase of the dip-drying cycles. The maximum absorptance of α=72% with a spectrally selective absorber profile was achieved by a SSA material synthesized using 0.3 M copper nitrate, 0.3 M propionic acid, and 8 times dip-drying cycles. The emitance value of ε=6.63% for this coating was recorded. Good optical performance of spectrally selective absorber and the operational simplicity of the synthesis process make this coating have high prospect as spectrally selective absorber material.

Index Terms— *copper oxide thin film; sol-gel dip-coating; absorptance – emittance, optimization*

1. INTRODUCTION

There are, at least, two approaches to convert solar radiation into electricity, namely direct approach using photovoltaic (PV) devices and indirect approach using photothermal conversion. Photothermal collectors convert solar irradiation to the heat, which is in turn, will be converted into electricity through the thermoelectric generator (TEG) or power steam generator (concentrator solar power (CSP). The efficiency of photothermal conversion is widely known much higher compared to photovoltaic [1]. Other applications for solar thermal collector are for solar water heater, solar air conditioner (solar AC), hybrid solar photothermal-photovoltaic (PV/T), solar dryer, etc. The key component of solar thermal collector is the solar-absorber surface which strongly affects the efficiency of the solar thermal conversion. Ideally, the surface absorps as much as possible incoming solar (UV-Vis_NIR) radiation (high absorptance) but rejects the mid-far infrared (MFIR) to minimize heat loss from the heated surface (low emittance) or welknown as spectrally selective absorber (SSA) surface.

Most widely-used industrial SSA in recent years are metal particles in ceramic (cermet) structures produced by electroplating/ electrochemical or sputtering /vacuum deposition methods. However, the electrochemical/ electroplating processes are not environmentally friendly [2] while sputtering/vacuum deposition processes are technically complicated and necessitates high cost [3]. There is, therefore, a need for cost-effective and environmentally-friendly production of high quality SSA materials. In this context, sol-gel techniques meet these criteria and they are potentially very promising techniques. The sol-gel methods are well-known, simple, low cost, and environmentally friendly thin film fabrication techniques resulting in a uniform chemical thin film composition.

Cobalt copper oxides ($Cu_xCo_yO_z$) are versatile materials which have been used in a number important catalytic reactions such as conversion of syngas to higher alcohols [4, 5], oxidation of carbon monoxide (CO) by O_2 [6], oxygen evolutions reaction (EOR) [7], for Fischer-Tropsch synthesis [8] and for thermoelectric power generation material [9]. Numerous studies have been conducted to characterize the physicochemical, magnetic, conductivity, electrochemical and thermal properties of copper-cobalt oxides. However, solar-based optical properties of copper-cobalt oxides thin film coating are comparatively less studied [7]. In previous work we have synthesized the copper cobalt oxide based SSA [10, 11] using simple and environtmentally sol gel process. Our SSA coating showed promising material for spectrally selective absorber coating application.

For cost minimizing, stand alone copper oxide is worth considering. Some researches have explored the copper oxide spectrally selective absorber material, even though they were produced using a not environtmentally friendly processess [12, 13]. In this study, we prepared copper oxide thin film coating deposited on highly reflecting aluminium substrate using simple and environmentally sol-gel dip-coating,

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and investigated the surface electronic structure and the optical (absorptance and emittance) properties. The parameters studied are concentrations of copper nitrate concentrations and the dip-drying cycles whereby they were directly correlated to the thickness of the thin films which ultimately influences their solar absorptance.

2. EXPERIMENTAL

2.1. Preparation of thin film coatings

Copper (II) nitrate trihydrate ($Cu(NO_3)_2.3.H_2O$ (Merck), propionic acid (C_2H_5COOH) and absolute ethanol (Merck) were used as received. The cleaned commercial aluminium size 2x4 cm^2 was used as substrate. Copper nitrate powder, coplexing agent propionic acid and absolute ethanol were mixed together and stirred for 2 hours to form a series of 0.1 M, 0.2 M and 0.3 M of copper nitrate sol precursors. The sol solutions were then used for thin film deposition on aluminium substrates via dip-coating at withdrawal rate of 180 mm/min and subsequently heated at 150°C for 1 minutes. Copper-cobalt thin films with varying thicknesses were prepared by repeating the dip-heating cycle before final annealing in oven at temperature 500 ^oC for 1 hour.

2.2. Characterisations

Solar absorptance was calculated based on the AM1.5 solar spectrum standard via hemispherical reflectance recorded from 300 to 2650 nm using UV-Vis-NIR Jasco V-670 double beam spectrophotometer with 60 mm integrating sphere. Infrared reflectance spectra in the wavelength area from 2.7 to 15.4 µm were obtained using a reflected-off type of Perkin Elmer Spectrum 100 FTIR spectrometer within the range from 500 to 4000 cm^{-1}. The coating surface was contacted on the diamond surface area and a pressure arm was positioned and locked at force of 80 N to maintain homogenous attachment onto the surface. The reflectance spectrum was obtained after four scans with resolution of 2 cm^{-1}. Background correction was performed before the collection of each spectrum.

3. RESULTS AND DISCUSSION

3.1. Absorptance properties

The absorptance (α) in the solar wavelength range of 0.3-2.5 µm is the most importance properties to measure the optical performance of material. Absorptance is defined as a weighted fraction between absorbed radiation and incoming radiation (I_{sol}) [14, 15]. The solar absorptance of a thin film on a substrate can be determined in term of reflectance as described by Duffie and Beckman [15] as seen in Equation (1). Low spectral reflectance indicates high absorptance and *vice versa*.

$$\alpha = \frac{\int_{0.3}^{2.5} I_{sol}(\lambda)(1-R(\lambda))d\lambda}{\int_{0.3}^{2.5} I_{sol}(\lambda)d\lambda} \quad (1)$$

Reflectance spectra of the copper thin film coatings on aluminium substrates produced with variations of dip-drying cycle are shown in Fig. 1. Every spectrum has its corresponding solar absorptance values determined practically based on the spectral distribution of terrestrial beam normal radiation at Air Mass (AM) 1.5 [15].

Generally the synthesized coatings have a low reflectance (< 50 %) in UV-Vis range, and moderate to high reflectance (up to 100 %) in near infrared range (NIR) (Fig. 1a-c). Such reflectance spectra approach a solar selective absorber (SSA) curve profile where they absorb much and moderate in UV-Vis and NIR wavelengths area, respectively. High absorption in UV-Vis area could be due to the existence of numeous spin-allowed electron transitions (octahedral arrangements) between partially filled d-orbitals [16, 17], while the moderate absorption in the NIR wavelength area is due to the combination effect between the absorber coating intrinsic properties and the aluminum substrate reflective properties. In this context our absorber coating behave akin a semiconductor. It is apparent that the stand alone aluminum substrate without coating has different spectra profile which reflects back almost all of solar radiations.

The reflectance property of substrate has a substantial influence on the overall performane seletive absorber coating. It is well accepted that in the infrared area, the longer the radiation wavelength, the more radiation will be transmitted through the semiconductor coating material due to the smaller energy owned by the radiations/photons, which makes it easier for radiation to pass through the coating material without being absorbed. This transmitted-through radiation will be then reflected back by the reflective substrate (dark mirror

ISBN 978-602-19877-3-5

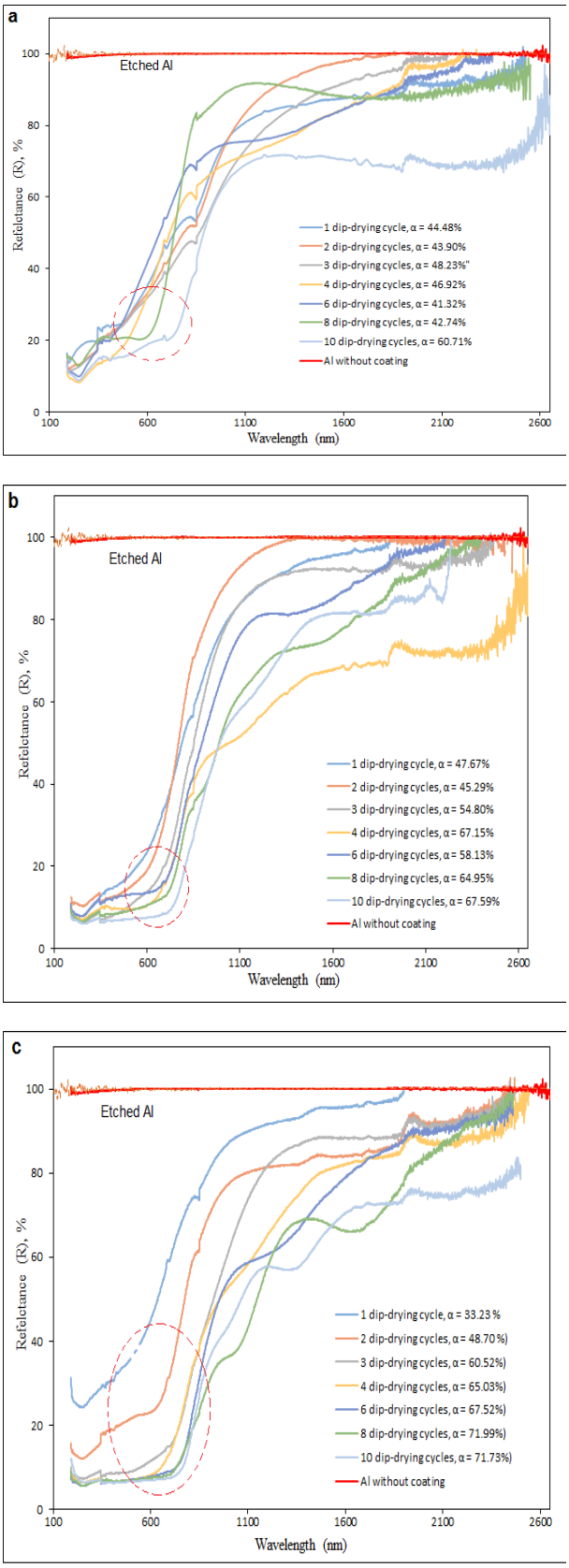

Fig. 1. Reflectance Spectra of Copper Oxide Thin Film Coatings on Aluminium Substrates Synthesized at Copper Nitrate Concentrations Of: a) 0.1M, b) 0.2M, c) 0.3M with Corresponding Solar Absorptance (α) Values.

absorber–reflector tandem). In view of this, the more reflective surface properties, the more IR reflection and the better emittance will be.

In figure 1a-c, it can be seen that even though there are little fluctuations, generally the increase in the number of the dip-drying cycles (which increases the thickness of the film) improve the absorptance (α) value. It is well known that the thickness of the absorber layer determines the final absorptance of the system [18, 19]. Similar phenomenon of absorptance improvement is also detected when the concentrations of sol precursor were increased. The highest absorptance (α=72%) is reached when the coating was synthesized using copper nitrate sol concentration of 0.3M deposited on aluminum substrate via 8 dip-drying cycles. It is estimated that the absorptance value wil be countinously increase until a certain higher sol precursor concentration and certain dip-drying cycles. However the optimum absorptance is limited by a criteria where the reflectance spectra and the cut-off line (at λ=2.5μm) are intersected at a absorptance value of minimum at least 50% [11].

An absorption adge is observed in every reflectance spectrum (red circle dashed line in figure 1a-c) which is formed due to the change of two reflectance slope when the wavelength is increased in wavelengths area below of 800 nm. It is clearly observed in figure 4b-c that generally the absorption edge moves to a longer wavelength when the dip-drying cycles are increased. When a high concentration of sol precursor was applied the increase of dip-drying cycles significantly increase the absorption edge position (Fig. 1c). However, overall, the absorption edges here in the positions of below 1000 nm which leads to relatively low absorptance compared other reports [11, 18]. It is impotant to note that the presence of absorption edge is normally begun by the presence of the interference peak as reported by other researches [10, 18, 20]. The presence of wavy curve (interference peak – absorption edge pair) is due to the combination factors of between the high refractive index of the absorber material and the and the low reflections in thi area. However, here, there is a minimum interference peaks observed, and it is a good sign for the improvement of the absorptance value when the high concentrations of copper sol concentration and high dip-drying cycles would be applied.

3.2 emittance properties

The emittance is the another properties to measure the performance of optical material. Thermal emittance (ε) is defined as a weighted fraction between the emitted radiation and the Planck black body distribution (*Ip*) and expressed in term of reflectance (*R(λ)*) as seen in the following equations [21]:

ISBN 978-602-19877-3-5

$$\varepsilon_{(T)} = \frac{\int_{2.5}^{20} I_P(\lambda)(1-R(\lambda))d\lambda}{\int_{2.5}^{20} I_P(\lambda)d\lambda} \quad (2)$$

The emittance vaule (ε) is practically determined based on the reflectance spectra using table of fraction of blackbody radiant energy between zero and λT for even increments of λT as described in Duffie and Beckman [15]. High spectral reflectance indicates low thermal emittance/low heat loss from the surface and vice versa. The reflectance spectra of the copper oxide thin film coatings synthesized using 0.3 M copper sol precursor and 8 times dip-drying cycles (the coating with the best absorptance) within the infrared wavelength range is presented in Fig. 2. In Fig. 2, it can be seen that there are infrared weak absorption in wavelengths area of around 10 μm and 14.5 μm. They could be attributed to the phonon absorption typically exhibited by the copper or cobalt oxide family [22].

The processing of reflectance data via spreadsheet based on the Duffie Beckman method [15] results the emittance value of ε=6.63%. This result is quite low for a slective absorber material since it is lower than 10% [23]. Based on this we can measure the selectivity of coating s = α/ε = 0.72/0.663 ≅ 1.1.

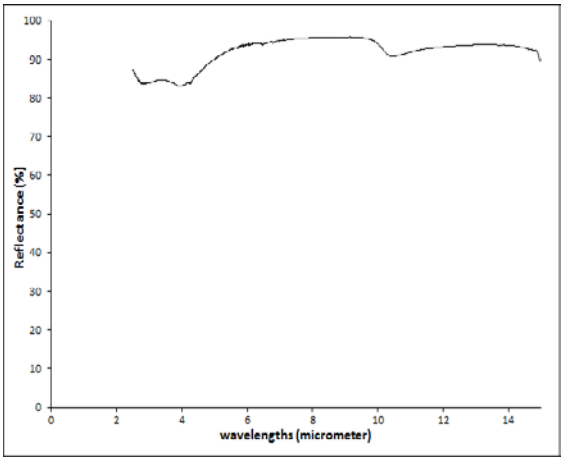

Fig. 2. Reflectance Spectra of Copper Oxide Thin Film Coatings on Aluminium Substrates Synthesized at Copper Nitrate Concentrations of 0.3M and 8 Times Dip-Drying Cycles.

4. CONCLUSIONS

Copper oxide thin film coatings have been successfully deposited on commercial highly reflective aluminium substrates using sol-gel dip-coating method. UV-Vis-NIR and FTIR reflectance spectra revealed that the increase in the number of the dip-drying cycles (which increases the thickness of the film) in the coating preparation improve the absorptance (α) value. Likewise with the increase of the sol precursor concentration. The highest absorptance (α=72%) is reached when the coating was synthesized using copper nitrate sol concentration of 0.3M deposited on aluminum substrate via 8 dip-drying cycles. The emittance value of 6.63% for this coating was recorded.

5. ACKNOWLEDGMENT

We gratefully acknowledges to Dikti for funding via Hibah Bersaing research grant

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ISBN 978-602-19877-3-5

USE OF *MIND MAP* IN INCREASING STUDENT LEARNING ACTIVITIES AND RESULTS OF GENERAL BIOLOGY COURSE IN FMIPA UNP PADANG *

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ABSTRACT

One of the activities that can improve learning outcomes and student learning activity is the use of learning strategies, Research aims to determine the use of *mind map* to improve the activity and student learning outcomes in general biology courses at the Faculty Mathematic and Science UNP Padang. Research method used is descriptive method. The population is of Chemical Education students who take courses in General Biology half of July to December 2014. The sample is the entire population (saturated sample), amounting to 49 people. The Data collected in this study is the ability of the students create a *mind map*, quizzes, observation and interviews. Data processed descriptive. The results Showed that the *mind map* can be used for the evaluation of learning that can Enhance the activity and student learning outcomes. In addition, students responsibility srategies well as applied learning with a *mind map*

Index Terms---Mind map, activities. Learning outcomes, general biology

1. INTRODUCTION

Mind map simple way to make a record of creative, effective, and literally will map our minds. Mind map also .represent one of technique note proposed by Tony Buzan. According to Buzan [1] there is some use of *mind mapping* in the learning process in the classroom, namely: 1) *Mind map* coachable / students to choose the information conveyed in learning, by absorbing the word or phrase that is really important and discard parts that are not essential , 2) Mind map to remember, made a variety of pictures and interesting game, 3) *Mind map* for imagination, seeking freedom of expression of a student in her mind to something pouring learning materials. 4) *Mind map* is able to describe a learning material in the form of the appearance of the center. This shows that the *mind map* student is able to concentrate on the material, meaning that they are able to concentrate on material students, meaning they would increase concentration in learning, 6) *Mind map* can be creative, creative thinking comes from the imagination high. Furthermore Wycoff [2] suggested *mind map* (mind mapping) is a technique to develop a more creative approach to thinking and innovative techniques that are highlighted in this study is the strengthening of the concept are *mapped* according to the way of thinking of an individual.

Mind map is already widely used in biology learning in school. This is shown by the many studies that the most active with a *mind map*. Research conducted by *research* Tuty Siswanti [3] states that the results of study biology class XI student SMAyang given the task *mind map* is higher than those given the task of pictorial concept maps

Research Fitri Diana Oktavia [4] states that the use of learning model kooperatif Team Asisted Individualization (TAI), which preceded chores create a *mind map* positive effect on learning outcomes IPA biology class VII SMP N 25 Padang. Of the many studies that have been conducted, *no* studies that focus specifically on the use of *Mind map* in improving activity and learning outcomes of students on course material General Biology. General biology is compulsory for new students FMIPA UNP, which was originally known in a group of subjects TPB (Preparatory Year Together), which originally numbered 24 credits followed for two semesters. Because there is a change of curriculum, now the total number of TPB is 14 credits. General biology is 4 SKS 'Based on the experience of researchers in the General Biology course there are still many students who do not understand the basic concepts in the material. Although learning strategy has been implemented, but the learning outcomes and student activity in the learning has not been satisfactory. General Biology study results obtained in July semester students in December 2013 A = 0% = 8.8% = A-, B + = 22.2%, B = 51.1%, B- = 17.7%, whereas in the first half July-December 2014 = A = 10.2% = 26.52% A-, B + = 34.34%, B = 20.4%, C + = 4.08%, C = 4.08% The results of the above study has shown an increase in the first half of July in December 2014

Assessment is one of the main elements in the learning process. Assessment serves as an evaluation tool to determine the success of the process and the results of student learning. According Sudjana [5], ability student learning outcomes are obtained after receiving their learning experiences. While the study results are presented Bloom in Anas [6] that the taxonomy of educational objectives that must always refer to the three types of domains exist in learners, namely the cognitive (thought processes), affective (attitude), and psychomotor (skills). These three domains were targeted in each evaluation. Cognitive domain is a domain that includes the brain activity associated with attention, attitude, respect, values,

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feelings and emotions. Psychomotor domains are domains related to skills (skills) or the ability to act after someone accepts a particular learning experience.

Assessment is an integrated part in learning activities that need to be implemented on an ongoing basis. Lecturer as a lecturer at the Universities usually gather information regarding the level of understanding of students through various means, such as discussions, asking questions, observing activities and student involvement in learning activities, assign tasks or give the test. Information obtained by the lecturers are very useful in evaluating the activity of teaching and learning outcomes. In other words, the need for a good appraisal system and planned that can collect all the information of the learning process. Accurate information about students' learning ability can be obtained through effective assessment and evaluation. One noted that the technique is widely used in schools is a *mind map*. *Mind map* have many advantages that researchers have conducted research into the use of *mind mapping* to increase the activity of learning and learning outcomes of students in general biology courses at the FMIPA UNP.

The purpose of this study is to investigate the use of *mind maps* and activity in improving student learning outcomes in general biology courses.

2. RESEARCH METHODS

This research method is descriptive method. This study describes the data obtained in the form of the value of the ability of students to make a *mind map*, learning activities, and the value of the quiz. Questionnaires and interviews. Samples are students of Chemistry regular education totaling 49 people who took a course General Biology.Teknik sampling is saturated samples (total sampling), that all the population sampled (Arikunto, [7]

The instrument used in the form of an assessment rubric to create a *mind map*, the format of learning activities, quizzes and interviews. Data were analyzed using descriptive qualitative data analysis techniques. The first analysis conducted on learning outcomes *mind map* created by students. Mind maps created by the students to use the rubric as follows:

Table 1. Assessment Criteria *Mind Map*

No	Item	Scale			Description
		1	2	3	
1.	General Structure				1. It has a central idea and Bois and branches are arranged radians, have 1-2 color combinations.
					2. It has a central idea, bois, the branches are arranged radians, pictures, and there are lines connecting between branches, having 5-6 or more combinations of colors
					3. Have a central idea, bois, branch composed radians, pictures, and there are lines connecting between branches, having 5-6 or more combinations of colors
2.	Idea Central				1. Located in the center, the position of "vertical / portrait", accompanied by images that are less supporting the central idea
					2. Located in the center, the position of "horizontal / landscape", accompanied by images that are less supportive central idea
					3. Located in the center, the position "horizontal / landscape", accompanied by images that support the central idea
3.	Outline				1. The lines Bois less continued to the central idea, not curved, not shrink to the tip
					2. Bois-line connected to the central idea, curved, not shrink to the tip
					3. The lines are connected to the central idea Bois, curved, narrowed to the end
4.	Line Branch				1. Less is connected to Bois, Bois equally thick line, not curved
					2. Connect to the Bois, thinner than lines Bois, not curved
					3. Connect Bois, Bois thinner than lines, curved
5.	Keywords				1. More than one word to a line, the line is not the same color, not shrink along the line
					2. One word to a line, the color is not the same as the color line, shrink along the line
					3. One word for one line, the same color with the color line, shrink along the line
6.	Image				1. Included on the central idea alone
					2. Included on the central idea and less than 50% of keywords
					3. Included in the idea central and more than 50% of keywords

Source: Adapted Mind Mapping Rubric from Ohassta (Ontario history and social sciences teachers, Association: 2004) and dimodidfikasi By Tim course General Biology FMIPA UNP [8]

ISBN 978-602-19877-3-5

Assessment results of the students' ability to make a *mind map* is calculated score is then assessed which obtained and interpreted in accordance with the criteria according to Arikunto [9] that's good (81-100%), Good (61-80%), Fair (41-60%), less (21-40%), less so) <21%).

The second analysis conducted on the student learning activities such as discussions, ask questions, ask questions, answer questions, seriousness, tasks, activity data processed in the form of a percentage. Then the percentage of student activities are categorized according to Purwanto [10] is very good (86% -100% 0, Good (76% -85%), Pretty (60% - 75%), less (55% -59%), so Less (<54%).

The third analysis that quiz, analyzed in accordance with the assessment criteria UNP [11] , the scores obtained are: Value A (85-100), A- (80-84), B + (76-79), B (70-75), C + (62-69), C (56-60), D (<55)

3. RESULTS AND DISCUSSION

The use of *mind mappin*g as an assessment tool in the process of learning not yet widely used, in this study that assessment was adopted from developed Ohasta, Assessment developed subsequently further developed by Tim Subjects FMPIA UNP general biology in 2012.

In this study, conducted on the cognitive abilities of students from the *mind map* created by students. The steps to create a mind map Buzan [1], are as follows: 1) Starting from the middle surface of the blank piece of paper that is placed in an elongated position by writing the central topic, usually crosshead and effort shaped image / picture. 2) Make a Basic Ordering Ideas-Bois, usually is the title of sub-chapters are created using SWH (What, Why, Where, When, and How). 3) Complete each Bois with branches that contain supporting data. 4) Connect the branches of the second and third levels at the first and second, and so on. 5) Use of color on the entire *mind map*. 6) Make a mind map branches curved rather than straight lines. 7) Use one keyword per line. 8) proceed with each branch with images, symbols, codes, lists or charts

Mind map created by student assessment by giving a score based on existing assessment rubric. In addition to getting the benefits of using a *mind map* in the learning process lecturers can deliver immediate value from the mind map made good student can produce good cognitive abilities. The ability of students to make a mind map.

Assessment ability of students to create a *mind map* done individu. The percentage of students' ability to make a *mind map* can be seen in the following table:

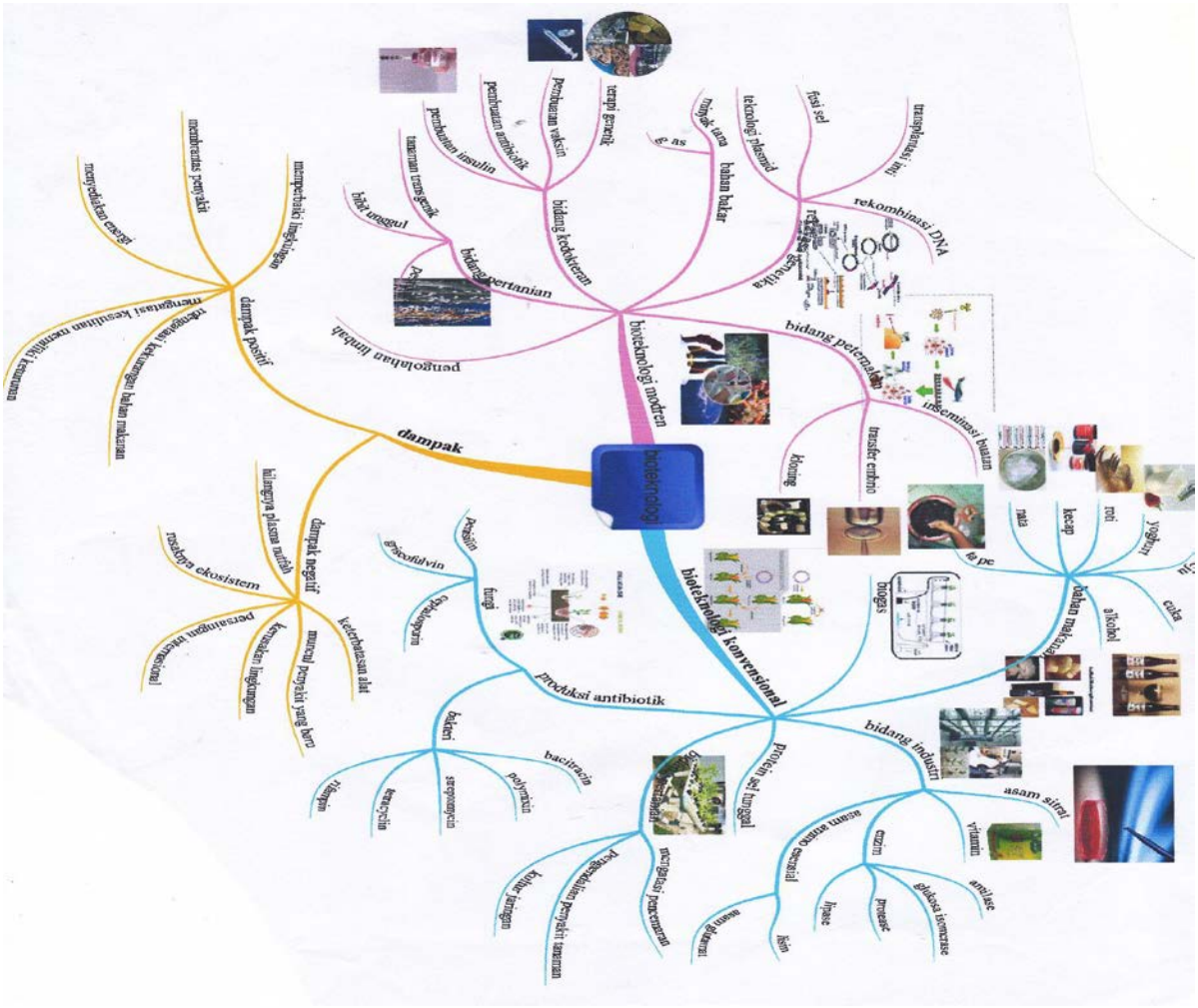
Table. 2. Percentage Value of *Mind Map* General Biology Course Chemistry Reguler Education Program 2014

No	Value (%)	Mind Map											
		1	2	3	4	5	6	7	8	9	10	11	12
		%	%	%	%	%	%	%	%	%	%	%	%
1.	(81-100) Very Good	4	40	40	40	42	36	38	34	38	40	44	66
2.	(61-80) Good	-	8	8	4	6	4	10	6	-	6	4	6
3.	(41-60) Self	-	6	8	8	8	4	10	4	10	12	2	12
4.	(21-40) Less	96	46	44	44	44	44	42	56	56	42	50	22
5.	(< 21) Less than once	-	-	-	-	-	-	-	-	-	-	-	-

Based on the table above, the majority of students have the ability splendidly in the amount of 40% based on interviews with some of the students at the beginning students have difficulty in obtaining example in applying the *mind map*, case according to the percentage obtained from early learning material until the end of learning materials (22% - 96%), where 22% of the initial manufacture of the *mind map* up to 96% the end of making the *mind map*. Still not satisfy the value of the *mind map* created by students of this is due to new students who are still in the transition to college, yet pernahnya students create a *mind map* on the previous education. The acquisition value of 12 events *mind map* given to students, the results are increasingly qualified in making a *mind map*, mind map-making that last increase (66%) very well. It should be understood that the necessary process of making the *mind map*, such as understanding the material, master program, placement senral idea, Bois lines, branch lines, keywords and images.

According Slameto [12] the student's attention focused on new things seen and observed. The new applied learning activities that attract the attention of students so most enthusiastic during proses`pembelajaran takes place that causes them motivated to keep learning. Based on observations during the learning process the student's attention focused from the beginning to the end of learning. Pembalajaran beginning of the process, the researchers explain the meaning and purpose of the *mind map* and how to create a *mind map* to display the *mind map* creation program. The program is accessible from Buzan. Most students pay attention to when explaining the material using a *mind map*. Siti Nurmala Sari research [13] Giving Home Before Cooperative Learning Task Group Type Investigatioan (GI) effect Positive Study Results Against Biology class X SMA N 8 Padang.

ISBN 978-602-19877-3-5



Ficture 1. Example *Mind Map* by student

The application of *mind map* of learning can develop the activity of thinking in all directions and process a variety of thoughts and symbols. In accordance with the opinion Buzan [1] that the *mind map* is the easiest way to enter information into the brain and to transform information from the brain. This method is a creative and effective way in making the remarks, so the *mind map* is said to completely map the mind.

Winda Novita Sari research [13] Development of biological worksheet nuanced contextual equipped with *mind map* on Archaebakteria and Eubacteria materials for high school students to stimulate student mindset unites left brain and right brain students. *Mind map* serves to make the subject matter appropriate visuals and graphics that can ultimately help to record, amplify attention, and recall information that has been learned.

Buzan in Mispawati [14] that the *mind map* is a *mind map* great for memory and provide ease of arranging all the facts and the ideas so that the workings of nature would not be involved from the beginning, this means that the effort to recall (remembering), and retract (recalling) information will be easier and faster than using a traditional recording dependable.

Table 3 Student Learning Activity

No	Activity	Activity		
		Early	Middle	Late
1.	Discuss	15	20	30
2.	Inquire	8	15	25
3.	Asking questions	22	50	90
4.	Answering questions	10	24	35
5.	The seriousness	20	33	46
6.	Working on duty	40	80	100

From the table above shows the activity of the students at the beginning activity not much, because the students still do not dare to reveal the questions as well as answer questions from his friends, so that discussions yet efekif. But at the meeting to two already starting to look a student realize that no one asked if they thought he lacked the courage according opinions, but the more intense meeting to discuss making students motivated to ask, feel less activity because not a lot of asking questions and answering questions

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Table 4: Values quiz Students

No.	Criteria	Quiz value (%) to			
		1	2	3	4
1.	(85-100) (A) With the compliments	0	2	12	66
2	(80-84) (A-) Excellent once	0	10	0	0
3.	(75-79)(B+) Very well	4	8	44	14
4.	(70-74)(B) Good	0	32	16	8
5.	(65-69)(B-) Pretty good	11	16	14	10
6.	(60-64)(C+) More than enough	24	10	0	0
7.	(56-59)(C) Enough	0	0	2	2
8.	(50- 54) (C-) Less enough	25	8	12	2
9.	(< 49) (D) Less	0	0	0	0

From the above data increased student quiz value, this is due to the frequency of the quiz, coupled with the creation of the *mind map*, so that students can prepare themselves to understand the material and quizzes given .

Table 5: Value Midterm and Final exams Student

No.	Criteria	Value	
		Midterm (%)	Final exam (%)
1.	(85-100) (A) With the compliments	0	32(65,28)
2	(80-84) (A-) Excellent once	3 (6,12)	9(18,36)
3.	(75-79) (B+) Very well	3 (6,12)	2(4,08)
4.	(70-74) (B) Good	15(30,6)	2(4,08)
5.	(65–69) (B-) Pretty good	13(26,52)	2(4,08)
6	(60-64) (C+) More than enough	5 (10,2)	1(2,04)
7	(55-59) (C) Enough	5 (10,2)	0
8	(50-54) (C-) Less enough	5 (10,2)	1(2,04)
9	(< 49) (D) Less	0	0

From the data in the table above the increase in the midterm to the final exams, percentage of quality to compliment the UTS nothing while the UAS as much as 32%. Quality value obtained is still there at UTS, while the UAS has decreased. It also impacts on the *mind map* created by students so that learning materials more controlled.

4. CONCLUSIONS

Based on the research results occur increased activity of learning, creation of mind maps, quizzes value and the value of UTS and UAS students.

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ISBN 978-602-19877-3-5

DEVELOPMENT OF AUTHENTIC CONCEPT MAP ASSESSMENT FOR LEARNING SUPPORT CONTEXTUAL TEACHING AND LEARNING (CTL) MODEL ON THE SUBJECT INVERTEBRATES TAXONOMY IN BIOLOGY DEPARTMENT FMIPA UNP

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ABSTRACT

Produced rubric and format (authentic assessment) to assess the product concept maps created by students to support learning model Contextual Teaching and Learning (CTL) in subjects Taxonomy of Invertebrate Biology Department, Faculty UNP. This type of research is the development of research (Research and Development). The research was conducted on subjects Taxonomy Invertebrate Biology Department, Faculty UNP. The research was conducted from August to October 2015. This study uses 4-D models (Four D Models). Authentic assessment device that was developed in this study is a rubric and assessment sheet product concept map to support learning model Contextual Teaching and Learning (CTL) in the course Taxonomy Invertebrate Biology Department, Faculty UNP. This research resulted in the rubric and format of authentic assessment to evaluate product concept maps created by students to support learning model Contextual Teaching and Learning (CTL). The value of its validity is 86.1% (very valid). Very practical with practicality value of 92% of the assessment team of lecturers course invertebrate taxonomy and very practical with practicality value of 89% of the assessment observer.

Index Terms— Authentic assessment, concept map, contextual teaching and learning, invertebrate taxonomy

1. INTRODUCTION

National education standards developed by the National Education Standards Agency (BNSP) contains a minimum of eight criteria on the education system in the whole territory of the Unitary Republic of Indonesia. One of these criteria is the standard educational assessment. The assessment process in education is to be done, because it is the minimum criteria developed by BNSP.

Assessment system in K-DIKTII use learning assessment standards in Permendikbud Number 49 Year 2014 Article 18, paragraph 1 is defined as the minimum criteria of the assessment process and the learning outcomes of students in order to reach the learning outcomes of graduates. Assessment processes and student learning outcomes include: principles of assessment; techniques and instruments; mechanisms and assessment procedures; the implementation of the assessment; assessment reporting; and graduation.

The principle of assessment include educational principles, authentic, objective, accountable, transparent and integrated manner. Learning assessment process in the Student Center Learning (SCL) is performed during the development process by looking at the results in some of the stages learning (Tim BELMAWA-Higher Education, 2014).

In this case the assessment process proposed and considered appropriate in teaching methods SCL is a model of assessment called Assessment of Performance (Authentic Assessment or Performance Assessment), the assessment consists of three basic activities are: lecturer giving the task, students shows their work, evaluate by certain indicators with instruments/ rubric. Authentic Assessment/ Performance Asssessment defined as "Assessment of the acquisition process, the application of knowledge and skills through a learning process that shows the ability of students in the process and produce the product".

Standards National Council of Teachers of Mathematics and the National Science Education Standards provide a vision assessment. One of the main forms of alternative assessment is authentic assessment. According to Maria Ruiz-Primo and Richard Shavelson (1996), assessment of performance has three important components: 1) a task which pose significant problems and require solutions that require the use of real material that reacts to actions taken students, 2) a composition student responses and 3) an assessment system that not only assess the correct answer but also the feasibility of the process that has been used to complete the task.

Lecturers should use to get the authentic assessment of learning outcomes as a whole which includes an assessment of the performance of learners during the learning process. Student learning outcomes information can be obtained by the test subjects, observations, notes and recording all behaviors or events experienced learners during the

ISBN 978-602-19877-3-5

learning process in the classroom on a regular and ongoing basis.

According to the team BELMAWA-Higher Education (2014), tend to assess the activity of the scoring / value to students than to provide guidance to unlock their potential. The main problem at the college this time is an instrument for the assessment tends to characterize the summative assessment of formative assessment. This may indicate that the lecturers of understanding in implementing good learning is still weak or lecturers less concerned about the learning achievements, strategies and teaching methods, as well as how a proper assessment.

During the learning process, one thing that must be done is an evaluation. Evaluation is very important because it can provide information about the success of education. Results of the evaluation has been done through a written test at the end of the learning process is used as a reference for determining the success or the achievements of learners. Whereas the information obtained from these tests have not been able to explain the actual learning outcomes of students.

Invertebrates Taxonomy course discusses the diversity of invertebrates with classification. In conducting the classification, there are two activities carried out in advance, that is to know the characteristics of animals to be classified and determine the credentials that must be done correctly. So with this activity, students can arrange invertebrates into a hierarchy of levels taxon composition class, order, family, genus and species that are systematically and to know there is a genetic relationship between the invertebrate animals. At this learning was also discussed about the role of invertebrate animals either beneficial or detrimental.

Taxonomy course also use laboratory practic. Subagja (2006) said that our environtment among us can used as a laboratory, so textual courses can change be contextual course. In addition, Johnson (2010) also state that contextual teaching and learning help the student to find their own knowledge by make a realtion between academic material and their own life. Student makes important realtions that resulting porpose by doing management course by their self, work together, critically thinking and creative, give appreciate to others, reach high standards, and take a role in many task of authentic assessment.

There is one problem in practic proccess of invertebrate taxonomy at Biology Department FMIPA UNP, learning was not effective. This situation was caused by weak understanding level of students. To solve that problem, students give homework to make concept map appropriate with material. Hopely the learning become more effective.

Constructivism theory is one of the contextual teaching learning theoritical base. Trianto (2011) state that Vigotsky was said concept study will be best when that concept stay closely by student's zone of proximal development. Closely development level of college students nowadays is first knowledge level or prerequisite knowledge that have control over by them, such as student's ability to make concept map before practic, so very possible meaning course will be happen.

Novak and Gowin (1985) state concept map is a tool or a method that can be used by teacher to knowing what student's know. Novak's idea based on Ausabel learning theory. Ausabel push the teacher to know their student's concept before course so that meaning learn cab be done.

Meaning learn need serious effort by students to connecting new knowledge with relevan concept that they really have. To expedite that proccess, both teacher and student need to know "first knowledge place". In other word, teacher should know the student's concept, whereas students can shows where they been, or what concept that they have to achieve new knowledge.

There are two learn dimension based on Ausubel and Willis Dahar theory (1988), first, achieve or found dimension and second, meaning dimension. Meaning course depends on cognitive structures, readiness from the students to get success.

Based on steps that we choosed to solve the problem, students was asked to make concept map. This matter have concequention make column and format to assess student's product, so researcher have been done a research about development authentic concept map assessment to support contextual teaching and learning model at Invertebrate Taxonomy course in Biology Department FMIPA UNP.

2. METHODOLOGY

This reasearch is developmental research. Trianto (2010) has defined research and development are series process and steps to develop a new product or to complete old products so it will be responsible. This research was happened on Agustus until Oktober 2015 in Invertebrate Taxonomy course of Biology Department.

The subjects from this research are (1) three experts in certain field to validate assessment column of concept map to support contextual teaching and learning model, (2) two lecturer from Invertebrate Taxonomy team and (3) three observers from course assistant. This research use 4-D development model that advised by Sivasailam Thiagarajan, Dorothy S. Semmel and Melvyn I. Semmel (1974). There are four phases in 4-D model, that are define, design, develop and desseminate.

Data type is primer data that have colected by researcher directly from the source. First data is skor from validator, and the second is skor from lecturer and observer who did practicality test by checking the validity sheet and practicality sheet. Data analysis

ISBN 978-602-19877-3-5

technique by descriptive analysis, started by scoring for each item by using Likert Scale, 1 – 4 (very agree, agree, disagree, very disagree).

3. RESULT ANG DISCUSSION

Define phase is the phase to determine and define the conditions of learning. At this stage, the front end analysis, analysis of student, task analysis, analysis of the concept and formulation of learning objectives. At the front end of the analysis phase, researchers determine the problems encountered and alternative solutions. Problems found were lecturers should use the way to get the authentic assessment of learning outcomes as a whole which includes an assessment of the performance of learners during the learning process, the main problem at the college today is an instrument to assess likely to characterize the summative assessment of formative assessment. The test results are used as a reference to assess the achievements of learners. Though the information is not yet able to explain the actual learning outcomes of students. To overcome this problem, there are ways to get the authentic assessment of learning outcomes as a whole which includes an assessment of the performance of learners during the learning process. Student learning outcomes information obtained by the test subjects, observations, notes and recording all behaviors or events experienced learners during the learning process in the classroom regularly and continuously.

At this stage of the analysis of students, researchers analyzed the characteristics of students in accordance with the design concept map-making tasks. From the aspect of cognitive development, students occupy the formal operational stage which is the last period in Piaget's theory of cognitive development. Characteristics of this stage is to have the ability to think abstractly, reason logically, and draw conclusions from the available information. At this stage it could be given the task of creating concept maps.

On the stage concept analysis, researchers identified the key concepts taught. This material discusses the diversity of invertebrate animals by way of classification. In conducting the classification, there are two activities are implemented first is to know the characteristics of animals to be classified and determine his identity. This activity should be done precisely. Task analysis phase, students are given the task of creating a concept map before practicum implemented.

In the analysis phase the goal, we propose learning objectives to be achieved. The learning objectives are students able to arrange invertebrates into a hierarchy of levels taxon composition class, order, family, genus and species that are systematically and to know there is a genetic relationship between the invertebrate animals. This material also discusses the role of invertebrates, both beneficial and detrimental.

At the design stage, the researchers designed a rubric and assessment sheets to assess a product that is a concept map. The steps are (1) the preparation of aspects assessed in accordance with the learning objectives to be achieved, (2) determine the criteria for assessment in accordance with the level of achievement of the aspects assessed. media selection according to the material characteristics and learning objectives, and (3) make an assessment based on the assessment rubric sheet.

The development stage is the stage to produce a product that is done in two steps, namely: (1) expert assessment followed by a revision, (2) test development. The purpose of this development stage is to produce the final form after going through a learning device revision based on the input of experts and data specialists test results. In this study only carried out expert validation step. According to Thiagarajan, et al (1974: 8), "the expert appraisal is a technique for Obtaining suggestions for the improvement of the material." The assessment of the experts of the learning device includes: format, language, illustrations and content. Based on input from experts, learning materials revised to make it more precise, easy to use, and has a high technical quality.

Sheet validity test is validated in advance by experts before being used and obtained a valid category with revisions. At this first validation, due to the validation of the first questionnaire, there are still shortcomings that need to be repaired two items and the items removed. Then validated questionnaire II. Validation of the results of the questionnaire obtained a valid category without revision.

Once validated questionnaire, then test the validity of the rubric and assessment sheet by three expert evaluation and zoology namely Prof. Lufri, M.S., Fitri Arsih, S.Si., M.Pd., and Dr. Ramadan Sumarmin, M.Sc. Validity test results rubric revision on points 3 and 4. In the first validation of revisions II followed by validation with the validation results of 86.1%. These results fit into the category of very valid. Rubric and format of the resulting assessment, it is valid in terms of construct, content and language, meaning rubric and assessment format is very feasible for use in assessing product CTL-based concept maps created by the students.

After validation of the second, then tested the practicalities of the rubric and assessment sheet by two lecturers teams Taxonomic Invertebrates course, they are Dr. Abdul Razak, M.Sc. and Drs. Ardi, M.Sc. and three observers, namely the Holy Aulia Putri, S.Pd., Nofri Zayani, S.Si., Fera Supia Mapiana.

The test results practicalities of lecturers is 92%, with very practical category. While the test results of the practicalities of the observer is worth 86%, with very practical category. Rubric and assessment sheets

ISBN 978-602-19877-3-5

produced is very practical in terms of benefits, timing, interpretation and equivalence.

4. SUMMARY

Based on the results, it can be concluded that have been produced in the form of authentic assessment rubric and format of the assessment concept map products to support learning model CTL very valid by the validity of 86.1% and very practical with practicality value of 92% of lecturers and very practical assessment with 89% of the value practicality observer assessment.

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ISBN 978-602-19877-3-5

ANALYZING OF NATURAL SCIENCE TEACHER UNDERSTANDING AT PADANG CITY ABOUT SCIENCE LITERACY, PROBLEM SOLVING AND SCIENTIFIC APPROACH

Heffi Alberida

ABSTRACT

The result of TIMSS and PISA explained that science literacy of Indonesian student is low. One of the factors is influenced by the teacher. Science literacy must have with students as a skill to prepare the attract the future challenges. The skill could be increase by learning process with problem solving approarches and scientific approach. Teacher has a main role in learning process, that is why teacher should understand about science literacy, problem solving and scientific approach in order to improves the skill of student. This research has a goal to know about understanding of teacher with science literacy, problem solving and scientific approach. This is a descriptive research. Population and sample is a teacher who had joined in Curriculum 2013 coaching at 22-26 June 2014. Sampling techniques is total sampling. Data was collected by using a questionnaire which conclude of 40 items. Thus data would analyze by count the percentage. Result of this research told that an average percentage of Science Teacher of Junior High School (SMP) in Padang about understanding literacy (60%). Understanding about connection between problem solving (62%) and understanding about scientific approach is 75%. Understanding about connection between problem solving and science literacy (77%), connection between problem solving and scientific approach (58%) and connection between science literacy, problem solving and scientific approach (85%).

Index Terms---Science literacy; Problem Solving; Scientific Approach

1. INTRODUCTION

Science literacy is the ability of student to apply the knowledge the have gained through the process of learning Natural Science[1] which is not only focused on products as a knowledge, but also Natural Science as a process and attitude[2]. Science literacy can be improved through a learning process with the guidance of teachers.

The teacher's role is very central because the teacher is the most influential factor in improving the quality of education[3]. The learning process is very dependent on the teacher, because the teacher is someone who organize the content, learning resource and manage the learning process[4]. Teachers should facilitate the implementation of Natural Science as a product, process and attitude in learning process.

TIMSS and PISA result suggested that the quality of education in Indonesia is low as a indicated by the low ability of students science literacy. Students science literacy can be enhanced through learning that supports Natural Science as a process that leads to the science process skills.

One of skill in the Natural Science process is problem solving ability. This relates to the ability to apply the skills of Natural Science in daily life (life skill). The characteristic of problem solving is a follows: 1) Student work individually or in small groups, 2) Task that must be solved is realistic problem, 3) Students use a variety of approaches, 4) Solution of problem was discussed together[5].

Main aim of problem solving is to develop forward thingking ability, especially the ability to find a causal and purpose of a problem and provide the knowledge and practical skills that are useful for daily life.

The scientific approach accommodate learning process in Natural Science not only as product but also science process. The scientific approach include process skill such as observing, classifying, measuring, predicting, explaining and concluded[6]. Teacher activity in learning process the based on scientific approach is as follows.

a. provide learning resources,
b. encourage student to interact with learning resources (assignment),
c. asking question in order to make student think about results,
d. monitored the perception and way thinking of student and also provide scaffolding,
e. encourage student to make a dialogues or share their idea,
f. confirmed the understanding of student, and
g. encourage student to make a reflection of their experience[7].

The essence of the scientific approach in the use of learning refers to perception that the learning process can be matched with the scientific process. Natural Science as a process can be also generated through a scientific procedure as known as scientific method.

Students science literacy skills can be improved through learning-based problem solving and scientific approach. The learning process is very dependent on the teachers. That is why science literacy, problem

ISBN 978-602-19877-3-5

solving and scientific approach should be understood by teacher.

This study aims to determine the understanding of teachers in Junior High School degree in the city of Padang on science literacy, problem solving and a scientific approach.

2. RESEARCH METHOD

This research is descriptive study. This study aimed to describe the understanding of science teacher of junior high school science literacy, problem solving, and scientific approach. The population of this study was teachers at the junior high school science subject in Padang who attended training of implementation of Curriculum 2013, which was held on 22 to 26 June 2014 at several schools in Padang, amounting to 97 people. Sampling technique is total sampling. Instruments research is a questionnaire. The questionnaire consists of 40 items. The data obtained is the primary data . Data obtained from the processing of questionnaires. The data is processed by finding the percentage of each aspect studied. The percentage obtained by the following formula.

$$P = \frac{n}{N} x\ 100$$

Explanation:

P = Percentage figure to be obtained
n = scores in each category
N = total score
100 = constants

The percentages are converted into certain criteria. Criteria percentage value is used as follows:

0 x = Poor
25< x ≤50 = Fair
50< x ≤75 = Good
75< x ≤100 = Very Good

3. RESULT AND DISCUSSION

3.1. Result of research

Based on the study of science teachers in Padang who have followed an implementation training of Curriculum 2013, obtained data on teachers understanding of the science literacy, problem solving and scientific approach.

3.1.1. understanding of science literacy teachers

Table 1. Result of analyze understanding of teachers to science literacy

No	Aspect	%	Category
1.	Learning purpose of Natural Science	82	Very Good
2.	Understanding of science literacy	79	Very Good
3.	Science literacy coverage	41	Fair
4.	Way in measuring science literacy of student	60	Good
5.	Things related to science literacy	36	Fair
6.	Concept of science literacy	47	Fair
7.	Process capability in science literacy	74	Good
8.	Importance of science literacy	52	Good
9.	Statements about the problems associated with a given science literacy	69	Good
Average		60	Good

Based on Table 1. It is known that, in the lowest aspect of science literacy are found in things related to science literacy, science literacy coverage, the concept of science literacy and the importance of science literacy.

3.1.2. Understanding of teacher to problem solving

Table 2.Result of analyze understanding of Teachers to problem solving

No	Aspect	%	Category
1.	Concept of problem solving	63	Good
2.	Aim of problem solving	76	Very Good
3.	Phase of problem solving	35	Fair
4.	Role of teacher in problem solving	41	Fair
5.	Method which is compatible with problem solving	66	Good
6.	Characteristic of problem solving	66	Good
7.	The appropriate question with problem solving	83	Very Good
8.	Correlation between problem solving with Curriculum 2013	91	Very Good
Average		62	Good

3.1.3. Understanding of teachers to scientific approach

Table 3. Result of analyze understanding of to scientific approach

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No	Aspect	%	Category
1.	Concept of scientific approach	68	Good
2.	Describe of scientific approach	75	Good
3.	Implementation of scientific approach to learning	75	Good
4.	Component of scientific approach	78	Very Good
5.	Learning method in accordance with the scientific approach	75	Good
6.	Aim of experiment activity in scientific approach	78	Very Good
7.	Observing stage activity scientific approach	80	Very Good
Average		75	Good

3.1.4. Understanding of teachers to linking between science literacy, problem solving and scientific approach

a. Link between science literacy and problem solving

Result of analyze to link between science literacy and problem solving presented in Table 4.

Table 4. Result of analyze to link between science literacy and problem solving

No	Aspect	%	Category
1.	Appropriate learning process to increase the ability of student science literacy	56	Good
2.	Linking problem solving with science literacy	89	Very Good
Average		77	Very Good

b. Understanding of teachers to linking between problem solving and scientific approach

Result of analyze to link between problem solving and scientific approach presented in Table 5.

Table 5.Result of analyze understanding of teachers to link between problem solving and scientific approach

No	Aspect	%	Category
1.	Link between problem solving and scientific approach	58	Good
2.	The ways to apply problem solving in learning which is using scientific approach	73	Good
Average		58	Good

c. Understanding of teacher to linking between science literacy, problem solving and scientific approach

As known as that percentage average of understanding of teacher to linking between science literacy, problem solving and scientific approach is about 85% which category very good.

3.2. Discussion

3.2.1. Science Literacy

In general understanding of science teachers of Padang on science literacy has been good, this seen in Table 1 where the average percentage of teachers understanding of the science literacy is 60% with good category.

If viewed on any aspect of study in science literacy, it is known that the understanding of teachers on aspect related matters of science literacy is till low (36%). It is clear that there are many teachers who do not know TIMSS and PISA as an international organization that test student' science literacy TIMSS is international organization that test math and science literacy skills of junior high school student while PISA is an international organization that literacy skills of reading, math and science high school student aged 15[8].

The understanding of teacher on aspects coverage of science literacy is still low (41%) and the concept of science literacy is also low (47%). An understanding of the scope of science literacy has to do with the understanding of the concept of science literacy. Teacher is said to understand the scope of science literacy if teachers know about the concept of science literacy well.

Science literacy was conceptualized as "*the capacity to* use *scientific knowledge, to identify question and to draw evidence-based conclusion in order to understand and help make decisions about the natural world and the changes made it through human activity*". Science literacy is defined as the human capacity to use their knowledge, ability to solve problems and to draw conclusion based on the evidence to assist in understanding the changes in nature associated with human activity. Based on the concept of science literacy in mind that coverage was not only about the ability to use the knowledge, to understand the natural phenomena but also the ability to apply scientific concept in everyday life, the ability to identify problems, and the ability to draw conclusion based on facts.

The low percentage of teachers understanding of the matters related to the science literacy, science literacy concept and its coverage because there are many teachers who think that science literacy is not important for students. Science literacy is important to be processed by the students because of the ability of students in mastering science is closely related to the

ISBN 978-602-19877-3-5

development of technology and science which is more rapidly each time[7]. Students should be able to apply the science they have learned in everyday life in order to solve problems that occur around them. The ability of science literacy is very important for students because the essential purpose of science teaching at primary school is to make the students have the literacy skill of science, namely the ability to apply their knowledge in order to solve everyday problems. The ability of students science literacy will increase if teacher understand well the concept of science literacy. Teacher should understand that train student with science literacy is important.

Another aspect of science literacy that is teachers have a good understanding as evidenced by a good understanding of the percentage criteria. It state that, train students science literacy skill. However, this has not been realized by the teacher.

3.2.2. Problem solving

Overall, the understanding of science teacher of Junior High School in Padang about problem solving has been good. This can be seen in Table 2. Based on the data in the table, are known to the lowest percentage in the aspect of problem solving stages. Teachers understanding of the stages of problem solving is low, indicating that the teacher has not been able to carry out learning using problem solving approach is good and right. Stages of problem solving, such as:

a. identification of the problem,
b. definition,
c. collection of data,
d. interpretation of data,
e. conclusion,
f. application, and
g. evaluation[9].

These stage should be well understood by teachers in order to improved students ability to solve problems. Problem solving is one approach to learning that can be trained on students to improve science literacy and making the student have the ability to think critically. The best way to learn science is through the provision of a challenging problem, evocative of thinking and action related to the problem solving[10].

Another aspect that received the lowest percentage is the role of teacher in problem solving. Based on that statement, it is known there are many teachers who do not understand their role in the implementation of problem solving based learning. In the process of learning problem solving, teachers act as a motivator, facilitator and director.

On other aspect in mind that teachers have a good understanding of how to provide question for train the problem solving of students, know to purpose of problem solving and understanding the learning methods related to problem solving.

3.2.3. Scientific approach

Teachers understanding of the scientific approach overall has been very good as shown in Table 3. When viewed under the aspect tested, based on table 3. The obtained data vary. The lowest percentage of value contained in that aspect of the concept of scientific approach. A scientific approach to learning that emphasizes providing direct experience through observation, experimentation or other processes can make the student build their own knowledge through observing, classifying, predicting, designing, carrying out experiments to communicate their knowledge to other using thinking skill, and use scientific attitudes as curious, careful, objective and honest.

Other aspect were also obtained a lower percentage is teacher understanding about what teaching methods are suitable for use in scientific approach. The purpose of scientific approach is similar to the learning objectives based on the problem or problem solving[11]. Kemendikbud through Curriculum 2013 recommends discovery learning and problem based learning as a learning model that fits the scientific approach. The scientific approach should be understood by teachers with very good because it is the main device used in the learning Curriculum 2013.

3.2.4. Link between science literacy, problem solving and scientific approach

Based on the data in Table 4., Table 5. and Table 6., is known that teachers have good understanding or the relationship between science literacy, problem solving and scientific approach. Science literacy and problem solving related as to improved science literacy of students can be achieved through the use of learning problem solving. Learning by facilitating problem students to apply their knowledge.

The link between the scientific approach to problem solving is at the stage of “identifying problems” on problem solving and stage “ask” the scientific approach. At this stage, the students are trying to identify the problem through the questions.

Science literacy is the ability to be processed by students, in the form of the ability to apply their knowledge. Problem solving is the of students to solve problems, while the scientific approach is an effort that can be taken to solve the problem so that when the student have been accustomed to train themselves to solve the problem of the ability of its science literacy will also increase.

In this study, found several problems among some teachers who did not answer all question the item, do not fill the items that reason asked for an explanation why. This is probably due to the lack of clear instructions questionnaire to be understood by the teacher.

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4. CONCLUSION

Based on the research that has been done can be concluded as follows.

a. Understanding junior high school science teacher of Padang on aspect of science literacy is at a good criterion (70%), junior high school science teachers understanding of Padang on aspect of problem solving is in good criterion (66%), and junior high school science teachers understanding of Padang on aspect scientific approach criteria that are in very good (64%).
b. The link between science literacy and problem solving are the criteria very well (85%), the link between problem solving and scientific approach are the good criteria (46%), and the link between science literacy, problem solving and scientific approach to the percentage of teachers are at the criteria very well (86%).

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ISBN 978-602-19877-3-5

DEVELOPMENT MODEL BASED LEARNING CONCEPT, MODELING METHOD AND DRILL FOR COURSE METHODOLOGY RESEARCH

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ABSTRACT

The aim of this research is to produces models for quality learning courses in Research Methodology, with the criteria validness and practical. In addition, this study also produced supporting products subjects, which include: (a) textbooks, (b) worksheet Students (c) an evaluation tool, and (d) a questionnaire about the perception, interests and attitudes. The method which used is R & D. Steps taken to achieve this goal are: (1) analyze the characteristics of the material subject Research Methodology in depth and relating it with approaches, methods and learning model that used today, as well as the orientation of the curriculum current, and set syntax learning model that is considered to be in accordance with the material characteristics of Research Methodology, (2) developing an appropriate textbook learning model (3) developing the Student Worksheet, (4) developing evaluation tools, (5) developing a questionnaire on perceptions, interests and attitudes of students towards learning. All of the products which produced from this study validated through testing expert (expert validity), and test of the practicalities of the products by colleagues students. Then, all of them improved products based on suggestions and inputs from validator. The data were analyzed descriptively. Based on the research that has been done, it has generated model of learning by supporting a very valid product and worksheets for students with very practical criteria.

Index Terms---learning model based concepts, modeling, drill method, research methodology

1. INTRODUCTION

Demands on improving the quality of higher education from various parties are always to the fore in various media and various forums educational meetings. The various parties implementing higher education has done a serious endeavor to meet these demands. One aspect that is closely linked to the quality of education and studied is the problem of students' final assignment, especially concerning about the quality and length of his solution.

The Results of a preliminary study that the researchers did with 10 of student thesis of bachelor program in Biology Education who graduated last three years, the general found some drawbacks include: the background is less sharp or less supported by the facts, identification of problems that seem fabricated or appear suddenly, the formulation is not in sync with the title and objectives, definitions of terms that are not operational, there is the study of the theory that are not relevant to the variation of buzzer research, conceptual framework that has not been show the linkage variables with each other variables, some paragraphs have not been complied with or not clear main ideas, most components of the method that has not been detailed and clear, some chapters results of research that has not been synchronized with the data needed to test the hypothesis, the tables appear suddenly, the tables were not commented upon, the discussion of which has not argumentatively with the conclusions are less in sync with the aim and hypotheses.

The relatively low ability students to understanding the concepts of this research methodology, often revealed when they follow a comprehensive examination (examination thesis). When the examiner asks about the basic concepts of research methodology, such as assumptions, hypotheses, operational definition, a conceptual framework, population, sample, sampling techniques, validity, reliability, significance, often they can not explain exactly.

The facts disclosed above, is certainly not the fault of the students alone, but there are other factors. Among other factors that are as yet appropriate teaching methods, guidance thesis that is not optimal, the training of student who has not been optimal, including difficulties students to find the model components of thesis an ideal that can be emulated.

Understanding of concepts are essential components in the learning process. This allows the students easily to understand the material and help their memory of the subject (UNESCO, 1986). A concept usually do not stand alone, but rather related to other concepts. The relationship between one concept and another concept that can be described with a concept map. In connection with this, the study

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based concept would be meaningless if the use of concept maps. Dahar (1988) states that the concept serves the students how to learn, to investigate what was known to the students, reveal misconceptions and evaluation tools.

Novrianto (2000) reports that the student achievement using the strategies taught by the student concept maps significantly better than student achievement that is taught without the use of concept maps. And also learning outcomes of students taught using concept maps educators is better as significantly than learning outcomes are taught without the use of concept maps. In line with this, Novak, Gowin & Johansen (1983) in Esiobu and Soyibo (1995) also found that the students who received instruction to made the concept maps can enhance meaningful learning. This is according to Jonassen (1996) in Dabbagh (1998), its happened because the strategy in making the concept maps can force students to think about the realm of content (content domain) in order to get to know and to test the important concepts, classifying these concepts, describes the relationship between the concepts and assess its significance, analyzing the nature of the relationship and create links or connections that use a lot of critical thinking, Murray, et al (1991) states that critical thinking in learning a conceptualization ability to think logically in analyzing, the synthesis and evaluation of reference to solve problems.

According to Gagne (1985) in Dwiyogo (1997) when a person learns based on the concept, it requires a combination of all the relevant concepts and principles and control the process of thinking. Based on Bloom's taxonomy, Blosser (1988) states that usually when the educators implement the method in understanding the concept of the learners, they anticipate that students become involved with the operation of thinking in the form of analysis, synthesis, and evaluation or is said to be thinking skills high level (higher-level thinking skills). It is very important to be developed to understand the concepts in learning Research Methodology.

Joyce et al. (1992, 2011) found a pattern of learning for educators is very important to use modeling. This modeling strategy is very good, because the prospective student of the teachers can imitate or emulate existing models. However, it is important to note how to create a good model or appropriate for the material and under certain conditions. This is the real work of educators, namely designing ideal learning model. Modelling have the meaning that educators use the model or simulate a model that has been designed in learning. Simulating models (modeling) helps the learners to understand a concept, in the form of objects, ideas, processes, and events. Modeling can also help overcome the problem of misconceptions. In this regard, the one strategy that fits subjects developed in Research Methodology is modeling. By the modeling drilled (drill) of Research Methodology in learning, it is expected that the students are able to understand the basic concepts in this course and realize the quality in the final work. Sudjana (2002) explains that exercise is not only reasonable use for things that are motor skills, such as writing, games, manufacture, but also to train mental skills, practice relationship, responses, and so on. Nevertheless, one of the principles that need to be considered in using this drill is the learners should be given insight before held drills.

Based on the facts which stated above, reinforced by a series of discussions within the team subject in Research Methodology, there are the idea to try and to find its solution. Therefore, to improve the ability of students to understand the concept of research methodology and writing thesis proposal, need to be developed based on the concept of learning model, modeling and drill method.

RESEARCH METHODS

This research is development research. The development method which used is a combination and modification of Borg and Gall (1983); Fenrich (1997); and Degeng (2000) in Asim (2001); Lufri (2005, 2007) as follows: (1) identification and determination of the problem, (2) the selection of products, (3) study of literature, (4) planning, (5) Preparation of product development, (6) the preparation and revision of testing in the field, (7) in the field of test and revision of products, (8) field implementation and revision of the product, and (9) dissemination. This research was carried out until the stage of field trials and product of revision. The products (devices) are the main developed (1) syntax learning model, (2) Textbooks Research Methodology, (3) The problem based on student activities (4) evaluation tools of learning outcomes and (5) Questionnaire on the perceptions, interests and attitudes of students in learning research methodologies.

The product of this research is validated by five people validator (three expert in the field of study, one expert in technology learning and a skilled Indonesian). Meanwhile, as the subject which tested in this study (for the implementation of learning models) are 23 students of Biology Education who took Research Methodology course in the second semester of the course year 201 4/2015.

The data in this study are primary data which obtained through the questionnaire, to obtain the data model and the validity of the device, from the validator and the practicality of the test subject. Questionnaire perceptions, interests and attitudes, as well as expert assessment sheets and colleagues to assess validity learning devices (overall product research), and questionnaires practicalities of products, in particular problem-based student activity

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sheet, made in the form Lingkert scale with 5 scale (1, 2, 3, 4 and 5). All of the tools were developed based on the lattice, then validated by the validator. The data analysis technique which used is descriptive statistics.

RESULTS AND DISCUSSION

Under the stages of research that has been done, then the outcome of this research is in the form of a model along the device may study subjects research methodology. The products that have been produced, it's been validated by experts who have been determined. The products that have been produced are: (a) syntax learning model, (b) textbooks, (c) the Student Worksheet, (d) an evaluation tool, and (e) a questionnaire on perceptions, interests and attitudes.

The syntax description of learning model that has been developed for the course Research Methodology, presented in Table 1.

Table 1. Description Syntax Learning Model that Developed for courses Advanced Research Methodology

Syntax	Description
Phase 1. Giving insight (first two weeks)	Lecturer gives an insight in the overall scope of the basic concepts and methodology research, split the group, and provide teaching materials and problem solving, delivering learning scenarios. The learning model which used is Jigsaw modified.
Phase 2. Preparation of the expert group	The expert group work / discussions about the given problem and make a Power Point media outside school hours / at home or at the library
Phase 3. Discussions in the origin group	Each member of the group expert are joining with origin group members, and 15 minutes discussions in the group home, then explaining to his/her friends about the problems that has been completed in each of the expert group (started in the early hours of meetings to 3).
Phase 4. Presentation of the expert group.	The representatives of the experts presented the result of discussion group of experts (in the form of media Power Point) 7-10 minutes.
Phase 5. Responses presentation of the expert group.	Responses with the presentation of the expert group (observers noted, when the experts group appear with odd numbered addressed by expert groups of the even numbered and vice versa (as primary responders), after that which the free response / personal.
Phase 6. Confirmation lecturer	Lecturer gives affirmation to the presentation and confirmation of the expert group response of students presentation
Phase 7. Determination of the title essay of students	Students set the title of thesis proposal, then discussed in the classroom with peers and faculty adviser for advice.
Phase 8. Writing students thesis proposal	Student write a thesis proposal (as a product of lectures), guided and the proposal was assessed by lecturer.

All the products of this research before assessed by experts, in advance of the research team assessed internally. Next, all of these products are supplied to the validator experts has been appointed to be corrected, criticized and evaluated and given the feedback. The experts that have been defined are Dr. Azwir Anhar, M.Sc., Dr. Abdul Razak, M.Sc., Dr. Ramadan Sumarmin, M.Sc., Prof. Dr. Agustina, M. Hum., Dr. Ramalis Judge, M.Pd.

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The results of experts validation, about the products that have been produced, are presented in Table 2

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Table 2. The Results of Summary of Expert Learning Tool Research Methodology.

No.	Product	Value of Validator						Meaning	Category
		I	II	III	IV	V	â '		
1	Syntax Learning Model	4.78	4:44	4:06	4.75	4.78	22.81	4:56	A
2	Textbook	4:48	4:48	4:08	4:40	4.77	22:21	4:44	A
3	Worksheet of students	4.78	4:44	4:22	4.60	4.77	22.81	4:56	A
4	Evaluation Tool (Test of Learning Outcomes)	4.71	4:29	4:00	-	4.71	17.71	4:42	A
5	Questionnaire (Perception, Interest and Attitude)	4.71	4:29	4:29	-	4.86	18:15	4:54	A
	Amount	23:46	21.94	20.65	13.75	23.89		22:52	
	The mean	4.69	4:39	4:13	4:58	4.78		4:50	A
	Category	A	A	A	A	A	A	A	

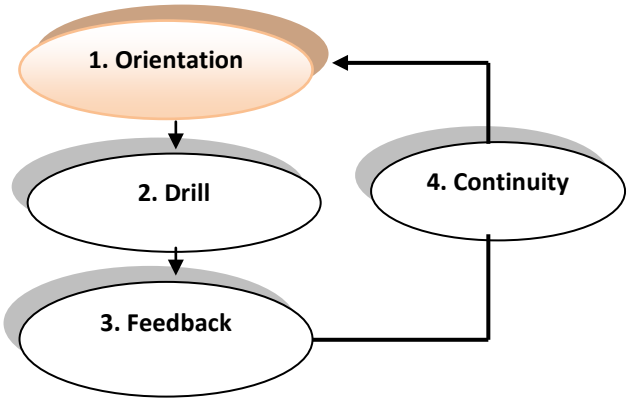
Note: 1. Validator (Expert) Â **I.** Dr. Azwir Anhar, M.Sc., **II.** Dr. Abdul Razak, M.Sc., **III.** Dr. Ramadan Sumarmin, M.Sc., **IV.** Prof. Dr. Agustina, M. Hum. And **V.** Dr. Ramalis Judge, M.Pd.

2. Category Assessment, **A** 4.1 - 5.0 (Very Good), **B** 3.1 - 4.0 (Good), **C** 2.1 - 3.0 (Enough), **D** 1.1 - 2.0 (Less) and **E** <1.1 (Very Less).

Under the stages of research that has been done, it has produced a model of learning courses along with the research methodology. The learning model is generated referring to the theoretical model developed by Joyce and Showers (1992), which has four characteristics, namely the presence of: (1) measures of learning (syntax), (2) social system , (3) the principle of reaction , and (4) supporting system . Furthermore, with regard to the models, Joyce and Showers (1992) stated that the educator very is need to improve the modeling which is adapted to the conditions of learners and the characteristics of the material. This modeling strategy is very good, because educators can imitate or emulate existing models. However, an important note is how to create a good model or appropriate for the material and under certain conditions.

The results showed that the quality of the research product as a whole according to the validator (experts) category is very good (A), both in the terms of experts who assess or review of the types of products which is produced. This means that the products developed have been very valid, both in terms of didactic related to the feasibility of the contents, terms of construction associated with the use of language, sentence structure, vocabulary, level of difficulty, and clarity appropriate in the sense understood by the students, and the technical requirements and the language associated with the language, presentation , as well as graphic aspects. However, for the evaluation tools and questionnaires are not rated by an expert of Indonesian, allegedly because it does not find an item which relating to the language of the product. This is understandable, because these devices have long prepared, and has also been tested in preliminary studies in the course of Research Methodology and also has done most of the draft revision of the product. The validation results are very reliable, because the judge is the expert in accordance with the field (research methodology expert, education expert biologists, technologists and expert learning in Indonesian language).

All of the products which produced in this study is a learning model that is complete enough and valuable to a learning process and in accordance with the educational theory Gal'Perin. According to the theory of education Gal'Perin, learning process can be described as a series of four stages, namely: (1) Students are oriented towards the elements that are important science, including the ways of reasoning that is typical for the discipline. (2) Students practice performing activities has reasoned through relationship between one object or activity to another. (3) Students gain awareness of learning results (feedback) has been achieved. (4) Students continue the learning process by means of orientation. Gal'Perin theory about this learning process can be described as Figure 1:



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Since the early theory of galPerin, Utomo and Ruijter (1985) states that while the students are expected to master the theory described, the more so if they have to mastering the material which are given, and especially if they have to be able to apply the theory it is necessary to exercise or necessary to apply the method drill (exercise) in learning. The exercise will work better if accompanied by the student in the learning process and the learning process is maintained.

In research methodology is sometimes not enough of the methods alone, it may take the integration of several methods, depending on the Characteristic of material, learners conditions, environmental conditions, facilities / infrastructure available. Usually for science or material that is applied and skills require a combination of several methods (Frazee and Rudnitski, 1995). This theory can be adopted as an argument and it uses a combination of several approaches or methods in the course of research methodology. The course material is a blend of learning and learning theory (pedagogy) with teaching practice, thus allegedly matched using a combination approach to the concept, modeling and training methods.

The methodology of the study is one of the subjects that explain the theory and steps in doing research, so the student must know the key concepts in the subject Research Methodology for conducting research. There is an student activity sheet based on the problem, and suitable to discuss material that is theoretical and Conceptually, that the material contains a lot of important concepts to be implemented in proposal writing and doing research, such as the Research Methodology course. Overall, the average value of the validity of the test results of products developed is 4.50 which is the criterion very well. By Therefore, it can be said that the student worksheets developed a very valid and can be used in the course Research Methodology at the State University of Padang.

The test results practicalities of problem-based student worksheets that have been produced by faculty, presented in Table 3. While the practicalities of test results by ma college students, are presented in Table 4.

Table 3 .a practicalities Test Results Problem Based on Student Worksheet By Associate

No.	Aspect	Practical Value	Criteria
1	Ease of use	4.55	Very Practical
2	Learning time efficiency	4.33	Practical
3	Benefit	4.42	Practical
Total		13:30	
Average		4.43	Practical

Test Results Table 4 .a practicalities Problem Based on Student Worksheet by Students

No.	Aspect	Practical Value (%)	Criteria
1	Ease of use	4.73	Very Practical
2	Learning time efficiency	4.41	Practical
3	Benefit	4.24	Practical
Total		13.38	
Average		4.46	Practical

Based on Table 3 and Table 4 it appears that the value of the practicalities of problem based on student worksheets by the lecturers is 4.43 and by students 4.46. Both of these values indicate that the practical student worksheets for use both by faculty and students, as a medium of learning in the subject Research Methodology.

In terms of ease of use worksheets of students by lecturers and students obtained an average rating of 4.55 and 4.4 1% with both criteria, it is very practical. It shows that the student worksheets developed a very easy to use by both lecturers and students. The material in the supporting information on the students worksheet have been presented in a clear and simple and use the size and type of font that is easily readable. Arsyad [2] states that the size and type of font used to print-based on media must be readable.

The category in practical aspects of ease of use shows that the language which used in the student worksheet is easy to understand. In addition, the content of student work sheet as a whole is also easy to understand. The clarity stage to be carried out, the clarity of the material in the form of supporting information submitted, the language used, the type and font size, and the size of the student worksheets. In line with the opinion of Prastowo [11], that clarity in the student worksheet is necessary for students interested in reading.

Judging from the aspect of benefits by faculty and students obtained an average value of 4.42 and 4.24 with a very practical criteria. The use of student worksheets supporting role as a facilitator in the learning faculty. In addition, the student worksheets can guide students in learning, so as to reduce the workload of the lecturer to explain the material repeatedly. Jigsaw models used in the learning stages discussion groups, in the presence of student worksheets, the lecturer easily in monitoring

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the students' learning activities and can provide individual guidance to students if any member of the group asked.

The use of students worksheets also considered beneficial for students. The existence of student worksheets to help students to understand the concepts in Research Methodology. The existence of students worksheets make learning more concise and structured according to the syllabus, so that learning materials Research Methodology very broad and so many, it can be studied in line with expectations.

From the results of the questionnaire also revealed that the practicalities of student worksheets test can improve the student learning motivation for students worksheets presented with an attractive appearance. The use of color and graphics on the student worksheet attract students to read.

Overall, the student worksheets which generated very practical categorized by faculty and the students. This indicates that the student worksheets easily used, rewarding and learning time becomes more efficient.

CONCLUSIONS AND SUGGESTIONS

Based on the research results which has done, then it is produced all the products of research, namely in the form of: (a) syntax learning model, (b) textbooks, (c) Worksheet Students (d) evaluation tool, and (e) a questionnaire on perceptions, interests and attitudes, the criteria are very valid. The students worksheet are generated , meet the criteria of very practical use in learning research methodology, both by lecturers and students.

Based on these results, it is recommended to the lecturer in Research Methodology, in order to apply the model of learning that has been produced with support device to reveal the effectiveness of the products of this research.

ACKNOWLEDGEMENT

Thanks to; Dr. Azwir Anhar, M.Sc., Dr. Abdul Razak, M.Sc., Dr. Ramadan Sumarmin, M.Sc., Prof. Dr. Agustina, M. Hum., And Dr. Ramalis Hakim, who has been a validator M.Pd. all products developed. Thanks are also due to Yosi Laila Rahmi, M.Pd., Rahmadani Fitr, M.Pd. as well as the students of Biology Education Studies Program who has been the subject of a test product practicalities student worksheets.

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ISBN 978-602-19877-3-5

MODERN INSTRUCTIONAL DESIGN ON EDUCATIONAL RESEARCH: HOW TO USE THE ADAPTIVE SYSTEMS ON INSTRUCTIONAL OF BIOLOGY

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ABSTRACT

The research objective is to obtain a product in the form of instructional biology education research methodology using the principles of adaptive instructional system that is valid and practical. This research uses design Plomp, has four stages preliminary research, prototyping phase, the assessment phase and systematic reflection and documentation. The primary data were obtained from validation and observation sheets and interviewe guide. The secondary data were obtained from the academic unit. The qualitative data were analyzed with a step reduction, data presentation and conclusion. The quantitative data were analyzed with descriptive statistics. The results of preliminary research found any problem on learning, are (a) the learning process is not characterized by a national qualifications framework of Indonesia, and it's not in accordance with the vision of the institution and the characteristics of student. The results of prototyping stage is valid with the construction of a prototype rated load 9 main competencies, 14 supporting competency and supported by 8 concepts. The results of the assessment phase is a practical prototype on cognitive aspects, less practical on aspects of skills and attitudes. The use of adaptive instructional learning system is one way in finding a solution to the problem of student learning. Thus concluded that it had acquired modern instructional based adaptive instructional valid and practical. The resistance to the revision of the products that have been produced needs to be done by aligning syntax with the actual, use an external expert review, and the practicalities of a broader test.

Index Term- modern instructional, educational research of biology, adaptive instructional systems

1. INTRODUCTION

Universities and colleges are required to apply the learning achievements of general and specific learning outcomes in accordance with the characteristic of the college outcomes. The aim is to equip graduates with the particular competence in accordance with Indonesian qualification frameworks. National Qualifications Framework Indonesian higher education is a framework level qualifications that can reconcile, equalize, and integrate the achievements of the learning of the path of non-formal education, informal education, and / or work experience in the types and levels of higher education [1]. The achievements of general learning, achievement of learning level 6 (bachelor/diploma 4) and learning achievement level 7 (the teaching profession). The full quote is as follows.

> *Capaian pembelajaran umum afeksi dalam Kerangka Kualifikasi Nasional Indonesia, sesuai dengan ideologi negara dan budaya Bangsa Indonesia, maka implementasi sistem pendidikan nasional dan sistem pelatihan kerja yang dilakukan di Indonesia pada setiap level kualifikasi mencakup proses yang menumbuhkembangkan afeksi sebagai berikut (a) bertaqwa kepada Tuhan Yang Maha Esa; (b) memiliki moral, etika dan kepribadian yang baik di dalam menyelesaikan tugasnya; (c) berperan sebagai warga negara yang bangga dan cinta tanah air serta mendukung perdamaian dunia; (d) mampu bekerja sama dan memiliki kepekaan sosial dan kepedulian yang tinggi terhadap masyarakat dan lingkungannya; (e) menghargai keanekaragaman budaya, pandangan, kepercayaan, dan agama serta pendapat/temuan orisinal orang lain; (f) menjunjung tinggi penegakan hukum serta memiliki semangat untuk mendahulukan kepentingan bangsa serta masyarakat luas. Capaian pembelajaran level 6 (sarjana/diploma 4) adalah (a) mampu mengaplikasikan bidang keahliannya dan memanfaatkan ilmu pengetahuan dan teknologi pada bidangnya dalam penyelesaian masalah serta mampu beradaptasi terhadap situasi yang dihadapi; (b) menguasai konsep teoritis bidang pengetahuan tertentu secara umum dan konsep teoritis bagian khusus dalam bidang pengetahuan tersebut secara mendalam, serta mampu memformulasikan penyelesaian masalah prosedural; (c) mampu mengambil keputusan yang tepat berdasarkan analisis informasi dan data, dan mampu memberikan petunjuk dalam memilih berbagai alternatif solusi secara mandiri dan kelompok; (d) bertanggung jawab pada pekerjaan sendiri dan dapat diberi tanggung jawab atas pencapaian hasil kerja organisasi. Capaian pembelajaran level 7 (profesi guru) adalah (a) mampu merencanakan dan mengelola sumberdaya di*

ISBN 978-602-19877-3-5

bawah tanggung jawabnya, dan mengevaluasi secara komprehensif kerjanya dengan memanfaatkan ilmu pengetahuan dan teknologi untuk menghasilkan langkah-langkah pengembangan strategis organisasi; (b) mampu memecahkan permasalahan sains, teknologi, dan atau seni di dalam bidang keilmuannya melalui pendekatan monodisipliner; (c) mampu melakukan riset dan mengambil keputusan strategis dengan akuntabilitas dan tanggung jawab penuh atas semua aspek yang berada di bawah tanggung jawab bidang keahliannya. [2].

This mastery of competencies requires learning system changes. Changes in learning systems require educators to revise instructional design for each course that will be taught to students. This instructional design revisions require certain ways. Activities undertaken to revise instructional design called adaptive instructional system. The adaptive instructional system will be a reference for educators to make intervention necessary for individual learners and can increase their knowledge and skills [3, p. 651]

The instructional design should be revised and modern. This revised will be conduct to achievements that have been written in document of the Indonesia framework qualification. The modern instructional models is a systematic process of building the instructional system that is effective and efficient, conducted by educators, teachers, lecturers and trainers or referred by teachers or staff who work specifically as an instructional designer in educational institutions [4, p. 2]. Integrative instruction is one form of learning and part of the modern instructional. Many integrative instruction identifier to be part of modern instructional design. The characteristics of integrative instruction as part of modern instructional design have been reported by [5]; [6]; [7]. Many other research reports that support this opinion, e. g research reports [8]; [9] and reviews on aspects that are relevant to this study [10]. There are several reviews of aspect of integration was published on Educational Technology Research and Development. There are five aspects related to this study are (a) the design aspects of development; (b) aspects of the use of the concept of the model; (c) aspects of the evaluation of the model, including the use of test validity; (d) aspects of integration; and (e) the development aspects of developmental of biology [6]. The reports of these studies is the result of research [11]; [12]; [13] and [14]. The fourth research report describes the integration of methods, strategies and learning materials. For example integrating the two approaches, namely objectivist and constructivist learning in instructional design [14]. The relationships fourth of this research with the development of integrated learning model in developmental of biology is to be the integration of several methods and learning materials.

There are many of the problems discovered at the research methodology on biology education. Beginning with the unavailability of adequate learning resources to incompetence and ignorance of students as learners in learning. I has made the initial observation by means of direct discussions with students Tadris Biology STAIN Batusangkar. The topic of discussion was about the difficulties and obstacles they find in college. These constraints are learning resources are less available, the lack of provision of early learning students, the learning method that is applied is less appropriate, the diversity of students' ability, lack of clear instructional use by teachers, curriculum applied not hit a 6 and/or 7 in the framework Indonesia framework qualification , there is no lack of understanding of information technology, no / less understand the techniques of scientific writing, the learning styles of students tend to be relaxed and seemed lazy, instructional media are used not according to the characteristics of learning, courses shortage lecturers primary, student trouble to consult the lecturers because lecturers rarely present on campus and/or busy with other activities, the supervisor lesser role in guiding proposals, lack of availability of local seminars and difficult proposal permits the study.

Based on the explanation needs to be done research on modern instructional design in biology education research methods. The research question is (a) how to shape the design and construction of modern instructional design methodology biology education research? (b) how the shape the validity and practicality instructional design methodology biology education research? The general objective of this study was to obtain product instructional design methodology of educational research in biology. Specific objectives of this study were (a) to describe the shape of the design and construction of modern instructional products biology education research methodology and (b) to describe the quality (validity and practicalities) product instructional design modern biology education research methodology.

2. METHOD

I used design research. This method has four stages, preliminary research; prototyping stage, assessment phase and systematic reflection and documentation [15, pp. 25-26]. The preliminary research, the researchers conducted a thorough analysis of the material and the problems associated with a framework based on literature review. At the prototyping stage, the researchers designed the initial reference framework and develop prototypes. This activity is cyclical, and can be divided into three forms, namely design, formative evaluation, and revision. At the assessment phase, researchers conducted in-depth exploration and assessment of the effectiveness of the prototype using summative evaluation. At the systematic reflection and

ISBN 978-602-19877-3-5

documentation, researchers conducted a systematic documentation of activities after the completion of the prototype (systematic documentation) and conduct in-depth studies to give new theories or principles that contribute to the scientific (systematic reflection). The participants are researchers who also acts as validator, practitioners and observers. Students of Tadris Biology STAIN Batusangkar was at grade three, which amounted to 61 people. The primaries data were obtained from the data validation and observation sheets and interview guide. The secondary data were obtained from the academic unit. The qualitative data was analysis was a step reduction, the data presentation and conclusion. The quantitative data were analysis with descriptive statistics [16, p. 337].

3. RESULT

3.1. Preliminary research

The analysis of the instructional needs of the work carried out by researchers on the identification of gaps of learning, gap analysis and the cause of the current state gap with the state should be. After the interviews were conducted, researchers found (a) learning resources are less available; (b) the lack of provision of early learning students (c) applied learning methods are less appropriate; (d) the ability of student diversity; (e) the lack of clarity instructional use by teachers; (f) curriculum is applied not hit a 6 and/or 7 in Indonesian Qualification Frameworks; (g) the learning styles of students tend to be relaxed and seemed lazy; (h) study program deficiencies main supervisor; (i) the difficulty of students to consult the lecturers as lecturers rarely attended college, and / or busy with other activities.

Furthermore, researchers identify about the state of learning that should be implemented. Based on the identification is done, the state should be first, learning in higher education is required to apply the Indonesian Qualification Frameworks. Indonesian Qualification Frameworks based learning requires students to master a certain level of competence. Second, the learning process in STAIN Batusangkar must be in accordance with the vision of college, namely the integration. Third, students are able to understand the concepts and be able to write research proposals and research reports in the field of education.

Researchers have been analyzing general instructional purposes. The main competence subjects is students are able to understand the concept of research as well as being able to write a research proposal in the field of biology education. Student behavior and baseline characteristics obtained by identifying the origin of school and college students majoring in high school / equivalent. This data was obtained from secondary data [17]. The research findings show that the average student in Senior High School was 52.46%, the students who enroll in *Madrasah Aliyah* was 44.26% and vocational school students was 3.28%. Students from majoring in science is 75.40%, students are majoring in social studies is 13.11%, language majors is 8.19%, and others 3.30%.

The findings in the literature review are (a) models of teaching [18]; (b) behaviorism, cognitivism, constructivism: comparing the critical features from instructional design perspective [19]; (c) modern instructional models [4]; (d) integrative learning of model, [20]; (e) Indonesian qualification frameworks [21]; (f) curriculum based competence at university [22]; (g) design research [15]; (h) adaptive instructional system [3]; (i) learning materials [23]. So that the instructional needs analysis findings can be concluded (a) the results of the analysis showed that the instructional needs of the learning process should be characterized by applying the national qualifications framework based learning Indonesia, in accordance with the vision of the institution and the student is able to understand the concepts and be able to write research proposals and research reports in the field of education; (b) the results of the initial analysis of the behavior and characteristics of the students showed that students have diverse characteristics and (c) the existence of a problem that causes gaps in learning research methods. These initial findings will be used as the primary reason in modern instructional design.

3.2. Prototyping stage

At the prototyping stage, I designed the initial reference framework and develop prototypes. This activity is cyclical, and can be divided into three forms, design, formative evaluation, and revision. Design activities consist of activities designed the prototype construction and design prototypes. Formative evaluation conducted by validity. Based on the findings of two previous activities carried out revision of the prototype.

3.2.1. Design prototype

The prototype has been designed is matrix construction design and written in Tables 1 and 2, instructional analysis, planning for learning, and learning outcomes assessment tool. Results of the analysis show the instructional core competencies expected and or be achieved after the learning process is a biology education research

> *"mahasiswa mampu mampu memahami konsep penelitian serta mampu menulis proposal dan laporan penelitian di bidang pendidikan"*

To support achievement of the key competencies required support of nine competence is

> *(a) mahasiswa mampu menjelaskan hubungan filsafat, penelitian dan pendidikan; (b) mahasiswa mampu menjelaskan konsep dasar penelitian pendidikan; (c) mahasiswa mampu menemukan dan menyeleksi topik penelitian;*

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(d) mahasiswa mampu membuat rancangan penelitian (research plans); (e) mahasiswa mampu menjelaskan cara menyeleksi sampel penelitian; (f) mahasiswa mampu merancang instrumen penelitian; (g) mahasiswa mampu memahami, memilih dan melakukan penelitian terpilih dari penelitian deskriptif (descriptive research), penelitian korelasi (corelational research, penelitian komparasi–kausal (causal-comparative research), penelitian eksperimen, penelitian subjek-sendiri (single-subject experiment) dan penelitian pengembangan (design research / research and development; (h) mahasiswa mampu menganalisis dan menginterpretasikan data hasil penelitian dengan statistika deskriptif dan statistika inferensia; dan (i) mahasiwa mampu menulis proposal dan laporan penelitian.

Syllabus is a more complete description of the instructional analysis. In the syllabus has been designed this subject written components, and sub-subject, learning and learning resources. Learning outcomes assessment tool is divided into two parts, namely cognitive assessment tools to measure student and an assessment tool to measure skills and attitudes. The instrument used to measure cognitive students in the form of a written test. The aim is to measure the level of mastery of the basic concepts of educational research carried out after the learning process. The instrument used to measure the skills and attitudes of students in the form of observation sheet. The aim is to measure the level of mastery of the skills and attitudes that emerged during and after the learning process implemented. Findings design phase concluded (a) the construction design of the prototype demonstrates that there are nine core competencies 9 and 14 supporting competencies that must be mastered by the student; and (b) the construction of the prototype design has 8 theories and concepts used in the design.

Table 1 Matrix of modern instructional design on biology educational research

No	Design Research (Plomp, 2010)		Construction of Model [18]					Integrative Instruction (Haviz, 2012b)
			Syntax	Principle of reaction	Social System	Supporting system	Instructional effect	
1	Preliminary Research	Characteristic of institution	●	●	●	●	●	●
		Characteristic of students	●	●	●	●	●	●
		Characteristic of instructional	●	●	●	●	●	●
2	Prototype Stage	Design prototype	●	●	●	●	●	●
		Formative evaluation	●	●	●	●	●	●
		Revision	●	●	●	●	●	●
3	Assesment *Stage*	Summatif evaluation	●	●	●	●	●	●
4	Documentation and Reflection of Systematic		●	●	●	●	●	●
			●	●	●	●	●	●

Note: Abb (●) show the component on matrix

Table 1 Matrix of modern instructional design on biology educational research

No	Design Research [15]		Model Instructional Modern [4]	Behaviorisme, Cognitivism, Constructivism [19]	IFQ [21]	KBK-PT [22]	Adaptive Instructional System [3]	Material of Research [23]
1	Preliminary Research	Characteristic of institution			●	●		
		Characteristic of students		●			●	●
		Characteristic of instructional	●	●	●	●	●	●

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2	Prototype Stage	Design prototype	●	●	●	●	●	●
		Formative evaluation	●	●	●	●	●	●
		Revision	●	●	●	●	●	●
3	Asesment Stage	Summative evaluation	●	●	●	●	●	●
4	Documentation and Reflection of Systematic		●	●	●	●	●	●
			●	●	●	●	●	●

Note: Abb (●) show the component on matrix

3.2.2. Formative evaluation

Formative evaluation is done to test the validity of the prototype. Based on the findings of the theory, written aspects of assessment of learning models, design research, integrative learning, learning theory, the instructional design modern, the curriculum based competence with Indonesian qualification frameworks, adaptive instructional system, and language learning material. The result of validity test are written in Table 3.

3.3. Assesment stage

At the assessment phase, I was conducted in-depth assessment of the practicality of the prototype using summative evaluation. Summative evaluation results include the results of cognitive learning, skills and attitudes. Thirdly the data is written in Tables 4, 5 and 6. The results are based on cognitive learning of students about the concepts and theories about educational research. Learning outcomes and skills and attitudes based on observed when students conducting thesis students in to reviewe earlier, writing summaries and write a plan proposal, find articles, article feasibility, understanding the article, and the quality of the study article.

Table 3 Results of the validation prototype

No	Aspects	Indicators	Result of validation			
			No Valid (χ ± STDEV)	Less Valid (χ ± STDEV)	Valid (χ ± STDEV)	Very Valid (χ ± STDEV)
1	Construction	Learning models	0,00 ± 0,00	0,00 ± 0,00	3,00 ± 8,49	0,00 ± 0,00
		design research	0,00 ± 0,00	0,00 ± 0,00	0,00 ± 0,00	4,00 ± 8,49
		Integrative instruction	0,33 ± 1,89	0,00 ± 0,00	0,67 ± 3,78	1,78 ± 10,06
		Theory of learning	0,00 ± 0,00	0,00 ± 0,00	3,00 ± 4,24	0,00 ± 0,00
2	Characteristics	modern design instructional	0,00 ± 0,00	0,24 ± 2,66	1,94 ± 21,96	0,88 ± 9,98
		KBK PT with KKNI	0,00 ± 0,00	0,00 ± 0,00	1,00 ± 5,66	2,67 ± 15,09
		adaptive instructional system	0,00 ± 0,00	0,4 ± 1,13	1,8 ± 5,09	0,8 ± 2,27
3	Content		0,00 ± 0,00	0,00 ± 0,00	3,00 ± 0,00	0,00 ± 0,00
4	Languange		0,00 ± 0,00	0,00 ± 0,00	3,00 ± 0,00	0,00 ± 0,00

Table 4 Results of cognitive learning students

No	Criteria		Cognitive Students Achievement (n = 61)			Level of Practicality
	Score	Quality	∑	X	STDEV	(χ ± STDEV)
1	85 – 100	A	29	47.54	13.11	Very Practice
2	80 – 84	A-	9	14.75	4.069	(68,27 ± 8,59)
3	75 – 79	B+	11	18.03	4.973	Practice
4	70 – 74	B	3	4.918	1.356	(11,47 ± 3,16)
5	65 – 69	B-	2	3.279	0.904	Less Practice

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6	60 – 64	C+	2	3.279	0.904	(3,28 ± 0,90)
7	55 – 59	C	2	3.279	0.904	
8	45 – 54	D	1	1.639	0.452	No Practice
9	< 45	E	2	3.279	0.904	(2,46 ± 0,68)

Note: ∑ = summary (61), χ = mean, STDEV = standart of deviation

Table 5 Result of skills and attitude of students

No	Criteria		Skills and Attitude of students (n = 61)									Level of Practicality (χ ± STDEV)
			Review of thesis			Write summary of draft proposal of thesis			Write draft proposal of thesis			
	Scores	Quality	∑	χ	STDEV	∑	X	STDEV	∑	χ	STDEV	
1	85 – 100	A	2	3.279	0.904	0	0	0	0	0	0	Very Practice (1.913 ± 0.527)
2	80 – 84	A-	5	8.197	2.26	0	0	0	0	0	0	
3	75 – 79	B+	11	18.03	4.973	4	6.557	1.808	1	1.639	0.452	Practice (11.2 ± 3.089)
4	70 – 74	B	17	27.87	7.685	5	8.197	2.26	3	4.918	1.356	
5	65 – 69	B-	15	24.59	6.781	3	4.918	1.356	5	8.197	2.26	Less Practice (7.65 ± 2.562)
6	60 – 64	C+	7	11.48	3.165	2	3.279	0.904	2	3.279	0.904	
7	55 – 59	C	4	6.557	1.808	2	3.279	0.904	2	3.279	0.904	
8	45 – 54	D	0	0	0	0	0	0	0	0	0	No Practice (25.41 ± 7.007)
9	< 45	E	0	0	0	45	73.77	20.34	48	78.69	21.7	

Note: ∑ = summary (61), χ = mean, STDEV = standart of deviation

Table 6 Skills students in understanding articles published in national and international journals

No	Criteria		Skills students in understanding articles published in national and international journals (n = 61)												Level of Practicality (χ ± STDEV)
			Found Articles			Quality Articles			Knowing Articles			Quality of Reviewed Articles			
	Score	Quality	∑	χ	STDEV	∑	χ	STDEV	∑	χ	STDEV	∑	χ	STDEV	
1	85 – 100	A	10	16.39	4.521	10	16.39	4.521	12	19.67	5.425	8	13.11	3.617	Very Practice (23.56 ± 6.50)
2	80 – 84	A-	25	40.98	11.3	12	19.67	5.425	18	29.51	8.138	20	32.79	9.042	
3	75 – 79	B+	10	16.39	4.521	5	8.197	2.26	5	8.197	2.26	5	8.197	2.26	Practice (7.99 ± 2.20)
4	70 – 74	B	4	6.557	1.808	4	6.557	1.808	4	6.557	1.808	2	3.279	0.904	
5	65 – 69	B-	2	3.279	0.904	2	3.279	0.904	12	19.67	5.425	2	3.279	0.904	Less Practice (7.51 ± 2.07)
6	60 – 64	C+	2	3.279	0.904	5	8.197	2.26	2	3.279	0.904	7	11.48	3.165	
7	55 – 59	C	2	3.279	0.904	6	9.836	2.713	5	8.197	2.26	8	13.11	3.617	
8	45 – 54	D	3	4.918	1.356	8	13.11	3.617	1	1.639	0.452	5	8.197	2.26	No Practice (7.17 ± 1.98)
9	< 45	E	3	4.918	1.356	9	14.75	4.069	2	3.279	0.904	4	6.557	1.808	

Note: ∑ = summary (61), χ = mean, STDEV = standar of deviation

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4. DISCUSSION

The results of this study showed that the product meets the criteria of this research has been written in the prototype validation sheet. Aspects of the assessment is a learning model, design research, integrative learning, learning theory, instructional design modern, curriculum based competence with Indonesian qualification frameworks, adaptive instructional system, and language learning material. These results also demonstrate the good of the current prototype used in the learning process or when testing the practicalities implemented. So the researchers concluded not currently required revision of the prototype. The question that must be answered is why this product is valid and practical? In the following section the authors explain the answers to these questions. Explanations followed by writing the arguments are equipped with support or referral source.

4.1. Models of teachings

In the aspect of learning model, I wrote five indicators of syntax, the social system, the principles of reaction, supporting system, and the effects of instructional and nurturant effects [18, p. 14]. The score of product research on learning model was 3.00 ± 8.49 (valid). This explanation shows that the product meets the theoretical aspects of the learning model. The learning model has a broader meaning [24, p. 74]. The learning model has several distinctive features, which are not owned by the strategy and methods of learning. The characteristic of the learning model is (a) the theoretical rational logical compiled by the creators or developers; (b) the rationale about what and how students learn; (c) the behavior of teaching required so that the model can be implemented successfully; (d) learning environment necessary for learning objectives can be achieved. The learning model leads to a certain learning approach, including the purpose, syntax, and environmental management systems.

4.2. Design research

In the aspect of design research, this study wrote four assessment indicators, namely phases of development, the characteristics of the development, evaluation and quality of interventions. Three indicators reviewed in this section. The fourth indicator of the quality of interventions for reviews on the documentation and reflection of systematic and determination of design. This research has been carried out by following the design research phase [15]. The development phase has been carried out properly and systematically. Therefore, the validation results obtained are very valid, which stood at a score of 4.00 ± 8.49. Plomp explains there are four stages of work in conducting research is preliminary research design, prototyping stage, assessment phase and documentation and reflection systematics.

This research products containing or having the characteristics of development. Thus concluded this study meets the characteristics of development research. The characteristics described by Van den-Akker et al., (2006: 5) in [15, p. 15]. The characteristics of research development that is (a) interventionist: intervention (interference) when designing research purposes; (b) iterative; the cycle of analysis, design and development, evaluation and revision; (c) the involvement of practitioners; a participatory active at every stage of practitioners and research activities; (d) the process-oriented; aims to understand and improve product quality; (e) oriented usibility; improving the quality of the design with the practicalities of the process by the user in the field and (f) oriented theory; the design is based on the conceptual and theoretical framework, supported by in-depth evaluation of the product.

The characteristics of research development could also be seen by the focus, the techniques and tools used when doing research development [25, pp. 1103-1115]. Techniques and equipment research and development combine different types of research methodology and implementing a variety of equipment needed at each execution of the study. The products of this study also indicate that fact. Some of the techniques that can be used is experimental research, qualitative, descriptive survey method. The necessary equipment in the research is the development of the experts which will be used as a determination theory, internal and external validity and statistical analysis [25, pp. 1103-1104].

Design research or/and research and development requires participants. Because the Design research will be done well if it involves participants in that quite a lot. This study has involved participants are designers, students and validators. The participants are (a) designer, developer and evaluator; (b) the client / student / students / learners; (c) teachers and facilitators of the program; (d) the organization; (e) the researcher who mastered the theory of design and development, and (e) the product [25, p. 1115].

Based on these descriptions, there are four conclusions that could be used to support this research, namely (a) design research or/and research development is the study systematically on the process of designing, developing and evaluating models, programs, strategies of teaching-learning and their devices, products, and systems as a solution to the problem complex in practical education, and also has a goal to increase the knowledge about the characteristics of the model, the program, the teaching-learning strategies and their devices, products, and the system; (b) the general stages of research development consists of the design, development, evaluation and implementation; (c) determination of focus, process, conclusions and

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results of the study will determine the type and form of development research that will be conducted by researchers who want to conduct research development in the field of learning; and (d) the use and selection of evaluation techniques largely determine the quality of the model, the program, the teaching-learning strategies as well as the device, product, and system [5].

4.3. Integrative instruction

The results of the validation about aspects of integrative learning is invalid (0.33 ± 1.89); less valid (0.00 ± 0.00), valid (0.67 ± 3.78) and very valid (10.06 ± 1.78). The findings of this study show that there is still an indicator of unmet integrative learning. In other words could be written that the product of this study less or do not contain all aspects of integrative learning. I have written nine indicators of integrative learning is interdisciplinary, thinking map, problem solving, learning phase, integrative skills, recitation, debate, discussion and presentation [26]. Based on the results of the validation only interdisciplinary, integrative skills, recitation, discussion and questions and answers that have valid scores, while problem solving and presentation scores invalid. The findings of this study demonstrate that the product does not contain or do not bring up aspects of problem solving and presentation. So it is necessary to improve the next development.

4.4. Theory of learning

The results the validation about learning theory is valid (3.00 ± 4.24). These findings show that the research products are designed with good theory. Because learning theory became the main runway while doing the design of instructional development. Some theories of learning that is relevant to this study is the cognitive, behavioral, constructivist. There are several arguments written by Sink to describe the relationship of learning theory and its implications for learning. First, learning theory contribute to improve the structure of concepts that underlie the process of providing information and stored in the memory long (long term memory) and can be called back in the observation of human perform (Gagne, 1997 in [27, p. 202]. Second, the theory of learning will improve learning strategies, tactics, and behavior learning experiences supported by the theory. For example, on the model of instructional systems design (ISD) designers make use of theories of learning and their learning strategies in the design phase. Third, the results Molenda and Russel (2005) shows the many ways in the development and design of the structure of matter, just as the individual materials, modules, units of learning appropriate to the subject that is always used and is based on one or more learning theory. Instructional design phase of system design is influenced by the behavioristic theory, cognitive and constructivist [27].

The relationship behaviorism, cognitivism and constructivism connecting yesterday's theories to today contexts (a) change in technology, changes in learners and change in methods; (b) not only do today's students want and prefer to learn differently, they seem exceptionally capable of doing and (c) today, with the use of available technologies, individuals from geographically diverse locations can form communities of learners to develop multidisciplinary solutions to important problems [19, pp. 58-59]. Behaviorism, cognitivism, constructivism; comparing critical features from an instructional design perspective. This explanation used to evaluate theory in design instructional. There are lists seven question, Schunk (1991) lists five definitive questions that serve to distinguish each learning theory from the others: (a) how does learning occur?; (b) which factors influence learning?; (c) what is the role of memory?; (d) how does transfer occur? and (e) what types of learning are best explained by the theory? Expanding on this original list, we have included two additional questions important to the instructional designer: (f) what basic assumptions/principles of this theory are relevant to instructional design? and (g) how should instruction be structured to facilitate learning? The seventh question has been filled with good current study was designed products. For example about the sixth question what basic assumptions/principles of this theory are relevant to instructional design? [19, p. 46]

The behaviorism, there are four specific assumptions or principles that have direct relevance to instructional design include the following (possible current instructional design applications are listed in brackets following the listed principle) are (a) an emphasis on producing observable and measurable outcomes in students (behavioral objectives, task analysis, criterion-referenced assessment); (b) pre-assessment of students to determine where instruction should begin (learner analysis); (c) emphasis on mastering early steps before progressing to more complex levels of performance (sequencing of instructional presentation, mastery learning); (d) use of reinforcement to impact performance (tangible rewards, informative feedback); and (e) use of cues, shaping and practice to ensure a strong stimulus response association (simple to complex sequencing of practice, use of prompts) [19, pp. 49-50]. The cognitivisme, specific assumptions or principles that have direct relevance to instructional design include the following (possible current instructional design applications are listed in brackets following the listed principle) are (a) emphasis on the active involvement of the learner in the learning process (learner control, metacognitive training, e.g., self-planning, monitoring, and revising techniques); (b) use of hierarchical analyses to identify and illustrate prerequisite relationships (cognitive task analysis procedures); (c) emphasis on structuring, organizing, and sequencing information to facilitate optimal processing (use of cognitive strategies such as outlining, summaries, synthesizers, advance organizers, etc.) and (d) creation

ISBN 978-602-19877-3-5

of learning environments that allow and encourage students to make connections with previously learned material (recall of prerequisite skills; use of relevant examples, analogies). The constructivism, the following are several specific assumptions or principles from the constructivist position that have direct relevance for the instructional designer (possible instructional design of applications are listed in brackets, following the listed principle) are (a) an emphasis on the identification of the *context* in which the skills will be learned and subsequently applied (anchoring learning in meaningful contexts); (b) an emphasis on learner control and the capability of the learner to manipulate information (actively using what is learned); (c) the need for information to be presented in a variety of different ways (revisiting content at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives); (d) supporting the use of problem solving skills that allow learners to go "beyond the information given" (developing pattern-recognition skills, presenting alternative ways of representing problems); and (e) assessment focused on transfer of knowledge and skills (presenting new problems and situations that differ from the conditions of the initial instruction) [19, p. 53]

4.5. Construction

4.5.1. Design instructional modern

In the aspect of modern instructional design, validation results obtained are less valid (0.24 ± 2.66), valid (21.96 ± 1.94) and a very valid (0.88 ± 9.98). These results were obtained from the 18 indicators, the nature of learning, typical learning structure, view of the state of knowledge, typical classroom climate, diagnosis of needs, purpose of intervention, view of human nature, learners attitude, possible answers, motivation to learn, change or improve, the role of experience, learner self-concept, learner orientation, learning objectives, how need established, instructional design, learning process (Anonymous, 2000). These results were obtained for all of the characteristics of modern instructional design were fulfilled in this study product. These results also show that this product has been built to build instructional system that is effective and efficient. Instructional models modern is a systematic process of building a instructional system that is effective and efficient, conducted by professors, teachers, lecturers and trainers or referred by teachers or staff who work specifically as a instructional designer in educational institutions. Some of the advantages of modern instructional design, namely (a) be equipped with a variety of the latest so that the substance reference date, while various references is retained because it is still relevant; (b) creating instructional systems in various contexts, both in face-to-face instructional activities in the regular classroom as well as to design self-learning materials; (c) used mainly for distance education, including computer-based instructional activities (computer based instruction); (d) use various concepts drawn from various sciences, especially learning of theory, motivation theory, learning theory, the theory of program evaluation and communication theory; (e) activities is revise instructional materials of an integral part of the formative evaluation so no described as a separate activity; (f) the modern instructional design load on the system is expected to sharpen the payment as a systems view (system view) and a systems approach (system approach); (g) modern instructional design load on competency-based learning is expected to sharpen the government's operational policy on competency-based education. [4].

4.5.2. Curriculum based competence with Indonesian qualification framework

The result of validation about curriculum based competence with Indonesian qualification frameworks, are valid (1.00 ± 5.66) and a very valid (15.09 ± 2.67). These results were obtained from nine (9) indicators, namely phases of preparation, student center learning, learning tools, evaluation of learning, the establishment of vision, mission, goals and graduate profile, establishment of frameworks national qualifications Indonesia level 6, the determination of competence of graduates /outcomes of learning, determination map element of competence with the competence of graduates and determination of the main points of the study of learning. These results show that these products, designed in accordance with the stages of preparation of a competency-based curriculum for universities. This product also has the characteristics of student learning centere and characterize the Indonesian national qualifications framework at level 6. Documents Tadris Biology curriculum STAIN Batusangkar which have been designed in accordance with the Indonesian national qualifications framework is written that a generic description of level 6 (the first paragraph) is able to utilize science and technology in areas of expertise and able to adapt to the situation at hand in problem solving, with specific descriptions (1) is able to master and apply knowledge and technology related to biological learning process; and (2) are able to solve the problems of biology in the classroom learning using information technology approach.

Referring to the competencies that have been written on the product, this course has a general competence which contains elements of completion of the task with a clear result. The definition of competence. There are many opinions of experts about the competence was review [4, p. 65]. Results of the review authors write back. First, the competence shown by the capabilities of the completion of the task with the results being between good and very good scale. This conclusion was obtained after a study of the three characteristics, namely (a) the competence that is a combination of three human capabilities are combined insights that cognitive, skills and attitude to improve the work; (b) competency has a strong indicator of an increase in performance up to the level

ISBN 978-602-19877-3-5

of good or very good and (c) the competence is a combination of knowledge, skills and behaviors is the basis for performance. Second, competence is indicated with minimal performance both as a result of use capabilities. Ability itself is application of a combination of knowledge, skills and attitudes behavior. This conclusion is based on the results of the study obtained from (a) capability is the basis of competence, which means that a person has achieved competence of capabilities; (b) capability may be derived from two sources, namely descent and aptitude and achievement results from professional capability in the work; (c) the knowledge, skills and attitudes of behavior is an important part of competence.

4.5.3. Adaptive instructional system

In the adaptive instructional system, the validation results obtained are valid (1.00 ± 5.66) and a very valid (15.09 ± 2.67). These results were obtained from five (5) indicators that is the main component, adaptability procedure, adaptability at the micro level, new pedagogical approaches and the three phases are input, and output transactions. These findings related on (a) main components of instruction such as instructional goals, depth of curriculum content, and delivery systems; (b) to adapt specific instructional procedures and strategies to specific student characteristics; (c) to adapt instruction on a micro-level by diagnosing the student's specific learning needs during instruction and providing instructional prescriptions for the needs; (d) new pedagogical approaches such as metacognitive strategies, collaborative learning, constructivist learning, and motivational competence and (e) three stages: input, transactions and output [3].

The adaptability of the product to the learning needs of research methods can be seen from some of the findings that have the following characteristics. *First*, learning meet the diversity of students. This adaptive requirements the efforts to develop and implement adaptive instruction have taken different approaches based on the aspects of instruction that are intended to adapt to different students. The first approach is to adapt instruction on a macro-level by allowing different alternatives in selecting only a few main components of instruction such as instructional goals, depth of curriculum content, and delivery systems. The second approach is to adapt specific instructional procedures and strategies to specific student characteristics. Because this approach requires the identification of the most relevant learner characteristics (or aptitudes) for the instruction and the selection of instructional strategies that best facilitate the learning process of the students who have the aptitudes, it is called aptitude–treatment interactions (ATI). The third approach is to adapt instruction on a micro-level by diagnosing the student's specific learning needs during instruction and providing instructional prescriptions for the needs. The degree of adaptation is determined by how sensitive the diagnostic procedure is to the specific learning needs of each student and how much the prescriptive activities are tailored to the learner's needs. Depending on the available resources and constraints in the given situation, the instruction can be designed to be adaptive using a different combination of the three approaches. The arguments in favor of the above statement. The micro adaptive instructional models using on-task measures are likely to be more sensitive to the student's needs. Some researchers have attempted to establish micro-adaptive instructional models using on-task measures rather than pre-task measures. On-task measures of student behavior and performance, such as response errors, response latencies, and emotional states, can be valuable sources for making adaptive instructional decisions during the instructional process. That is, most tutoring activities are determined by the tutor's intuitive judgments about the student's learning needs and ability for the given task. Also, one-on-one tutoring is virtually impossible for most educational situations because of the lack of both qualified tutors and resources. A typical example of micro-adaptive instruction is one-on-one tutoring. The tutor selects the most appropriate information to teach based on his or her judgment of the student's learning ability, including prior knowledge, intellectual ability, and motivation. Then the tutor continuously monitors and diagnoses the student's learning process and determines the next instructional actions. The instructional actions can be questions, feedback, explanations, or others that maximize the student's learning. As the one-on-one tutorial process suggests, the essential element of micro-adaptive instruction is the ongoing diagnosis of the student's learning needs and the prescription of instructional treatments based on the diagnosis. Instructional researchers or developers have different views about the variables, indices, procedures, and actions that should be included in the diagnostic and the prescriptive processes, that different adaptive systems have been developed to adapt different features of instruction to learners in different ways [3, pp. 652-661].

Secondly, the research findings also showed micro adaptive instructional characteristics as required. The micro adaptive model uses the temporal nature of learner abilities and characteristics as a major source of diagnostic information on which an instructional treatment is prescribed. Thus, an attribute of a micro adaptive model is its dynamic nature as contrasted with a macro adaptive model. *Thirdly*, the founding of research identically with adaptive web-based instruction. Treatments variables in micro adaptive models, intelligent tutoring systems, adaptive hypermedia and adaptive web-based instruction. *Fourthly*, this study was designed several assignments for student mastery of the skills associated with the use of computers and the Internet. These tasks is one part of the product is designed. These findings show that there are characteristics adaptive hypermedia and

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adaptive web-based instruction. While most adaptive systems reviewed in the previous sections could not be developed without programming skills and were implemented in the laboratory settings, recent authoring tools allow nonprogrammers to develop adaptive hypermedia or adaptive web-based instruction and implement it in real instructional settings. Adaptive hypermedia or adaptive web-based systems have been employed for educational systems, e-commerce applications such as adaptive performance support systems, on-line information systems such as electronic encyclopedias and information kiosks, and on-line help systems. Adaptive hypermedia methods apply mainly to two distinctive areas of adaptation: adaptation of the content of the page, which is called content-level adaptation or adaptive presentation; and the behavior of the links, which is called link-level adaptation or adaptive navigation support [3, pp. 666-668].

Fifthly, the study also discovered and explained the new teaching methods to methods of research. This finding is consistent as a new pedagogical approaches in adaptive instructional systems. On the late nineties, researchers began to incorporate more complex pedagogical approaches such as metacognitive strategies, collaborative learning, constructivist learning, and motivational competence in adaptive instructional systems. Sixly, the result has meet three stages: input, transactions and output. The input stage basically consists of the analysis of the student's entry characteristics. The student's entry characteristics include not only this or her within-lesson history (e.g., response history) but also pre-lesson characteristics. The pre-lesson characteristics may include information about the student's aptitudes and other variables influencing his or her learning. As discussed earlier, the aptitude variables measured prior to instruction will be useful for the beginning stage of instruction but will become less important as the student's on-task performance history is accumulated. Thus, the within-lesson history should be continuously updated using information from the evaluation of the performance (i.e., output measures). The transaction stage consists of the interactions between the student and the system. In the beginning stage of the instruction, the system will select problems and explanations to present based on the student's entry characteristics, mainly the premeasured aptitudes. Then the system will evaluate the student's responses (or any other student input such as questions or comments) to the given problem or task. The response evaluation provides information for diagnosing the student's specific learning needs and for assessing overall performance level on the task. The learning needs will be inferred according to diagnostic rules in the system. Finally, the system will select new display presentations and questions for the student according to the tutorial rules. The tutorial rules should be developed in consideration of different learning and instructional theories (e.g., see Snelbecker, 1974; Reigeluth, 1983), research findings (e.g., see Gallangher, 1994; Weinstein & Mayer, 1986), expert heuristics (Jonassen, 1988), and response-sensitive strategies discussed earlier in this chapter. The output stage consists mainly of performance evaluation. The performance evaluation may include not only the student's overall achievement level on a given task and specific performance on the subtasks but also the analysis of complete learning behaviors related to the task and subtasks. According to the performance evaluation and analysis, the instructional components will be modified or updated. The instructional components to be updated may include contents in the knowledge base (including questions and explanations), instructional strategies, diagnostic and tutorial rules, the lesson structure, and entry characteristics. If the system does not have the capability to modify or update some of the instructional components automatically, a human monitor may be required to perform that task. [3, pp. 673-678].

4.6. Content and language

In the aspect of the content, the researchers use a book that has been designed by Gay, et al., (2009). Textbook is equipped with a media power point. Selection and use of this product caused by the product is in accordance with the core competencies and competency supporters who have written in the previous section. These products are written by experts who have been published regularly and has been revised to perfection by the author. These products always contains the latest information on educational research. Fourth, based on the writer's observation almost every researcher, lecturer, teacher, student, students and education observers use this text book. In conclude, so this product is valid and practical aspects of language and content.

4.7. Documentation and reflection of systematic and determination of design

The findings practicalities test results show that (1) the cognitive learning of students is very practical (68.27 ± 8.59), practical (11.47 ± 3.16), less practical (3.28 ± 0.90), not Practical (2.46 ± 0.68) and are not practical, (2.46 ± 0.68); (2) skills of students in studying the thesis, writing summaries and proposals are very practical (1913 ± 0527), practical (11.2 ± 3,089), less Practical (7.65 ± 2562) and cumbersome (25.41 ± 70.07) and (3) skills of students understand articles published in national and international journals is very practical (23.56 ± 6,50), practical (7.99 ± 2.20), less practical (7.51 ± 2.07) and practical (7.17 ± 1.98). These findings show that the learning process that has been implemented into stages that are essential to the achievement of key competencies in the subjects of biology education research. Because the competency-based learning has meaning (a) the learning process is designed and implemented in accordance with the competencies defined in the learning objectives; (b) the learning process was

ISBN 978-602-19877-3-5

designed and implemented from the competence of learners who have mastered before following the learning process. the next stage of learning is done systematically; (c) all components are in a learning system was designed and implemented to create a learning process that leads to the achievement of competencies that have been formulated in learning goals; and (d) measurement successful learning is done to determine the level of achievement of the competence of learners [4, p. 79].

The findings of this study also includes the importance of mastery of the competencies and level 6 or level 7 should be given to undergraduates. Achievement of these competencies must be stated in the curricullum document. The curriculum at college is a set of plans and arrangements regarding the content and study materials and lessons as well as the delivery and assessment is used to guide the delivery of teaching and learning in higher education. The role of curriculum in higher education is (a) higher education management policy to determine the direction of education; (b) philosophical formation that will color the academic community and the climate; (c) patron or learning patterns; (d) atmospheric or climatic formed from the interaction of managerial universities in achieving learning goals; (e) a reference quality of the quality assurance process and (e) measure college success in producing graduates that are beneficial to society.

This product has a benefit in achieving the competency level 6. [28, pp. 8-9]. The document discovered at the benefits and impact of the Indonesian National Qualifications Framework. Researchers write back about it. About the benefits, the Indonesian National Qualifications Framework is intended to (a) establish the qualifications of learning outcomes acquired through formal, non-formal, informal or work experience; (b) establishes a scheme recognition of qualifications acquired learning outcomes on formal education, non-formal, informal or work experience; (c) equalizes qualifications betwen learning outcomes acquired through formal education, formal education, non-formal, informal or work experience; and (d) developing methods and system of recognition of qualifications of human resources from other countries who will be working in Indonesia. The impact of the Indonesian National Qualifications Framework are (a) to increasing the quantity of Indonesian human resources quality and international competitiveness in order to ensure the increased accessibility of Indonesian human resources to the labor market; (b) to increasing the contribution of learning outcomes obtained with formal education, non-formal, informal or work experience in the growth of the national economy; (c) to increasing academic mobility to increase mutual understanding and solidarity and cooperation anta state of higher education in the world and (d) to increasing recognition of other countries both bilaterally, regionally and internationally to Indonesia without leaving the traits and personality of the Indonesian nation. Related to this, the Directorate General of Higher Education expects (a) Institute of Personnel Organizer becomes a mirror of education for another course as a mother character education; (b) Institute of Personnel Organizer become a source of superior human resources in education; (c) Institute of Personnel Organizer open to changes and future-oriented and (d) Institute of Personnel organizers are willing and able to produce powerful educators, creative, and infectious goodness for the glory of future generations.

For comparison, I have done a review of several studies relevant to the research that has been done this. In the previous section has been written that others have reviewed the literature on integration in instructional design. The results show that the aspects relevant to the research that (a) the design aspects of development; (b) aspects of the use of the concept of the model; (c) aspects of the evaluation of the model, including the use of test validity; (d) aspects of integration; and (e) the development aspects in developmental of biology [5]. Several other studies that is relevant with this research are (a) instructional design strategies for intensive online course: an objectives-constructivist blended approach [29], an instructional design in education: new model [30], blended learning instructional design: a modern approach [31] and an instructional design framework for authentic learning environments [32].

Based on the explanation of the findings of this study, then compared with other research reports, this study has limitations. Some limitations is the use of self-evaluation in a way to test the validity. Theoretically, self-evaluation can be carried out because of the strong support that theory. Tessmer (1999) explains that self-evaluation is one way to assess product development results. While research and development, researchers are often faced with a difficult situation that will affect the quality of the product, especially the learning model. Because the study required the collaboration within the team. For example collaboration between researchers with practitioners, the collaboration between the evaluators and other participants. Sometimes there is a clash of interests and needs which will lead to a different perception when the research done in the field. The conditions described will cause a dilemma in development research [15, pp. 31-32].

In this study, evaluation techniques are selected and used to determine the quality of products, and the criteria for product quality development results [33]. Based on evaluation techniques, the product because it uses self-assessment (self-evaluation). This criterion shows the quality of the product is low resistance to revision. Evaluation techniques are self-evaluation, expert review, one-to-one evaluation, small group or micro evaluation and field test. The results of the development of good learning outcomes depend on quality product development. The quality of learning

ISBN 978-602-19877-3-5

development in research and development is determined by the criteria of validity, practicality and effectiveness. This study uses have used the principle of validity, practicality and effectiveness, this is called tessmer's evaluation [33, pp. 93-94].

In practical terms, many conditions other dilemma researchers found when doing research development. In order for research purposes continues to run according to the principles of research development, Mc-Kenny et al. (2006) describes a picture of the dilemma and the solution to the condition [33]. The conditions and the solution is (a) researchers is the designer, sometimes as evaluators and implementers (b) the state or condition of the field and the conditions of adaptability. Currently, research and development carried out, sometimes researchers are also involved as designers, evaluators and implementers. There are three compensation that can be done by researchers to solve this problem: first, making research and discuss openly with others who are professionals who are not involved directly or indirectly with the study. Researchers are open to suggestions and criticism of the person. Second, the paradigm researchers during or at the beginning of the study was a creative perspective, and a researcher who paradigm critical perspective on the end of the study. Third, have a research design with good quality. Some good development research design criteria are (a) have a problem, ideas and strong reasons (strong chain reasoning); (b) increase the quality of methods, techniques and analysis of good data (triangulation); (c) to test the practicalities and effectiveness (empirical test); (d) the process of documentation, analysis and reflection systematically during the design, development, evaluation and implementation (documentation, analysis and systematic reflection); and (e) using a variety of methods and strategies in research, for example, using practitioners and other researchers as a critical friend, using the observer more than one.

Research and development is closely related to practices in the field. Circumstances or conditions in the field often and effect to research. A frequent problem is the unwillingness or properties that do not open from the participants (other educators, principals, chairman of the institutions and others) and does not support research in accordance with the design. To that end, researchers should be able to be an outsider when the study was conducted. Aspects of objectivity and honesty should be prioritized by the researcher. That research conducted properly and in accordance with the principles of research development. The adaptability of the study will determine the results. The problem that often arises is the inability or lack of conceptual design studies inability to adapt to conditions on the ground. According to Van-den-Akker (2005) adaptability between research and practice in the field can be maximized in several ways, namely full preparation in research, tolerant, open and receiving input from other parties [15, p. 31].

5. CONCLUSION

This research has produced an instructional design modern in the course of educational research methods. The result of the preliminary stage is the existence of a problem that causes gaps in learning research methods. The gap in the form of (a) analysis of instructional needs shows that the learning process should be characterized applying based National Qualifications Framework Indonesia, in accordance with the vision of the institution and the student is able to understand the concept of research as well as being able to write proposals and reports of research in the field of education and (b) analysis of behavioral and baseline characteristics of students showed that students have diverse characteristics. Results of the research prototype stages are (a) the construction design of the prototype demonstrates that there are 9 main competencies and 14 supporting competencies that must be mastered by the student; (b) the construction of the prototype design show 8 theories and concepts used in the design; and (c) the results of validation prototype is valid with many revisions that must be done by the researcher. The results of the assessment phase of research is practically on the terms of the practicalities of test results which contained three aspects of the cognitive learning, skills and attitudes.

This research has produced an instructional design modern in the course of educational research methods. The need to revise the product to align learning syntax premises actual conditions. Necessary to test the validity of using an external expert review to improve the resistance of the product. Necessary to test the practicalities of using a wider scale externally to increase the resistance of the product.

6. ACKNOWLEDGMENT

This research was funded by DIPA funds STAIN Batusangkar year 2015 with the contract number Sti.02/IX/TL.00/2500.a/2015.

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ISBN 978-602-19877-3-5

IDENTIFYING THE MISCONCEPTIONS RELATE TO EVOLUTION MATERIAL PRESENTED IN STUDENTS BIOLOGY TEXTBOOK FOR SMA CLASS XII

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ABSTRACT

The development of knowledge content in general, curriculum and issues in biology learning has enhanced various textbooks which is commercially published. Without ignoring its legitimacy, any books can generate a misconception for the reader. In this case, content complexity and advanced language using may lead the misconceptions. A number of researches have been conducted to recognize students' misconception toward particular topic in biology, and also evolution. But, limited studies focused on misconception originated from book. This kind of misconception should be overwhelmed as book is assumed as undeniable knowledge sources so that it can cause an increasingly misconception for each readers. This study aimed at identifying and describing misconception exist on biology book class XII which is written by "X" publisher.

This descriptive study took the "X"s publisher's book as object. Data analysed descriptively and presented as narrative explanation in related tomisconceptions existed in the book. Triangulation technique is applied here by comparing identified concepts toward similar concepts in related reference. A concept which differs significantly from reference book will be verified by 3 (three) experts. The concept then claimed as a misconception if only its definition is distinguish, have vary interpretation from literature, and agreed by 2 of 3 experts judgement.

The study pointed out that 4 (four) of 16 (sixteen) concepts related to substances of evolution are misconception. These concepts comprise of half-time, ontogeny, lyposome, and microevolution. To sum up, misconception is proven appeared in "X" book publisher, thus readers, especially teacher and students have to aware and consider it in order to achieve a more appropriate learning content.

Index Terms— Misconception, evolution, book.

1. INTRODUCTION

Textbook is one of main learning reources utilised by teacher and student in biology learning. There are a number of books published commercially are available. Opting a most recommended book have to considers some particular criteria or standards, such content, presentation, language, graphics appropriatenesses (Depdiknas, 2003, p.8)[2] and its relevance to curriculum.

In fact, not all of these factors are well regarded when choosing a book. Particular schools or biology teacher suggested the students to guide a biology book by simple reasons, are due to has been accustomed to use a book produced by a particular author or publisher. Ignoring others criteria, for example truth of concepts exist on content and understoodable sentences or language will interfere with students conception. In the other word, anxious of misconception will be other next problem.
Hammer (cited in Tayubi, 2005, p.5) [21] argue that misconception is a conception or cognitive structure which has strongly remained in students' mind, but it is actually differ from the original concept. Misconception can be generated through teacher and the teaching method, students condition, learning context and books (Liliawati&Ramalis, 2009, p.160) [10]. Almost student are fully believe the truth of a book content. Sentences complexity sometimes unconsciously lead students to an incorrect interpretation. Wrong conception also will be forward in condition having a self-learning. For example, when a students have a book reading, students possibly build new concept. This constructing process is one of misconception source (Tekkaya, 2002) [22].
Fitrianingrum (2013, p.74) [5] shows misconception commonly appears in science learning, especially biology. Tekkaya (2002, p.261) [22] argued that misconception is frequently found in topics respiration, photosynthesis, ecology, energy, genetic, classification and circulatory system. Besides, a number of study have been conducted in related to biology book misconception. Adisandjaja (2007,p.8) [1] found that book misconception level gained 11% in 7 biology topics include plant structure, function and cell structure, coordinating system, cell metabolism, biotechnology, cell reproduction, and biogeography). Additionally, muscle, skeletal, movement system (Imran, 2013) [9], human body structure, natural selection, and evolution concept (Murni, 2013) [13].

It is widely understoodable, evolution topic is complex in content, use inter-dicipline approach,

ISBN 978-602-19877-3-5

contain unreachable evidence due to time and location, and highly adapted with knowledge development. To comperehend this material, correctly concept explanation should be a priority. Book misconception on evolution topic is specific focus in this study, especially students' book, i.e book which is used by almost students. In this case, book misconception is defined as inappropriate definition and/or explanation which is significantly differ, at least slightly, from a legitimate textbook. Those possibly lead students toward a broader misconception. For a simplicity, term **students' book misconception** will be frequently used in this article.

Thus, it is important to assure that students' book are free of misconception. This research has limitation on itss ability to analyse deeply the cause of misconception through book and how does it work to make students' experience further misconception.

2. AIMS

The study aims to investigate misconception exist on students' biology book. Concepts identification prior misconception determination. The result are hopefully can be used in evolution teaching at senior high school to help student achieved a correct understanding toward this learning material.

3. METHODS

The study is a descriptive-qualitative investigation. Research objects are biology students' book. Reseach instrument is named with **concept identification sheets**. Data come from quotation of concept explanation then analysed descriptively. To verify the result, triangulation technique is used by involving 3 experts in evolution expertise. Briefly, research stages consist of:

1. Opting and determining a students' biology book as research object. The book is coded anonymously with "X" publisher book and has met criteria: widely used throughout biology learning, specifically evolution topic, for class XII of SMA in Padang City.
2. Setting a textbook. In this case, a textbook tittled Biology, written by Campbell and Reece, 2008. This textbook is agreed because of the content has been updated periodically and arranged by using evolutionary approach. Besides, the book are also widely refered in most of biology learning.
3. Designing instruments.
4. Instruments are specifically designed for this purpose in order to acommodate all of valuable data with full responsibility.
5. Collecting the data. Data gathering stages started from reading the book, determining relevance concepts, rewriting the concepts from students textbook and also its explanation on the sheets. Then, a concept explanation is cited from a referred textbook, Biology by Campbell. All of data are detailed by its page and paragraph position.
6. Analysing the data.
7. Concept explanation in both book are compared each other. A concept in "X" publisher book which present incomplete or unsimilar meaning to Biology Campbell book, are determined as misconception. To assure researcher findings, data is trianguled by 3 expertise in evolution teaching, 2 are evolution lecturers, another is biology teaching. Finally, misconception is stipulated if 2 expertises judge misconception.

4. RESULTS AND DISCUSSION

Evolution learning material is one of learning courses for SMA Class XII. It describe all changes on living things which occurs in certain periods then inherited to next generation within population scale. Most students get difficulty to comprehend this topic due to processes are unreachable in time and location. Abundant live evidences are required to make this theory become real and acceptable in students mind.

It is commonly accepted that evolution topic is mostly known by its controversial issue "human originated from apes". A brief comprehension are required to argue this statement. Concept clearance is one of salient key. In contrary, a vague concept can cause misconception.

Misconception is a condition where a concept understood incorrectly. Dikmenli (2010, p.235) [4] state that misconception is part of knowledge system which involve interconnected concepts used by students to understand their experiences. Furthermore, Hammer (cited in Tayubi, 2005, p. 5)[21] explains misconception as a conception or cognitive structure which strongly and permanently remained in students mind, unfortunately the meaning is deviate from experts' view. This condition can lead students getting a distraction in understanding and conducting scientific explanation. Misconception also defined as a certainty which is not suitable with commonly accepted knowledge and also invalid, in term of phenomen and events (Omrod,, 2009, p.338). [15]

In this study, sixteen concepts presented in "X" book are claimed have wrong explanation and lead to misconception (later, author use term book misconception). Based on analysing the different explanation between students' book explanation and referred book' explanation, then verifyied by 3 experts, four misconception are identified. Misconceptions exist on concepts 1) half-life time (waktu paruh), (2) ontogeny (ontogeni), (3) microevolution (mikroevolusi) and (4) liposome. Completed results are presented in Table 1.

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Table 1. Identifyed concepts and misconception existed on "X" publisher's book and experts aggreement

No	Concepts	Experts No.			Decision
		1	2	3	
1	Evolution	-	+	-	-
2	Enzym	-	-	-	-
3	Protein	-	-	-	-
4	Protobion	-	-	-	-
5	Phylogeni	-	-	-	-
6	Fossil	+	-	-	-
7	Biogeography	-	-	-	-
8	**Half-life time**	**+**	**+**	**+**	**+**
9	**Ontogeny**	**+**	**+**	**+**	**+**
10	Sympatri Speciation	-	+	-	-
11	Allopatry Speciation	-	-	-	-
12	*Gene Pool*	-	-	-	-
13	**Microevolution**	**+**	**+**	**-**	**+**
14	*Cline*	+	-	-	-
15	Evolusi Makro	-	+	-	-
16	**Liposome**	**+**	**+**	**-**	**+**

Assertion :

Expert 1 : Rahmawati D, M.Pd.
Expert 2 : RRP Megahati S, S.Pd., M.Si.
Expert 3 : Dra. Febria Suhatri, M.Si.
\- : No Misconception
\+ : Misconception

Four concepts which undergo misconception will be explained below.

1) Half-life time concept

At "X" book, half-life concept is defined " time which is needed to change a half radioactive atoms become its more stable isotop (*waktu yang dibutuhkan agar separuh atom-atom radioaktif berubah menjadi isotopnya yang lebih stabil*.) On the contrary, refered books presents its definition as "the time required for 50% of the parent isotope to decay (waktu yang diperlukan bagi 50% isotop induk untuk meluruh). The difference between both explanation exist on "changes become a more stable isotop" vs "drop of". An expert clarifiy that first explanation is refer to defenition of nuclear transformation process, and dropping of does not mean to reach its stability, just falling of its quantity. In this case, the second concept is more appropriate and simpler.

2) Ontogeny concept

In "X" book, ontogeny is defined as the development of an individu from one cell become an adult (perkembangan individu dari satu sel menjadi individu dewasa). Instead, in referred book, ontogeny is defined as embrionic development on organism (perkembangan embrionik suatu organisme). First concept is incomplete rather than false absolutely. Embrionic development need to be emphasized on this definition. According to expert 1, embrionic development may begin from more than one cell, for example two gametes cell fertilize then grow become embryo. Nonetheless, second concept does not describe adequately time limit of embrionic development. Expert 3 notes that ontogeny is organisme development begin from zygot till a complete embrio, not an adult. It is recommended to revising these both concept.

3) *Microevolution*

Microevolution concept is stated quite different between both books. According to "X" book, microevolution is a gradual changes on genes level which produced phenothypic changes-physically looks- in an organism (perubahan bertahap pada tingkat gen yang menimbulkan perubahan fenotip/ penampakan fisik). However, refered book explain microevolution as alels frequency changes in a particular population from a particular offsprings to its next generation (mikroevolusi merupakan perubahan frekuensi alel dalam suatu populasi dari generasi ke generasi). There is a misconception in this concept. Expert 1 notes, it is not a certainty whether genes scale alteration will lead phenotipic changes, yet alleles frequence change. Similarly, expert 1 argue that genes scale level has narrower meaning that alels frequency changes. In contrast, expert 3 states that there is no misconception.

4) Liposome concept

Liposome concept refer to "X" book is protobion which is directly auto-formed into a tiny drops only if its organic composotion contains particular lipid (protobion yang langsung terbentuk dengan sendirinya menjadi tetes-tetes kecil apabila komposisi organiknya mengandung lipid tertentu). On the other hand, in reference book stated that lyposom is a few of tiny drops packed by a membrane, formed when water is added while lipid or other organic molecule formation. (liposom adalah beberapa tetesan kecil terlingkup membran, yang terbentuk ketika lipid atau molekul organik lainnya ditambahkan air). Difference between these definition described in Table 2.

Tabel 2. Deviation of liposome explanation

	Liposome concept	
	In students book	Referenced book
What	**Protobion** (collection of molecules formed abiotically and it is wrapped by a membran-like structure) **changes** into **small droplets**	**Small droplets** wrapped in a **membrane**

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Requirements	While **any lipid** contained in its composition	While **water is added** into lipid or organic molecule

Expert 1 verifyed that phrase "if presented in students book is ambigue, means that any possibility to attach various of lipid. Actually, lipid is not trigger factor, instead water.

Based on the findings, four concepts on this students textbook experienced msiconception. Student book's misconception can be recognized if concept explanation included is dissimilar with concept explanation in refered book. It is highly assumed that the cause of misconception lay on explanation technique and language using. According to Suparno Suparno (2005, p.53) [19], outlines causes of students' textbook misconception, are (1) wrong clarification, (2) innacuracy in writing, (3) advanced language style, (4) disjointed reading, (5) innacurate picture, and (6) using cartoonish or humorous drawing. If these factor found, the book is potentially cause books' sourced misconception.

In order to prevent books' misconception or book sourced misconception, validity of content information would be the most significant. Furthermore, Hernawan (2012) [8] explain that each students' textbook has to consider five requirements, are nationally securing, contents-curriculum relevancies, writtenly presenting technique, understoodable language and how to illustrate. If all of these citeria met, a students textbook would help students to comprehend its content. Besides, teacher need to analyse misconception contained and direct the students during textbooks reading.

9. CONCLUSION

To conclude, among sixteen identified concepts in students' textbook, for of them experienced misconception. these concept are half-time, ontogeny, microevolution and liposome. This misconception is due to inappropriateness of students' textbook explanation compare to referred book. Regarding to misconception possibility among common students' textbook, teacher need to analyse and identify concepts which experience misconception.

10. ACKNOWLEDGEMENTS

Excelency thanks are given for Dikti for the funding and Rector of State University of Padang for his eligibility in the research conducting. Respectable thanks are dedicated for researcher in this project and three experts who have contributed his mind and time for some valuable judgements. Honorable Dean of Science and mathematic Faculty, chief of Biology departement, and all colleagues who have actively participated to support this project.

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ISBN 978-602-19877-3-5

BIOLOGY EDUCATION STUDENT ACCEPTANCE OF EVOLUTION THEORY BEFORE LEARN EVOLUTIONARY COURSE IN BIOLOGY DEPARTMENT

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ABSTRACT

Studies on student acceptance of the theory of evolution have been conducted intensively in American and Western countries. This study purpose was to measure university students' acceptance of evolution in Indonesia, especially West Sumatera. This article reported a preliminary research to know biology education student acceptance of evolution before learn Evolutionary course in Biology Department, Faculty of Mathematics and Science, State University of Padang. Data collected using the MATE instrument by Rutledge and Warden (1999) that given to 37 biology education students who will take Evolutionary course in the second semester of 2015. The result showed that those students acceptance of evolution theory was 60.81%. This study concludes that biology education student acceptance of evolution theory before learning evolutionary course is in the low categories of acceptance. This condition is discussed and proposed some suggestions.

Index Termss — Biology Education Students, Acceptance of Evolution, Evolutionary Course

1. INTRODUCTION

Evolution is a knowledge which strongly controversy among public around the world, because of people's misunderstood on it [8]. The rejecting of evolution often relies on the misconceptions to evolution [15].

Despite the evolutionary concept have been more effectively proven by the molecular explanation [2], in United States, several studies reveal that many Americans have a poor understanding of evolution and reject it as a valid scientific theory (Gallup, 1993; Recer, 1996; cited in [11]). Whether citizens of the United States are less belief on evolution, citizens of Europe and several non European nations more believe on evolution [5]. But, it does not mean that all of them accept evolution. As the effect, a big range of misconceptions happens on learning evolution at school and even at the university students around the world.

Studies on student acceptance of evolution have been conducted intensively [14]. This kind of study is important to known by teacher or lecturer, because some studies suggest that there are two possibilities for people on evolution [8]. Firstly, people believe in evolution but do not understand on it. Secondly, people have understood about evolution theory, but do not accept evolution. It makes there are separately of knowledge and acceptance in learning evolution.

On the one hand, research has shown that student acceptance of evolution positively associated with their understanding of biological evolution in final grades (Ingram and Nelson, 2006 cited in [14]). On the other hand, some studies showed that there is little or no relationship between knowledge of natural selection and acceptance of evolution (Walter, Halverson, and Boyce, 2013). Although it is the fact in some countries, the relationship in Indonesia does not known yet. Therefore, this survey conducted to measure students' acceptance of evolution and the factors that influence it.

2. PURPOSE

This study purpose was to measure university students' acceptances of evolution. It was a preliminary research to know biology students' acceptances on evolution. This research will be the basic information for the follow up that should be carried out by lecturer when teaching evolution theory. Thus, our study assessed students' acceptances before they learn evolutionary course at Biology Department. The research question guiding this investigation was: "What is the level of acceptance of evolution theory among biology students before they learn evolutionary course at Biology Department?"

3. METHOD

3.1. Participants

The participants of this study were biology education students who will take Evolutionary course in the second semester of 2015 at Biology Department, Faculty of Mathematics and Science, State University of Padang. On this semester, there are two classes, but on this study only one class as the participants, in amount of 37 students.

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3.2. Measures

The Measure of Acceptance of the Theory of Evolution (MATE) instrument [10] was used to measure participants' acceptance in evolutionary theory. This instrument consists of 20-item questionnaire which questions as follow:

1. Organisms existing today are the result of evolutionary processes that have occurred over millions of years.
2. The theory of evolution is incapable of being scientifically tested.
3. Modern humans are the product of evolutionary processes that have occurred over millions of years.
4. The theory of evolution is based on speculation and not valid scientific observation and testing.
5. Most scientists accept evolutionary theory to be a scientifically valid theory.
6. The available data are ambiguous (unclear) as to whether evolution actually occurs.
7. The age of the earth is less than 20,000 years.
8. There is a significant body of data that supports evolutionary theory.
9. Organisms exist today is essentially the same form in which they always have.
10. Evolution in not a scientifically valid theory.
11. The age of the earth is at least 4 billion years.
12. Current evolutionary theory is the result of sound scientific research and methodology.
13. Evolutionary theory generates testable predictions with respect to the characteristics of life.
14. The theory of evolution cannot be correct since it disagrees with the Biblical account of creation.
15. Humans exist today in essentially the same form in which they always have.
16. Evolutionary theory is supported by factual historical and laboratory data.
17. Much of the scientific community doubts if evolution occurs.
18. The theory of evolution brings meaning to the diverse characteristics and behaviors observed in living forms.
19. With few exceptions, organisms on earth came into existence at about the same time.
20. Evolution is a scientifically valid theory.

The MATE instrument uses a five points of Likert scale ranging:

a. Strongly Agree
b. Agree
c. Uncertain
d. Disagree
e. Strongly Disagree

The MATE is scored using composite values from the 20 items with the lowest level of acceptance being 20 to the highest level of acceptance being 100. To determine comparative levels of acceptance, Rutledge (1996) as stated in [10] provides the following scores and categories:

89-100 = Very High Acceptance
77-88 = High Acceptance
65-76 = Moderate Acceptance
53-64 = Low Acceptance
20-52 = Very Low Acceptance.

The MATE items have been tested based on the reliability and validity to assess high school biology teachers' overall acceptance of evolution [10]. This instrument also have tested its reliability in using for university students, suggest that the MATE is a reliable instrument which appropriate for assessing our participants' acceptance of the theory of evolution [11]. This instrument also recommended by [14] as one of the four instruments to classify levels of student acceptance that have reviewed on his qualitative research.

3.3. Analyses

To account for positively and negatively-phrased items, the scaling of responses must be appropriately reversed so that responses indicative of a high acceptance of evolutionary theory receive a score of 5 while answers indicative of a low acceptance receive a score of 1.

Step 1. Scoring of items 1, 3, 5, 8, 11, 12, 13, 16, 18, and 20 is as follows:
Strongly Agree = 5
Agree = 4
Undecided = 3
Disagree = 2
Strongly Disagree = 1

Step 2. Scoring of items 2, 4, 6, 7, 9, 10, 14, 15, 17, and 19 is as follows:
Strongly Agree = 1
Agree = 2
Undecided = 3
Disagree = 4
Strongly Disagree = 5

Step 3. An individual score on the MATE is equal to the sum of the scaled responses to all 20 items. [11], (p.335).

4. RESULTS

This study presents biology education students' acceptance of evolution theory before learn evolutionary course in Biology Department by the concepts addressed by the MATE [11]. The data presents in Table 1.

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Table 1.Biology Education Students' Acceptance of Evolution Theory

CONCEPT	ITEMS	%
Process of evolution	1, 9, 18, 19	10.94
Scientific validity of evolutionary theory	2, 10, 12, 13, 14, 20	19.81
Evolution of humans	3, 15	6.54
Evidence of evolution	4, 6, 8, 16	10.71
Scientific community's view of evolution	5, 17	6.73
Age of the earth	7, 11	6.08
	SUM	**60.81**

This data shows that biology education students' acceptance of evolution theory is in the low acceptance criteria (in the criteria 53-64%).

5. DISCUSSION

This study presents that biology education students' acceptances of evolution theory before learn it in the university level is low category. This data consists of six criteria of evolutionary concept, and it re-arranged which percentage from the highest to the lowest as follow.

5.1. Scientific Validity of Evolutionary Theory, Process of Evolution, and Evidence of Evolution

Scientific validity of evolutionary theory concept got the highest percentage of acceptance by biology education students (19.81%), because they learned it at the senior high school. The students think that evolutionary theory is scientific, based on their basic knowledge from senior high school. It follows by the concept about process of evolution and evidence of evolution. This fact shows that teacher teach it at their school.

The free comments which filled by the students showed that the evolutionary concepts which students still remember from the highest level to the lowest until this data collected were:

a. Evolutionary changing = 81.08%
b. Natural selection = 40.54%
c. Heredity = 32.43%
d. Darwin and Lammarck theory = 27.03%
e. Speciation = 13.51%
f. Abiogenesis and biogenesis = 10.81%
g. The origin of life = 2.70%

Those concepts discuss by the teacher based on the evolution curricula in Indonesia. It proves to the students that evolution is a scientific theory which facilitated with some evidence.

Difference with Indonesian curricula, American has seven tendency of evolutionary topic, as the instrument developed by Bilica (2001) cited in [12] using TETS (Teaching Evolutionary Topic Survey). [12] Survey to the private school teachers used TETS showed that teachers tend to teach these seven topics with the percentage as follows:

a. Diversity = 84.2%
b. Natural selection = 81.6%
c. Speciation = 75.0%
d. Evidence of evolution = 59.2%
e. The speed of evolutionary process = 51.2%
f. Heredity modification = 44.7%
g. Human evolution = 30.2%

Based on those seven topics, only three topics that same with Indonesian curricula; natural selection, speciation, and heredity. The diversity in Indonesian curricula is included on evolutionary changing, as the result, it creates diversity of organisms.

Despite the different, the approach of teaching evolution understands more on the concept with low controversy on it, such as: diversity, natural selection, and also speciation. Those make the result of this study seems to be logic, because the students understand that evolution is a scientific theory which some concepts are provable.

5.2. Scientific Community's View of Evolution, Evolution of Humans, and Age of the Earth

These three topics are quite controversial among public, and students in this study also showed it. They gave lower percentage of acceptance on it. This condition formed by some possibilities. Firstly, their teacher never discussed this aspect at the senior high school. There is no explanation about scientific community view of evolution in the school. As the effect, the students do not understand about this topic, and also about evolution of humans and age of the earth. [12] Survey reported that on these three topics, American private teacher tend to do not discuss it in their class, because it do not linked with religiosity.

Different with United States, in Indonesia, the students do not learn about it because of those topics are not synchronize with the curricula. Based on Indonesian curricula document, evolution is in the 3.9 Basic Competences: Analyze about evolution theory and natural selection with the new view of speciation in the earth based on literary study [9].

5.3. Influencing Factors of Students' Acceptances

Student acceptance indicates that their acceptances influenced by varied factors. The dominant factor is the way of teacher taught them in the senior high school level. This fact also suggested by Carlesen (1991) cited in [7], teachers' understanding about a subject, will affect their way of teaching.
Students explained that most teachers taught evolutionary topic by lecture strategy only. It makes

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the students difficult to understand and the time to discuss it also very fast. The other strategy that teachers used was discussion, recorded, reading, doing worksheet, individual task, and debriefing. The teachers rarely used this alternative strategy, and just little teachers explain evolution in the appropriate time. This condition makes students understanding of evolution are low.

Students' understanding of evolutionary concept got some misconception from their teachers' explanation. As Thompson and Logue (2006) cited in [15], there are possible ways for student to develop misconception such as through parents, media, teacher, and others. Jarvis and colleagues (2003) cited in [8] reported that the teachers having misconceptions tend to teach their misconceptions to their students. It indicates that an educator will influence the students' understanding, conceptions, and also acceptance. This happens because teacher tends to teach what they were taught (Deemer, 2004; Kikas, 2004; Llinares & Krainer, 2006; cited in [8].

The ideal action that teacher must do when teaching evolution is teach evolution based on the right concept, and cultivate student wisdom for learning evolution. Individual wisdom is associated with experience, spirituality, and passion [3]. Therefore, students' experiences when learn evolution is the important aspect to change student acceptance on it.

The other factors that influence student acceptance of evolution are: evolution concept, religions, the difficulties of theory, students' curiosity, validity of references, the explanation in the textbook, evidences in daily life, scientists' ideas, and individual views on evolution.

Research conducted by [13] reported that students' acceptance of evolution is most often considered as a product of an individual's views of science and religion. When students perceive a conflict between their religious beliefs, students prefer holding on to their religious beliefs [6]. However, the data above differ with this survey result, which show teachers explanation for the majority factors that affect evolution. Less than 10% student on this study reported that their belief make them do not want to learn about evolution.

From the aspect of evolution conception, many studies have documented that once individuals shifting a conception (whether it is correct or incorrect), this person tends to argue on it briefly and resist receiving other perspectives, even it completes with evidences (Mason & Limon, 1999; Sinatra & Pintrich, 2003) cited in [8]).
This data correspondingly with several factors that affect learning and students' performance in education; related to teachers, students and others. The factor that related to teachers is adequacy in professional knowledge, teaching style, attitude, sympathy, language skill, etc. The factors that related to students are ability, attitude, need, learning styles, working memory capacity, and motivational styles, etc. Others factors such as physical situation, assessment methods, and socio-cultural factors [1].

Increasing the standard of learning evolution, United States' scientist had evaluated the factors that important to consider, such as: the selection of textbooks, the adequacy of teachers' own knowledge, and the organization of curriculum [4]. These factors have to be considering by Indonesian teacher to increase students' understanding about evolution concept and changing their conceptions.

5.4. The Effect of Student Acceptance of Evolution to Their Motivation of Learning Evolution in the University

According to [8], (p.15), low acceptance of students on evolutionary theory, "…, this presents a significant barrier for learning and teaching the scientific view of evolution." In addition, [14] also pointed out that a lack of acceptance of evolution may contribute to negative learning experiences about it, such as lower instrinsic motivation, less interest, higher anxiety, and more emphasis on grades.

It is different with our data. On one hand, despite the students' understanding of evolution are low based on their concept from senior high school, most biology education students are interested to follow Evolutionary course in the university level. They want to follow this course with different reasons. Majority students want to learn evolution because they have high curiosity to know the correct answer and explanation. They are generally in doubt with evolution theory, although some of them like this topic since senior high school because evolution consists of interested discussion and fact.

The other reasons that make students interested on evolution are because evolutionary concept also makes students become open minded and remind students about our origin and the origin of life.

On the other hand, some students told that they do not interested on learn evolution, because this topic quite confusing, difficult to understand, the evidences are rarely happen in daily life, and do not believe that evolution processes are really happen.

Biology education students claim that they have high motivation to follow Evolutionary Course because they want to make their misconception about evolution from senior high school become right conception. Misconception is an important factor that affects learning [1].

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In addition, the students also think that this course is very important to follow, because they will teach evolutionary topic after they graduated from the university. Understanding evolution concept in the university will help them when teaching evolutionary topic at the school. Therefore, they have to understand evolution well, in order to teach evolution better for the next time.

As [8] (p.16) cited: "Since teachers are products of the educational system, it is anticipated that they would also hold misconceptions of evolution". Therefore, it will be more effective to prepare university students who will teach evolution with conceptual shifts in their acceptance of evolution theory [8]. As the follow up, lecture have to make biology education students increase their understanding of evolution, to cut the chain of misconception of evolution from the school.

The other reason to learn evolution by the students are because much knowledge can learn from this course and some benefits can get by learning evolution for the way of people thinking by analyzing the changing in organism and life.

6. CONCLUSION

Biology education students' acceptances of evolution theory before learn Evolutionary Course in Biology Department, Faculty of Mathematics and Science, State University of Padang is "Low Categories of Acceptance". The majority factor that affects it is the way of teacher taught the students about evolution at senior high school, which combine with other factors such as evolution concept, religions, the difficulties of theory, students' curiosity, validity of references, the explanation in the textbook, evidences in daily life, scientists' ideas, and individual views on evolution. Despite biology education students have low acceptance on evolution; they have high motivation to learn evolution in Evolutionary Course of Biology Department, by the most reason because they have high curiosity to know the correct answer and explanation about evolution and they also consider to teach this topic next time when they are being a biology teacher.

7. SUGGESTIONS

The discussion of this study suggest for:

a. Teachers to teach evolution in the right strategy, in the appropriate way, in the suitable time, and cultivate individual wisdom of learning evolution.
b. All educators have found the alternatives to increase student acceptance and understanding of evolutionary theory.
c. All biology teachers have to make a whole and integrated understanding of evolution, to make the diversity of biology giving completely to the next generation.

8. ACKNOWLEDGEMENTS

This research conducted with some suggestions from my colleagues Muhyiatul Fadilah and Fitri Arsih who kindly supported me in many ways. I also give my thanks to my chairman of Biology Department for the support to publish this article.

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ISBN 978-602-19877-3-5

LEARNING STYLE OF FIRST-YEAR BIOLOGY COLLEGE STUDENTS IN STATE UNIVERSITY OF PADANG

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ABSTRACT

At the beginning of the learning process in college, one of the things that must be understood by a lecturers is identifying student's learning styles. Basic knowledge is needed about condition of the student in order to achieve instructional goals. By knowing the learning styles of students, lecturers can design techniques and methods to make an effective lecture time, to open the opportunity to make learning productive more, as well as to design appropriate approach for each activity. For students, this research will be useful to know whether learning method that they use is accordance with their learning styles, also to open some opportunities to change their learning habits, it can also be a reference for what types of careers corresponding roughly to live. By understanding the importance of basic knowledge about the learning styles, researcher have described the learning styles of freshmen year in Department of Biology, Faculty of Mathematics and Natural Sciences, State University of Padang. Of the 177 students who became the object of research, note 96 (54.23%) of them are visual learners. 58 (32.76%) of them are students who have audio style. The rest numbering 23 people (12.99%) have a kinesthetic learning style. These results provide information to faculty and students to use variety methods and media during the lecture time.

Index Terms— Learning style, visual, auditory, kinesthetic

1. INTRODUCTION

Learn at the college level can not be separated from active participation of students and lecturers who foster related subjects. Both aspects are keys to create a quality atmosphere of courses. The expected outcome of this process is the graduate can make a positive contribution to the environment and their society, since the main objective in the learning processes are to growstudent's dexterity, forming attitudes and their actions[1].

The lofty hope very influential to the process that occurs before. For example, acourse in the classroom, students who comes and sits only in the class without attempt to participate in class activities, lecturers who use the monotonous technique, of course, this condition will hamperinglearning objectives to be achieved by students. The success of an educational process in every level of education depends on the process experienced by participants of the students[2]. That successfull point can be measured byattitude and behavior of student's daily and also must be permanently.

Based on description in the previous explanation, lecturers have an important role to create graduates embodiment useful for society, therefore optimally teachers should strive withimprove continuously quality of their self in order to remainable to innovate techniques or methods of learning. Based on the theory of mental discipline Plato-Aristoteles, in the implementation of teaching, lecturers must be an actor to train their students[3]. The ability of lecturer to choose and use a variety of techniques or methods in learning are soft skills integrity within aneducator[4].

When lecturers makes an update and always changetheir style of teaching in the classroom will directly offset the learning style unit or group of students. By offsetting the learning style unit or a group of students, will facilitate that student to absorb the course materials provided by the lecturer. Because of when we understand one's learning style, learning will be easier and more enjoyable. Learning styles of the students do not relate with the attendance of lecturers in classroom[5].

When learning in the classroom is started, one of the first steps that must be understood by lecturers is identify students' learning styles, as the modalities of visual, auditory, or kinesthetic (VAK)[6]. Despite the development of many studies that reveal a new type of learning modality and adapt to the needs, but still it is needed basic knowledge about the condition of students in order to achieve the purpose of the instructional learning process[7]. By knowing the learning styles of students, lecturers can design manyeffective techniques or methods course[8]. It also open the opportunity to make learning more productive[9], and designing an appropriate approach for each activity in the classroom[10]. For students, this research will be useful to know whether learning method is used for this in accordance with its learning styles and opportunities to change the study habits[11], it can also be a reference for what types of careers that roughly correspond to do[12].

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By understanding the importance of prior knowledge about type of student's learning styles, researchers have described the learning styles of freshmen year in 2015 Department of Biology, Faculty of Mathematics and Natural Sciences, State University of Padang.

2. METHODOLOGY

This research is a descriptive study that conducted in September 2015. The object of research is all new students of the Department Biology, Faculty of Mathematics and Natural Sciences, State University of Padang.

The study was conducted by questionnaire to the research's object, and object were asked to fill out the questionnaire. Data collection assisted by two second year students from the Department of Biology, Sarah and Enjelvi Permanda. The questionnaire was adapted from the education planner, an online service provider to test the students' learning modalities. Once the data is collected, the study continued to analyze the result and make the tabulation of data. Data are grouped into three groups, namely the data of visual, audio and kinesthetic.

3. RESULT

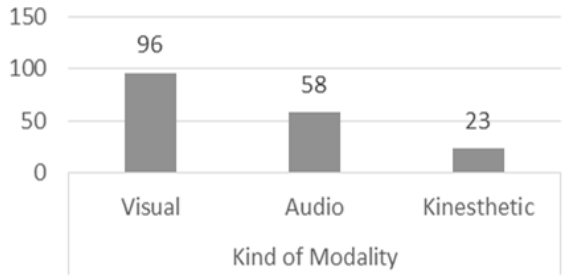

Figure 1. Distribution Data of Biology First Year Students

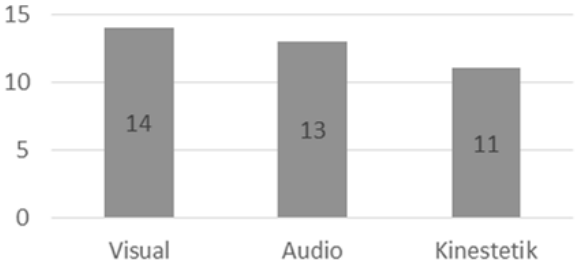

Figure 2. Distribution Dataof Biology EducationClass A

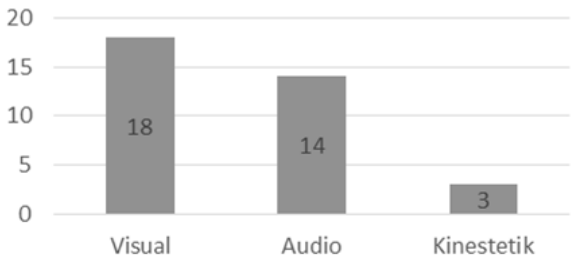

Figure 3. Distribution Dataof Biology EducationClass B

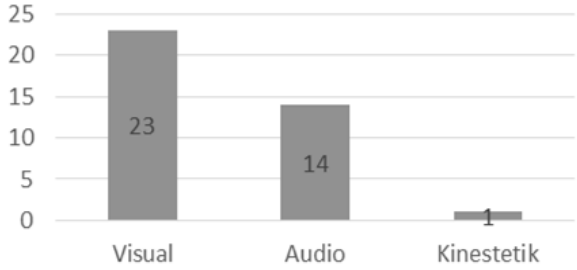

Figure 4. Distribution Dataof Biology Education Class C

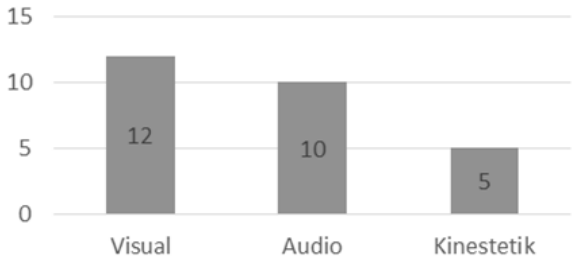

Figure 5. Distribution Data of BiologyClass A

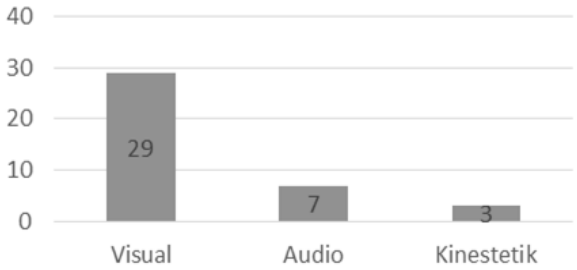

Figure 6. Distribution Dataof Biology Class B

Based on Figure 1. we can look that out of 177 students who became the object of research, note 96 (54.23%) of them are students who have a visual's learning style. 58 (32.76%) of them are students who have learning style type audio. The rest numbering 23 people (12.99%) have a kinesthetic's learning style.

Students who have a visual's learning style is 96 people total, or approximately 54.23% from all. That is consist of 14 people (14.58%) students from biology education class A (Figure 2), 18 (18.75%) students from biology education class B (Figure 3), 23 (23.95%) students from biology education class C (Figure 4), 12 (12.5%) class A biology student (Figure 5) and 29 (30.2%) students from biology

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classB (Figure 6). The finding of this study provide information to the reader that the dominant learning styles in freshmen students fromBiology Departmentis a visual learning style. The largest percentage of students with visual learning style is a student of biology class Babout 30.2% and the lowest percentage is studentin biology class A, that is 12.5% about.

Students who has visual's learning style emphasize learne activities by using the senses of sight (eyes). The use of images and colors are helping students to understand the course materials. Students with this learning style are asked to sit on the front row seat, because lecturers can observe more closely, as well as image material that is being given.

Students who has a learning style type audio is totaled 58 people, consist of 13 people (22.41%) students of biology education class A (Figure 2), 14 (24.13%) students of biology education class B (Figure 3), 14 people (24,13%) students of biology education class C (Figure 4), 10 people (17.24%) class A from biology student (Figure 5) and the last one is 7 people (12.06%) students of biology class B (Figure 6).

In addition to visual's learning style, there are students who have a learning style audioalso. Students who have this type of learning style will get their focusmore on sound based learning activities. Activities that use auditory stimulus as a catcher. Intonation of the lecturer when explaining the material help them to improve their understanding. It is recommended that students record the lecturer's sound when they heard explaination from the lecture material, it is very usefull because they can repeat again when they back home. The sitting position does not affecting them, but students with the type of audio learning is strongly influenced by level of noise in the surrounding environment of study. The largest percentage of students with audio's learning style are student'sfrom biology education class B and class C, there is 24.13%. The lowest percentage is in students from biology class B, that is 12.06%.

The third learning style which is owned by the students according to the results of this research are kinesthetic's learning style. The number of students who has learning style kinesthetic types are 23 people, 11 (47.82%) from the biology education class A (Figure 2), 3 (13.04%) from biology education class B (Figure 3), 1 people (4.34%) from biology education class C (Figure 4), 5 (21.73%) from study program biology class A (Figure 5) and 3 (13.04%) of the study program biology class B (Figure 6).

This learning style is different from others type. Students who has this learning styles will concentrate on learning if learning is designed for physical movement. Kinesthetic's learning style focused on the movement of limbs. They read and talk with the familiar moving the mouth or other body parts. Instructional design is fitting to the students of this type is the method the lab or demonstration. The largest percentage of students with kinesthetic's learning style is studentsfrom biology education class A, that is 47.82% and the lowest percentage is in students from biology educationclass C, that is 4.34%.

4. CONCLUSION

This study gives information to all students infirst year and also to Biology Department staff that dominate learning styles in their studentsare visual's learning style. In addition, also found other learning styles namely audio and kinesthetic. These results also provide information to chooseappropriate methods, medias and varied during the course.Acknowledgements researchers to all the parties involved in this study, especially Sarah and Enjelvi Permanda.

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ISBN 978-602-19877-3-5

DEEPENING MATTER AND TRAINING FOR COMPETENCE PROFESSIONAL AND PEDAGOGIC TEACHERS OF MATHEMATICS AND SCIENCE AT JUNIOR AND SENIOR HIGH SCHOOL IN DISTRICT DHARMASRAYA OF WEST SUMATRA-INDONESIA

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ABSTRACT

The teachers are one of key factor in students success acquire to get of science. Teachers have responsibility of professional education and teaching. The teachers are professionals in charge of planning and implementing the learning process, guidance perform, training and assessment. Is a professional teacher educators should have pedagogic, personality, social, and professional competence. The research aims to determine the initial value of professional and pedagogical competence of teachers junior and senior high school in the District Dharmasraya, West Sumatra-Indonesia. The study was conducted in September 2014, methodology with a competency test against 99 teachers. Mathematics as many as 33 teachers from 25 junior high school, physics and biology science 34 teachers from 24 junior high school and 32 mathematics teachers from 15 senior high school. To teachers conducted is pre-test, deepening matter and training, and post-test as research data. Quantitative analysis using Excel program. The results showed the average value of the pre-test of teachers of Mathematics SMP low at 45.45, however, increased by 25.55 points up 56%, the final value of 55.04. The pre-test pedagogical competence junior high science teachers are low at 48.28, an increase of 24.91 points up 51%. The final value IPA SMP teachers average of 52.79, post-test was 69.74 points up 32%. The average value of math teacher SMA/SMK is low at 45.94 increasing the value of pedagogical competence as high as 80.47, up by 75%. The final value of the average pre-test of 49.22.

Index Terms— deepening matter and training, competence professional and pedagogic, teachers of Mathematics and Science, Junior and Senior High School

1. INTRODUCTION

Teacher as educators are in charge of planning and implementing the learning process, guidance perform, training and assessment. Is a professional teacher educators should have pedagogic, personality, social, and professional competence. That education quality pendidikan outlined the national standard of education and teachers should have a minimum qualification and certification authority in accordance with the level of teaching, physical and spiritual health, as well as having the ability to achieve national education goals [12]. The teachers are one of key factor in students success acquire to get of science. Teachers have responsibility of professional education and teaching. Is a professional teacher educators should have pedagogic, personality, social, and professional competence [12]. Teachers are professional educators with the primary task of educating, teaching, guiding, directing, train, assess, and evaluate students in formal education, as well as on basic education and secondary education [7]. Furthermore, states that teachers must have academic qualifications, competence, teaching certificate, physically and mentally healthy, and have the ability to achieve national education goals. With regard to competence, a teacher must have pedagogic competence, personal competence, social competence, and professional competence acquired through professional education. Teachers are professional positions that provide expert services and demanding requirements of academic abilities and pedagogical and professionally acceptable in an environment where the teacher in charge. More specifically PP No. 74 tahun 2007 on Teachers [8], stated that the teaching certificate for teachers acquired through professional education programs organized by colleges that have a procurement program accredited educational staff. World Bank [14] states that teachers, school management and infrastructure is a determinant of the quality of education respectively 34%, 22%, and 26% in developing countries [10].

Teachers who teach in accordance with the profession must be quality that meets the specifications are in accordance with the quality assurance system / quality in fact and quality in perception [5], improving the quality of teachers, as well as provide learning and using the media and methods vary [10]. One effort to improve the quality of education is the achievement of minimum service standards, such as the ratio of students to teachers, teacher qualifications and competence of teachers in providing teaching in

ISBN 978-602-19877-3-5

schools in accordance with Permendiknas No. 053/2001[9]. According Nunuy stated that the principles of professionalism [4] under the legislation are as follows: have the talent, interest, call the soul, and idealism; is committed to improving the quality of education, faith, piety, and noble character; have academic qualifications and educational background in accordance with the task; have the necessary competence in accordance with the task.

The number of teachers nationwide are adequate, but the problem is the uneven distribution [11]. To that end, in addition to the average ratio of classroom teachers to study groups as a whole (district / city), needs to be seen also the ratio of classroom teachers terhdap study groups according to the school, the adequacy of the teachers at the level pendiidkan SMP / MTs and SMA / MA / SMK calculated according subjects, because each subject has a different learning free and liabilities subject teachers is 24 hours per week [2]. Ministry of Education stated that the issue of education is not only linked to the problem of school buildings that nearly collapsed, but also the classical problem, namely the lack of teachers, teachers who teach not in accordance with the educational background (mismatch), qualifying low, disparities competence, and distribution [2]. This can be evidenced by the current situation in Indonesia is still a shortage of 200,000 teachers.

In addition it is necessary to empirically validate standards and basic competencies. Increased competence standards are based on the curriculum [13]. The purpose of the curriculum is to improve the quality of education through self-reliance and initiative in developing the school curriculum, managing and empowering resources available. Teacher competency standards are always associated with: management competence component of learning and educational insight, academic or vocational competency component corresponding learning materials Professional Development [6]. Number of junioos and senior high school teachers over in District Dharmasraya as [1] number of schools SMP / MTs are 31 units of 6.799 the number of students, number of teachers 614 teacher, ratio: students was 11.07. At the senior high school level SMA/MA/SMK has a number of 12 units with 5,035 students and 510 teachers with teacher ratio: 9.87 for students. Teacher ratio: students better than in 2012, ie: for junior 12.53 and 15.71 senior high school [1]. Number of junior high school teachers amounted to 61 teachers of Mathematics and 61 teachers of Science. In senior high school teacher: Mathematics: 25, with a total of 147 teachers. For that conducted this study with the title of an increase in professional and pedagogical teacher. The purpose of the research is the first knowable basic data and mapping the capabilities and competence of teachers each field of science in understanding and mastery of science are taught. Both can know the capabilities and competence of teachers in the field of science each in doing the learning to the students.

2. METHODOLOGY

The research aims to determine the initial value of professional and pedagogical competence of teachers junior and senior high school in the District Dharmasraya, West Sumatra-Indonesia. This research was conducted in September 2014, methodology with a competency test against 99 teachers. To teachers conducted is pre-test, deepening matter and training, and post-test as research data. Quantitative analysis using Excel program and analysis of qualitative.

3. RESULT AND DISCUSSION

3.1. Value of Pre-test of teachers SMP

The average value of pretest pedagogic competence test Mathematic teacher SMP showed that low at 45.45, however there is an increased pedagogical value of about 56%. This shows a good improvement of the understanding of teachers in pedagogic competence. The final value of the average pretest of 55.04 is lower than the average value is 55.45 UKG. Training upgrades provide increased competence given the average value of the end of the post-test by 28% as shown in Table 1.The average value of the pre-test a Science teacher at SMP low at 48.28, however there is This shows a good improvement of the understanding of teachers in pedagogic competence. The final value of the average pre-test in the form of the total value of the professional and pedagogical value of 52.79 an average value post-test is 69.74 points up about 16.95 points, or 32%. The average value of the pre-test test math teacher pedagogical competence SMA / SMK is low at 45.94, an increase in the value of pedagogical competence by 24.91 points, or around 51%. This shows a good improvement of the understanding of teachers in pedagogic competence. The final value of the average pre-test in the form of the total value of the professional and pedagogical value of 52.79 an average value post-test is 69.74 points up about 16.95 points, or 32%. The average value of the pre-test test math teacher pedagogical competence SMA / SMK is low at 45.94.However, after the enrichment and deepening of the material obtained by increasing the value of pedagogical high at 80.47, up by 34.53 points, or around 75%. It showed an increase. Which are both understanding the teacher in pedagogical competence. The final value of the average pre-test such as the number of professional values and pedagogic value obtained 49.22, while the average value was higher

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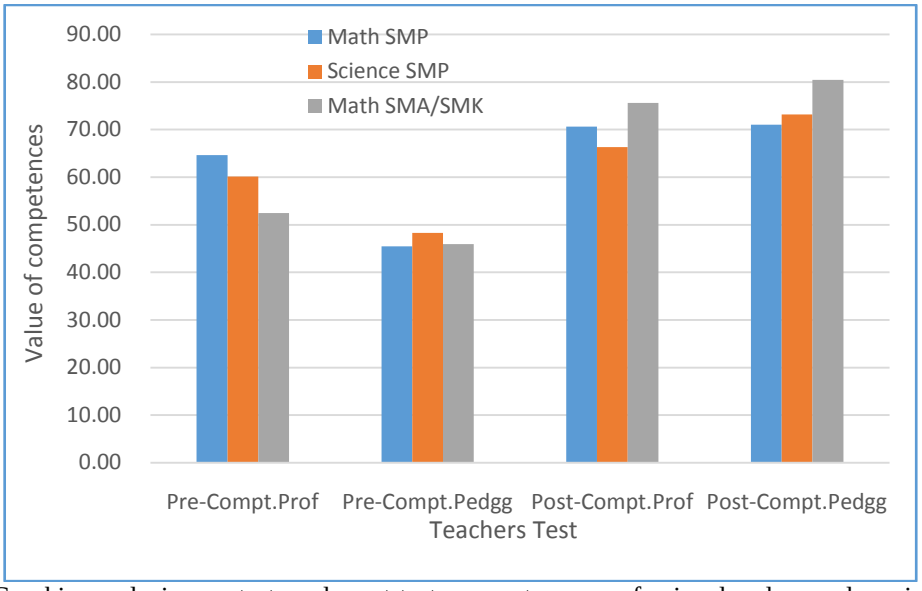
than the UKG's value 35.43. Increase in total the average post-test score is 58% .

Table 1. Avarage value of competence professional and pedagogic tests for teachers Mathematics SMP, Sciences SMP and Mathemathics SMA/SMK.

Teachers/ *Standard Dev.*	Pre-test		Total	Post-test		Total	UKG's
	Compt. Profess.	Compt. Pedgg.		Compt. Profess.	Compt. Pedgg.		
Math SMP	64.62	45.45	55.04	70.61	71	70.8	55.45
Standard Dev.	*10.59*	*13.94*	--	*8.82*	*9.43*	--	--
Science SMP	60.15	48.28	52.79	66.29	73.19	69.74	na
Standard Dev.	*21.37*	*23.13*	--	*19.45*	*12.75*	--	--
Math SMA/SMK	52.500	45.940	49.220	75.63	80.47	78.05	35.43
Standard Dev.	*8.80*	*15.05*	--	*13.37*	*12,79*	--	--

na: no available

3.2. Analisys of Competence Profesional and Pedagogic



Graph 1. Graphic analysis pre-test and post-test competence professional dan pedagogic teachers of Mathematics SMP, Science SMP, and Mathematics SMA/SMK.

There is an increase in the value of teachers' professional competence and pedagogical science subjects Physics and Biology SMP before and after the test / test, but was not statistically significant. The results of the competency test analysis showed an increase in the standard deviation but also quite high, both before and after the deepening of the material is given to the participant teachers as can be seen in Table 1. From these results it can be concluded that the deepening of the material provided to teachers teaching science Physics and Biology has not shown any significant change. It is expected to further deepening and enrichment of the material needed to be done to improve the ongoing teachers' skills and competencies. The observation during the implementation of the enrichment and deepening meteri also show a high motivation for teachers and expect plus training time. Pretest value test of professional competence and pedagogical math teacher SMA / SMK is low, that is below the value of 55, but after being given the deepening and enrichment matter can increase the value of these competencies. The results of the post-test and a test of professional competence of teachers pedagodik mathematics courses SMA / SMK there is a statistically significant increase. The results of the competency test analysis showed a significant increase for the second test of professional competence and pedagogical competence test, ie after the deepening of the material given mathematic SMA / SMK to participating teachers as can be seen in Graph 1. Overall the training material and material enrichment of each field of study that tested the competency test and test pedagogical competence profesioanl secondary school teachers increased. It can be stated that the training gave positive results seen from the increase in value and understanding of teachers' professional ability and pedagogical.

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4. CONCLUSIONS

1. The average value of professional competence of teachers and SMP and SMA / SMK is sufficient, while the value of all the pedagogical competence of teachers is still low. Results enrichment and deepening of the material, as well as the training provided to increase the value of professional competence and pedagogical school teachers but not significant.
2. Results of enrichment and deepening of the material, as well as the training provided to increase the value of professional competence and pedagogical senior high school math teacher high and statistically significant compared to junior high school teacher.
3. Increasing the value end of the post-test of senior high school teacher higher than junior high school teacher and statistically significant.

4. ACKNOWLEDGEMENTS

Gratefulness to Policy Research Centre, Council Research and Development, Ministry of Education and Culture Republic of Indonesia and Goverment District of Dharmasraya for financial and facilities supporting this research.

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ISBN 978-602-19877-3-5

FISH FARMING OF NILA TO AGAINST THE POPULATION RELIANCE OF BIOLOGICAL RESOURCES AT KERINCI SEBLAT NATIONAL PARK (TNKS) IN NAGARILIMAU GADANG LUMPO, PESISIR SELATAN

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ABSTRACT

Geographically, Nagari Limau Gadang is located adjacent to the Kerinci Seblat National Park (TNKS). The distance of Nagari Limau Gadang with TNKS area is about 2 Km. Nagari Limau Gadang consists about 2,500 people of 500 families (KK). About 250 families have lands cultivated at TNKS. The activity of fields manufacture was cut and burned the forest. The Logging and burning activities caused many species of flora and fauna were threatened with extinction. Economic activity of population is pressing The TNKS region very high, because TNKS forest is the place where they earn for living. The economic activity of Nagari Limau Gadang population can be survived without explored the TNKS if we are able to create other economic business options, such as Nila fish farming. Economically, Nila fish farming is very profitable, and then the use of artificial feed itself can be carried out for the cultivation of Nila. Nila fish farming could be a model of economic activity option for reducing dependence of Nagari Limau Gadang population of TNKS on biological resources. The purpose of this study is that people no longer make a living in the forest of TNKS. Specific targets to be achieved from this study is for rising standard of living for Nagari Limau Gadang population and releasing the TNKS forest from the pressure of population and minimalizing the natural disasters at Nagari Limau Gadang. To achieve the goal, we need the action research. The population sample is who earn a living at the TNKS forest been as many as 40 families, and then divided into 5 groups. In the first conducted research activities are counsel and guide the population sample on: (1) the benefits of the ecosystem and human, then the risk of make a living in TNKS; (2) create a pond breeding and rearing of Nila fish; (3) the breeding and mendeder the Nila fish; (4) Making the fish feed; (5) collecting data of economic activity conducted population sample. Data taken from sample's frequency of visits to TNKS. The economic activity data in the first year of the study were compared with data on a sample of economic activity in the second study. The second year of study lasts about 6 months. To see the similarities or differences between the mean results of economic activity used formula T-Test statistics. Activity is expected in the second sample is not more economic activity in the region TNKS. Of aquaculture for 6 months produced: (1) fingerlings 25,000, (2) an enlargement and nursery 5 units, (4) feed. The mean percentage of traffic TNKS sample members for 6 months to 86%. The visit to TNKS still high, it could not be concluded because the second phase of the research has not been carried out. Based on the research in second year, the group visitation level to TNKS is 75,06% in a month. The average of frequency reduction to TNKS is about 11.06%. The reduction of visiting to TNKS in second year of cultivating Nilotica can fight out the public dependence to TNKS.

Index Terms---TNKS, Aquaculture, Nila, Natural Resources, Economic Activity

1. INTRODUCTION

Seblat Kerinci National Parkis a tropical forest ecosystem that has high biodiversity of flora. Among the flora and fauna is rare and endangered species as well as under-represented in other protected areas in Sumatra. Seblat Kerinci National Park is the source of the water catchment of several large and small streams, so that the water resources of about 10 million hectares of watershed make this area as part of a "life support system" in the region. The adorable nature and ecosystems and their biodiversity at TNKS has a very important meaning, both as a life support as well as a source of genetic reserves, where research, education and tourism destination.

Geographically, Nagari Limau Gadang is located adjacent to the TNKS. The distance of villages (villages) with TNKS area is about 3 km. There are not limitation area between Nagari Limau Gadang and TNKS. Farming area is directly united with TNKS.

Nagari Limau Gadang is consists of about 2,500 people from 500 families (KK). There are about 250 families have cultivated lands at TNKS. The resident fields planted with various crops, such as cinnamon, nutmeg, coffee, nut, and crops. The manufacture activity of farming is about cut and burn the forest. Due to logging and burning cause many species of flora and fauna threatened with extinction. Other economic activities of people, who suppress TNKS forest, are porters of processed wood, seeking for Madang, taking Manau and seeking Gaharu. Suppress economic activities TNKS region is very advanced, because the forests is the only place where they get the money to carry out from work, without the forest,

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they may not be able to carry out their daily lives. Economic activities outside the region TNKS farming and grow rice in paddy is not enough for adequate the economy to support the population.If we do the observation, economic activity in the region TNKS is not the best and right choice, but it will forced to save the run and the household economy.

Number of processed wood are transported every day to a village population are about 3 cubic Manau and Madang skin is about 3 cubic. Manau and Madang skin are produced in seasonal (not every day). Economic activities take biological resources of forests and farming clearly damaging ecosystems and lowering the rate of biodiversity TNKS region.

Economic activity at the region TNKS population Nagari Lemons Tower has lasted for 30 years. As a result of population pressure on TNKS region resulted in several species of flora and fauna to extinction. Based on studies in the field, the total area of timber extraction in TNKS has reached an area of approximately 50 ha.

Engage in economic activities (for a living) at TNKS has very high risk because the distance to pick up the wood into TNKS region reaches 14 km and impassable terrain is very dangerous. Based on interviews with 50 resident researchers, who conduct daily activities as porters, wood, they said that they were bored for taking the woods, but circumstances force. Economic activity in the village is not sufficient to meet the needs of life. On average their income as porters wood Rp. 10.000, - per day.

According to researchers Nagari Limau Gadang population can survive the economic activity outside TNKS if the government or the party concerned TNKS capable of creating economic business options, such as raising poultry, gardening outside TNKS and freshwater fish farming. All of these efforts is very promising economic improvement of the population.

One form of proper economic business conducted is the cultivation of Nila fish. Economically Nila fish farming is very profitable. Based on direct experience of researchers cultivate Nila in the pond jetted to 1 ton of fish can achieved the consumption a profit of about Rp. 2.000.000, - within 3 months. The average daily income of Rp. 20.000, -, hence the use of the feed itself can be carried out for the cultivation of Nila. Nila fish farming can be an option Model of Economic Activity to Reduce Dependence Population Nagari Limau Gadang of the Biological Resources at TNKS.

Objectives and benefits of the research are:

1.1 Train the sample population to cultivate Nila fish, so they are skilled at making the pond, pond enlargement, making pellets, and making seeds.
1.2 The sample population earns their living in villages by growing Nila fish.
1.3 Population of Limau Gadang is not press the TNKS, so the Limau Gadang villages can release from flood.
1.4 Economic of Limau Gadang population increases, and then the materialized prosperous society.

Poverty and damage TNKS.

Environmental damage caused by many factors, especially the human activities that are not friendly to the environment itself. Humans should be responsible for preserving the environment, but they would damage the environment. They tend to take the natural resources arbitrarily, causing damage and pollution. After the natural resources used, they do not care about the needs of future generations also have the right to enjoy it. The Needs often encourages people to take TNKS natural resources on a large scale without considering its impact. One of the main factors causing environmental degradation is poverty TNKS (Ferryal 2010).

Poverty literally can be said as a state does not have any sufficiently. In the various views, there are three types of poverty are seeing noted that structural poverty, relative poverty and absolute poverty. Structural poverty is understood as poverty arising as a result of government policy and corporate behavior that makes people poor, no or very few have access to the productive economy. Relative poverty is poverty that arises not only from the aspect of revenue alone, but also alive in a social environment. While absolute poverty, according Sumodiningrat (1997) that poverty is measured from the level of ability to pay for basic living according to the dignity of human life.

Many experts argue that poverty is one of the main causes of environmental degradation in TNKS. Environmental damage caused by the poor tend to be influenced by their mindset because they are oppressed by poverty, their thoughts focused only on foods that they can get to survive today. Narrow thinking is what drives them damaging to the environment and plunder of natural resources without giving time for nature to renew its resources (Altin, 2007)

Forest destruction because of poverty also occurred in the Seblat Kerinci National Park at Nagari Limau Gadang. The damage of the Seblat Kerinci National Park is estimated to have been quite severe about 50 ha. The damage of the Seblat Kerinci National Park includes flora, fauna, and land.

Activity of Limau Gadang villagers earn their living at TNKS eg farming, hunting, and gathering other natural resources. As evidence of ecosystem damage TNKS at Nagari Limau Gadang, there has been a flood in 1997. According Yusran (2011) TNKS ecosystem damage can be overcome by over economic activities. One of the economic activities that can be done by the public is freshwater fish farming, because land and water resources are very supportive in Nagari Limes Tower. Yusran (2011), said fish farming would be able to improve the local economy so that they would not enter the forest.

Associated with fish farming, fish farmers experienced problems in getting a cheap feed, because the fish feed prices tend to rise. According Sinaga

ISBN 978-602-19877-3-5

(2013) when farmers use artificial feed material from the plant, its value could reach 70% of all cost components. One effort that can be done so that freshwater fish farming success is making their own feed. Most of the fish feed raw materials available in Nagari Limes Tower.

Nila Fish.

According to the latest classification of the scientific name is *Oerochromis niloticus*. Oerochromis genus name according to the applicable classification previously called Nila. The name changing has been agreed and used by scientists, even among lay still called *Tilapia nilotika*. Experts fish (ichtyologi) grouped into three genera Nila genus based on the behavior of concern for the eggs and their children, namely:

1.1 Genus Oerochromis, parent female fish lay eggs in the mouth and take care of their own children, for example: *Oerochromis niloticus, Oerochromis hunteri, Oerochromis anreus, and Oerochromis spillurus.*

1.2 Genus Sarotherodon, parent male fish lay eggs and raising children, for example: *Sarotherodon galileus* and *Sarotherodon melaotheron.*

1.3 Genus Tilapia, do not lay eggs and larvae in the mother's mouth but on a substrate (a), for example: rendali Tilapia and Tilapia sparmanii.

Generally, Body shape of Nila is long and slender, the ratio between the length and height of 3: 1, Nila fish scales are large and coarse, etonoid shaped with stripes (streaks) vertical dark colored on the fins. Body color fish vary greatly depending on the strain and type. Nila plain black colored whitish while the red colored red Nila. Nila has a dorsal fin with the formula: DXV, 10 ID = Dorsolis (dorsal fin), XV = 15 spines and 10 = 10 fingers weak] and pelvic fins VI, 6 [V = Vlatralis (pelvic fins), 1 barb and 6 jari0jari weak]. Nila fish eyes are round, prominent and white colored edges (Rukmana, 1997).

Hence the Gift Nila fish result of crosses between several species excels in several countries in the world, the nature of his life together with local Nila. Gift Nila can live in fresh waters, eg ponds, rice paddies, rivers, lakes, swamps and puddles with gradual adaptation techniques. According Rukmana (1997) "Nila can still grow in a state of salted at salinity levels of 0-35 per mil". Djarijah (1996) says that "the optimal salt concentration for Nila fish farming is 0-10 per mil".

The Ideal habitat for fish farming freshwater is having a temperature between 14 ° C - 38 ° C or the optimum temperature of 25 ° C - 30 ° C. The temperature is too low (less than 14 ° C) and very high (over 38 ° C) can inhibit the growth of Nila (Rukmana, 1997).

Fish feed

Every living organism needs food for survival and growth. Food for fish can be obtained from nature (natural food) and human (artificial feed). The feed material is consumed by animals serve as a food source and a source of nutrients or both in the ration (food regularly provided or consumed by an animal) (Cruz, 1996). Hidayat, D. (1985) states that "the feed eaten by the fish used its energy for survival and the excess will be used for growth". Nutritional elements needed by fish as follows:

1.1 Ptotein

Protein is one of the most important elements needed fish for power and for growth (Mujiman, 2000). Protein is considered as the main nutrient in food rations because they can not be replaced by other nutrients eg, fat can be replaced by carbohydrates as an energy source.

Protein function, to stimulate the growth of fish, maintenance of body tissues, the formation of certain enzymes and some hormones, regulating certain processes in the body and as a source of energy (Djajasewaka, 1985). Protein is absorbed in the form of amino acids.

In general, fish require more protein than farm animals on land (birds and mammals). The Needs of protein in fish ranged between 20-60% by weight of the total, while the need for optimum 30-36% (Mujiman, 2000).

1.2 Fat

Fat is the highest energy source in fish feed, serves to maintain balance in the body and the buoyancy of the fish in the water (Djajasewaka, 1985). Needs fatty fish ranged from 4-18%, with energy efficiency can reach 85-95%, while the need for optimum 10-16% (Mujiman, 2000). Fat is absorbed in the form of fat droplets are formed from the merger of triglycerides (the results of the synthesis of fatty acids and glycerol), phospholipids and cholesterol. Excess fat will be stored as a backup food (Soewolo, 2000). The accumulation of fat in fish tissue will cause the fish gain weight.

1.3 Carbohydrates

Carbohydrates serve as an energy source for fish. Carbohydrate needs for fish ranged between 15-30%, for a carnivorous fish ranged between 10-20% (Djajasewaka, 1985). Carbohydrates are absorbed in the form of glucose, fructose and galactose. Excess carbohydrates are stored in the body of animals as food reserves in the form of glycogen in the muscles (Winarno, 1997). Stockpiling of glycogen in the muscles will cause the weight of fish gain weight.

1.4 Vitamin

Vitamins function as part of the enzyme and coenzyme, so it can also be said regulating various metabolic processes, in order to maintain the function of various body tissues, affecting the growth and formation of certain cells in the body. Needs vitamin in fish adapted to the needs, ranging from 1-2% (Djajasewaka, 1985).

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1.5 Mineral

Minerals function in the formation of various tissues such as bone, teeth and fish scales. Regulate the balance of acids and bases in the body, to the process of osmosis between the liquid and the environment, for the blood clotting process and for other metabolic processes in the body. Mineral needs in fish is required only in small amounts and is usually mixed with vitamin (Djajasewaka, 1985)

The raw materials needed to make feed Nila are:

1.1 Concentrate

A protein source raw material used in this study because it is a product of the plant concentrates that are easy to obtain. Concentrates contain very high protein and has become a standard as a source of protein to feed fish and poultry. If the concentrate can be replaced with trash fish or snails in the research sites.

1.2 Cassava

Is the raw material that is prioritized in this study, because it is easily obtained has never been used by people as a raw material feed. Aside from being a raw material, cassava also serves as an adhesive (binder) (Soetanto, 1998). Cassava is used in the form of subtlety of cassava that has been boiled. The goal is to induce sap boiling and eliminate toxins HCN contained by cassava. In the list of foodstuffs aalisa issued by the Directorate of Health Nutrition, nutritional stated that cassava is: 1.2% protein, 0.3% fat, 34.7% carbohydrates, 63% water (Djaeni, 1999, p 290).

1.3 Bran smooth.

Is a byproduct of rice milling, largely made up of layers of pericarp and bran. The raw material is easily obtained in a rice mill and hargamya relatively cheap. Preferred bran has a texture (btiran) smooth, moist, no smell musty, and have fresh colors. Bran contains nutrients: protein 11.35%, 12.15% fat, carbohydrates 28.62%, 10.5% ash, crude fiber 24.46% and 10.15% water (Mujiman, 2000).

1.4 Premix

Is a material that contains vitamins and minerals that dbutuhkan fish in certain sizes. This premix is instantly available in the packaging and the composition of which has been listed on the label. This premix can be obtained easily, especially in the sales depot fodder.

Feed Mechanism Effect on Growth

Growth in fish is a fish the size of the change in the form of a weight, length, volume for a certain time. Fish growth will occur when the amount of food consumed more fish than makana amount needed for basic metabolism, movement, sexual orga production, treatment of body parts or to replace damaged cells (Effendi, 1978). One goal is to meghasilkan aquaculture fish products as much as possible in a short time. This can be achieved by giving artificial feed that has nutritional value in accordance with the needs of the fish.

Nila has a slightly elongated body shape flattened laterally. Mouth (lips) are at the threshold of the center. Has two pairs of mustache, sometimes having one pair of antennae, the radius of the second dorsal fin hardened like a saw, while located between the two fins, dorsal and ventral opposite. Pectoral fins located behind the gill cover. Nila relatively large scales cycloid type, intestines generally not so long, have no stomach, no teeth so that when digesting food as a substitute pengerusnya is part pharing hardened (Santoso, 1993).

Habitat Nila are usually cultivated per ponds, can be bred throughout the year, spawn at the beginning or throughout the rainy season (Santoso, 1993). According to Santoso (1993) Nila can grow normally, if the maintenance locations in town at an altitude between 150-1000 meters above sea level, water temperature 20 ° C - 25 ° C, water pH between 7-8.

The main source of oxygen for breathing is dissolved oxygen. Many of dissolved oxygen depends on the water temperature, the presence of organic matter and the amount of aquatic

vegetation. Generally Nila breeding at 5 ppm dissolved oxygen conditions. Dissolved oxygen in water is affected by temperature, pH and the concentration of carbon dioxide (Lingga, 1994; 13).

2. RESEARCH METHODOLOGY

The method used in this study is the experimental method to appoint 40 families (KK) as the sample (respondents) of 250 families that are highly dependent for a living (economic activity) in the region of TNKS. Samples are 25-40 years old. Age 25-40 potential economic activity in TNKS because they were young and strong.

Samples were made into 5 groups, each group consisting of 8 people. Each group fostered manage a pool. Processing includes the development, manufacture ponds, feed manufacturing, spawning, nursery, seed stocking in ponds, maintenance and marketing. The study period was divided into two phases. The first stage takes 6 months. Once the first phase is completed followed by a second phase of research. In the first phase guidance activities done to make the feed, making the pool, spawning, nursery, stocking of seedlings into the pool, maintenance and harvesting. During the first phase of the study lasted retrieved data about economic activity in the region

TNKS Sample.

Data taken the form of the frequency of arrival of the sample into TNKS. Economic activity data sampled at the first stage of the study compared to the economic activity data sampled at the second stage of the study. The second phase lasts about 6 months. To see the similarities or differences in average output of

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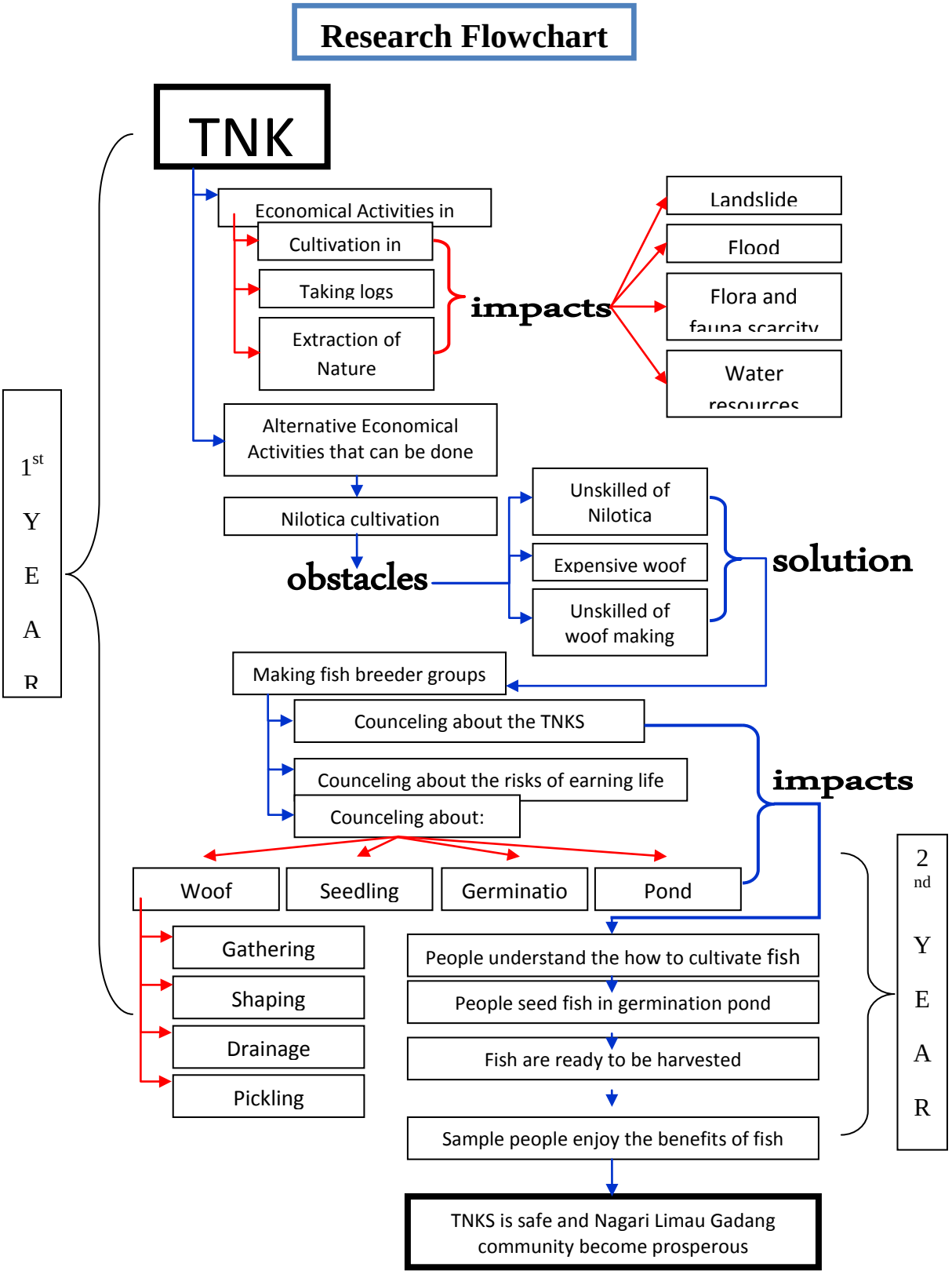
economic activities used formula T-Test statistics. Expected in the second stage of sample activities are no longer carry out economic activities in the region TNKS. Factors causing the sample does not perform economic activities in the region TNKS because they have felt the first harvest Nila fish farming. They can compare the results received from the cultivation of Nila with the results received from economic activity (for a living) in the TNKS. For more details on this study can be seen in the flowchart.



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In the first year conducted research activities:

a. counsel sample population on the benefits to the ecosystem and human at TNKS;
b. counsel risk of making a living at TNKS on ecosystems and humans;
c. guiding the sample population to determine and design the location of the pool;
d. guiding the sample population make breeding and rearing pond Nila fish;
e. guiding the sample population and mendeder breeding Nila fish;
f. guiding the population sample making fish feed (pellets) includes selecting, brewing, printing and drying the feed ingredients;
g. collecting data of economic activity conducted sample population: the frequency and amount of income;
h. analyzing the research data;

3. RESULTS AND DISCUSSION

a. Produced fingerlings of 25,000 head size 3-5 cm, age 2-3 months were obtained due to the high number of group members to an already understand how membibit and work seriously.
b. Swimming enlargement 5 units, each the size of 4x6 m.
c. Swimming nursery 5 units, respectively ukurang 15x25 m.
d. Generated feed (pellets), the result of an exercise group members. Pellet containing nutritional standards for the consumption of Nila. Pellet can be made members of the pool of 20 kg / day per person. If the printer pellet appliance driven by the engine, the pellets can be produced 350 kg / day. The volume of pellets produced will be paid back when it is done with the engine power.
e. Seed produced enough to fill 5 pools research to be raised. Each pool contains 5,000 hatchlings research.

Level members of the group caught on TNKS pool, pond, and feed

a. Based on a survey of members of the pool, obtained information:
b. A total of 36 people (90%) of group members do not understand the benefits of an TNKS (Seblat Kerinci National Park) to the surrounding environment. Ignorance of the group caused no TNKS an extension of the government, both villages and the district government.
c. A total of 38 people (95%) of group members do not know the risk of damaging at Seblat Kerinci National Park (TNKS) to the environment prominence. The high percentage of group members do not know the damage TNKS pool because they can not be extension of the government.
d. Members of the group an understanding to make the pond Nila fish pond only 2 (5%). Only a minority of the population who know to make the pond, it is because members of the pool everyday for a living in TNKS. They are not pursued to earn a living in their villages, for example the cultivation of freshwater fish.
e. Members of the group pool that is able to make an enlargement of about 5 people (12%). The low percentage of members of the group were able to make the pond rearing ponds because they are not commonly cultivated freshwater fish.
f. No one group member can create a pool of fish feed (0%). The absence of members of the pool were good at making fish feed, because they have never led to make fish feed and cultivate fish.

Level visits to group members pool TNKS Year 1

The mean percentage level visits to group members pool TNKS:

a. The mean of the visit members of the pool to TNKS in February, the first week was 84.6%, the second 88.2%, 85.7% the third and fourth week of 87.5%. The high percentage of the frequency of visits to the pool TNKS group members, in February, March and April because they do not get results cultivate Nila.
b. The mean visits to group members pool TNKS in March, the first week was 84.6%, the second 86.4%, 83.9% the third and fourth week 86%.
c. The mean visits to group members pool TNKS in April, the first week was 83.9%, the second 84.6%, 87.5% the third and fourth week of 89.2%.

The high percentage of the frequency of visits to the pool TNKS group members, in February, March and April because they do not get results cultivate Nila. Overall during the 3-month average of the group members visit each month TNKS to 86%.

Based on a survey of members of the pool, obtained information:

d. A total of 36 people (90%) of group members do not understand the benefits of TNKS (Seblat Kerinci National Park) to the surrounding environment. Ignorance of the group caused no TNKS an extension of the government, both villages and the district government.
e. A total of 38 people (95%) of group members do not know the risk of damaging at Seblat Kerinci National Park (TNKS) to the environment prominence. The high percentage of group members do not know the damage TNKS pool because they can not be extension of the government.
f. Members of the group an understanding to make the pond Nila fish pond only 2 (5%). Only a minority of the population who know to make the pond, it is because members of the pool everyday for a living in TNKS. They are not pursued to earn a living in their villages, for example the cultivation of freshwater fish.

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g. Members of the group pool that is able to make an enlargement of about 5 people (12%). The low percentage of members of the group were able to make the pond rearing ponds because they are not commonly cultivated freshwater fish.

h. No one group member can create a pool of fish feed (0%). The absence of members of the pool were good at making fish feed, because they have never led to make fish feed and cultivate fish

The mean percentage level visits to group members pool TNKS in Year II:

a. The percentage of visits to group members pool TNKS in April, the first week was 76%, the second 78.6%, 77.1% the third and fourth week of 77.1%.

b. The percentage of visits to group members TNKS pond in May, the first week was 73.6%, the second 74.6%, third 75%, and the fourth week 75%.

c. The percentage of visits to TNKS kolan group members in June, the first week of 74.2%, the second 76.4%, 71.8% the third and fourth week of 70.7%.

d. Tingginya percentage frequency of visits to the pool TNKS group members, in April, May and June, due to members of the pool not getting farmed Nila, while they must meet household income then they still have to enter TNKS for a living.

e. Rerat a visit to the pool TNKS group members in April 77.2%, 74.7% in May, and in June 73.3%.

f. Frequency of visits to group members pool TNKS lower in May compared to the month of April. This situation shows the rate of visits to TNKS began to decrease because the group members focus more pools to cultivate Nila.

g. Average of visits to the pool members TNKS in June lower dibandingankan in May. More pronounced decline in the third and fourth weeks. Decrease visit keTNKS pool group members in June caused by Ramadhan factors.

h. Overall during the 3-month average of the group members visit each month TNKS to 75.06%.

4. CONCLUSIONS AND SUGGESTION

4.1. Conclusion

a. Most members of the group pool does not understand the benefits and risks damage to the surrounding natural TNKS.

b. Visit the group members to an extremely high TNKS.

c. Members of the group to an already successfully produced seedlings of Nila fish to be raised.

d. Feed made by the group pool can be used for raising Nila seed.

e. Only a small part of the group that can make the swimming pool. enlargement and nursery.

f. The level of group members visit pond in Year II has decreased.

g. Overall for 3 months Year II mean a visit to the group members each month TNKS 75.06%.

h. The mean rate of decline in the frequency of visits to group members TNKS an approximately 11.06%.

4.2. Suggestions

a. Need socialization gradually TNKS benefits and risks damaging to the members of the group pool.

b. Strived to invite members of the pool reduces visits to TNKS.

c. Dideder fish in the pond should be monitored on a daily basis in order not to be attacked by pests.

d. Food that is made to be dried in the sun to dry before being stored.

e. Guidance makes rearing ponds and nursery pelu intensively.

f. Feeding on fish in rearing ponds must be in accordance with established guidelines.

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ISBN 978-602-19877-3-5

POLLEN MORPHOMETRIC OF *Euphorbia milii* Moulins. VARIETIES

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ABSTRACT

Pollen can be used to identify plant because of its unique structure and ornamentation. In addition, certain plants have specific pollen morphology. This research is aimed to find out the similarities and dissimilarities of pollen morphology structures in some E. milii varieties. This is a descriptive research that was done at Botanical Laboratory of Biology Department, Faculty of Mathematics and Science, Universitas Negeri Padang. This research was done in December 2014 to January 2015. This research was done by using acetolysis method. The staining process of this method used safranin 0,1% in alcohol 70%. The samples of this research are the pollen of eight E. milii varieties that were collected at some places in Padang City. Based on the result of pollen morphology observation, the pollen has isopolar polarity, radially symmetric, and has been released as monads. The size range of pollen is about medium (33,25µm) to large (50,48 µm). The pollen of the eight E. milii varieties has five shapes; suboblate, oblate spheroidal, prolate spheroidal, subprolate, and prolate. The pollen's aperture is tricolporate type and the ornamentation shape is in reticulate. The dissimilarities of the eight E. milii varieties pollen morphology are in their shapes. Those five shapes are generally grouped into two; subspheroidal and prolate. Thus, it can be concluded that the structure of pollen morphology from those eight varieties are similar except the pollen's shape that is influenced by the length of polar axis and equatorial sector.

Index Terms—pollen, morphometric, Euphorbia milii

1. INTRODUCTION

Most of Euphorbia flowers are reduced and merged into a pseudanthium called siatium. So the perianthium of that plant is bractea which has various patterns and colours. One of Euphorbia species that is commonly used as decorated plants in Indonesia is *Euphorbia milii.*

The pollen is a male reproduction organ on flowering plants or *Angiospermae* and *Gymnospermae* (Agashe and Caulton, 2009). Sitologically, pollen is a cell with three nuclei, which namely vegetative nucleus, generative I nucleus, and generative II nucleus. Cell in pollen is covered by two layers; inner layer (*intine*) and outer layer (*exine*) that have a function as dehydration prevention (Walker, 1999).

Huang (1972) said that the knowledge about pollen morphometric and taxonomy could be used as instruments of scientific research such as botanical systemic, paleobotany, paleoecology, pollen analysis, aeropalinology, criminology, alergy, drugs, and honey quality improvement.

The characteristics of pollen can be used to identify plants taxonomy at familia, genus, species or subspecies level (Bagu, 2003; Coyle, 2005). Hidayat (1995) also said that pollen has a role at familia and species level in taxonomy. The pollen comes in various sizes, shapes and outer surfaces of a species to another, so they turn into characteristics of each species (Wilson, *et al*., 1964)

The dissimilarities of pollen morphology are also happened in various varieties. Aprianty and Kriswiyanti (2008) gave information that Hibiscus with various colours of corolla showed significant difference of pollen size. It has been proved by the differences of the polar axis and equatorial sector in each flower with various colours. Des, *et al*. (2013) observed seven varieties of Coleus and informed that there are some variations of pollen shapes, such as *prolate spheroiidal, subprorolate,* and *prolate.*Widiyanti (2008) also gave information that rice with Rojolele variant from different places has similar characteristics of pollen morphology, except the shapes of them, which are the ratio of polar axis and equator sector (P/E). Based on those results, researcher did a research under title "Pollen Morphometric of *Euphorbia milii* Moulins Varieties".

2. RESEARCH METHOD

The samples were collected at some places in Padang city, such as Batipuah, Cupak Tangah, Kampung Jambak, Lubuk Minturun, dan Pila Tarok. The observation of pollen morphology was done in Botanical Laboratory of Biology Department, Faculty of Mathematics and Science, Universitas Negeri Padang.

The researcher used Acetolycis method by Aprianty and Kriswiyanti (2008) to observe the pollen morphology. The pollen samples in phial bottles were taken out and moved to test tubes. Then they were

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centrifuged at 2000 rpm in 5 minutes until the pollen precipitates in the bottom of the test tubes.

First, *fixation*, the pollen is fixed in Glacial Acetic Acid (AAG) 45% as long as 24 hours with standard temperature. After 24 hours fixing, the samples were centrifuged at 2000 rpm in 5 minutes, then the AAG 45% was thrown away.

Second, *washing*, the pollen was washed twice with aqua dest before centrifuging. After that alcohol 50% and 70% were used to *dehydration* process. Each of them was centrifuged at 2000 rpm in 5 minutes, next the alcohol was thrown away.

The next step is *staining* with using safranin 0.1% and alcohol 70%. The observation was done by scanning electron microscope (SEM) and digital microscope that used 40 times magnification at objective and 10 times at ocular lens.

The analysis of data was done qualitatively by observing unit, polarity, symmetrical, size, shape, aperture (quantity and type), and outer surface of pollen. Then, measuring the length of pollen's polar axis (P) and equatorial sector diameter (E) was done quantitavely by micrometric.

3. RESULT AND DISCUSSION

3.1. Result

The result of this research showed similar distribution, polarity, and symmetry of pollen. The pollen has isopolar polarity, radially symmetric, and has been released as monads. The pollen of the eight E. milii varieties has five shapes*; suboblate*, *oblate spheroidal*, *prolate spheroidal*, *subprolate*, and *prolate* (Table 1).

The pollen's aperture of the eight *E. milii* varieties is *colporate* (Figure 1) and the ornamentation is net-like or *reticulate* (Figure 2). The pollen observation result of axis polar and equatorial sector can be seen at Table 2.

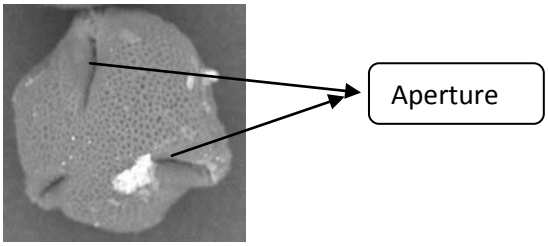

Figure 1. Pollen morphology by using *scanning electron microscope* (SEM)

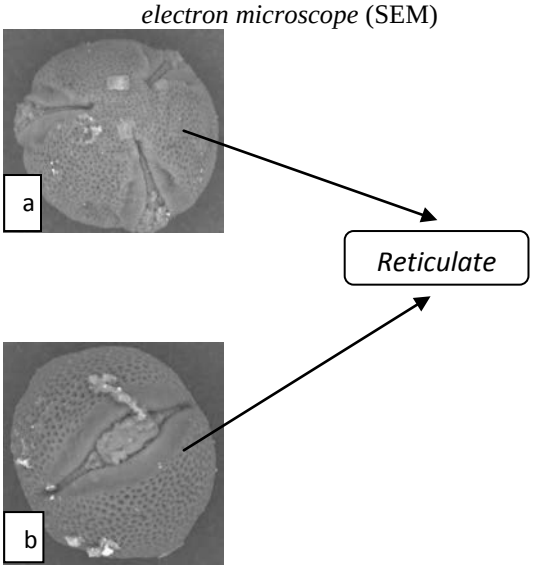

Figure 2. *E. milii* pollen morphology by *scanning electron microscope* (SEM), the type of pollen outer surface is *reticulate* (a) polar view (b) equatorial view

Table 1. The result of *E. milii* varieties shape and ornamentation measurement

No.	Varieties	The length of polar axis (P) and equatorial sector (E) (µm)		Index of P/E x 100 (µm)	Shapes	Aperture		Ornamentation
		P	E			Quantity	Type	
1	*Rose of Nothern City*	36,4-42,58	38,6-44,69	94,30-95,27	*Oblate Spheroidal*	3	*Colporate*	*Reticulate*
2	*Pink with white pattern*	34,61-39,36	34,75-36,44	99,59-108,01	*Prolate Spheroidal - Subprolate*	3	*Colporate*	*Reticulate*
3	*Forever Green*	35,68-41,06	34,61-35,17	103,09-116,75	*Prolate Spheroidal*	3	*Colporate*	*Reticulate*
4	*Num Choke*	35,75-36,99	37,73-42,16	87,74-94,75	*Suboblate -Prolate Spheroidal*	3	*Colporate*	*Reticulate*
5	*Minibell*	33,25-37,48	28,30-36,98	101,35-117,49	*Subprolate -Prolate*	3	*Colporate*	*Reticulate*

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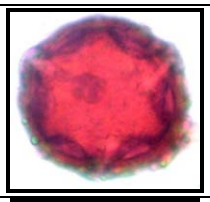
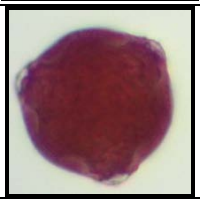
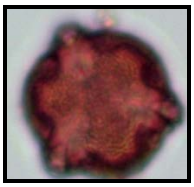
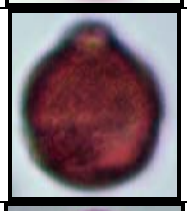
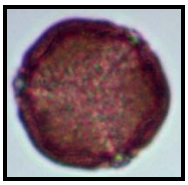
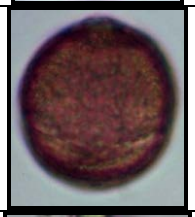
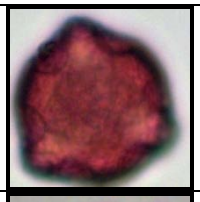
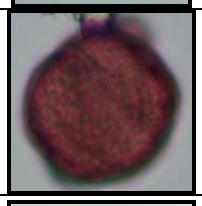
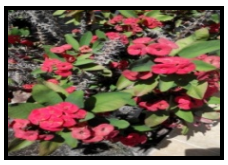
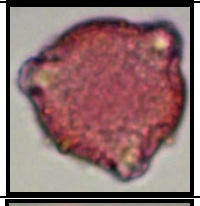
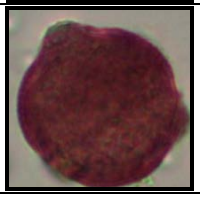
6	*Jode Bird*	35,25-50,48	38,00-41,45	92,76-121,78	*Prolate Spheroidal - Subprolate*	3	*Colporate*	*Reticulate*
7	*Color Burst*	36,33-38,90	31,16-35,88	108,41-116,59	*Prolate Spheroidal -Prolate*	3	*Colporate*	*Reticulate*
8	*First Kiss*	33,50-44,81	28,90-33,85	115,92-132.37	*Subprolate*	3	*Colporate*	*Reticulate*

Table 2. The figures of the eight varieties *E. milii* pollen

No.	Varieties	Figures	Polar View	Equatorial View
1	*Rose of Nothern City*			
2	*Pink with White Pattern*			
3	*Forever Green*			
4	*Num Choke*			
5	*Minibell*			
6	*Jode Bird*			
7	*Color Burst*			

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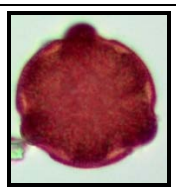
8	*First Kiss*			

3.2. Discussion

Based on the observation, the pollen of the eight *E. milii* varieties is released as *monads*. The polarity of the pollen is *isopolar* polarity because it has similar part on distal and proximal side. The polarity is figure of the pollen axis polar.

This fact goes well with Hesse, *et al*. (2009) and Simpson (1953) statement, the *isopolar* polarity has similar part on distal and proximal side. Beside that, the symmetry of the eight *E. milii* varieties is radially symmetric. This fact goes well with Erdmant (1972) statement, the radially symmetric is a symmetry that can divide object equally more than two vertical parts.

Based on the observation result, the pollen of the eight *E. milii* varieties has different size. It can be seen from the polar axis (P) and equatorial diameter (E) view (Table 1). The longest polar axis (P) is seen on *Jode Bird* (50,48 µm) and the shortest polar axis is seen on *Minibell* (33,25 µm). The longest equatorial sector (E) is seen on *Rose of Nothern City* (44,69 µm) and the shortest equatorial sector is seen on *Minibell* (28,30 µm). So, based on the measurement, *E. milii* pollen has various polar axis (P) and equatorial sector (E) length. Beside that, the size of *E. milii* pollen in Padang city belongs to medium (*mediae*), 25-50 µm, to large size (*magnae*), 50-100 µm. This fact goes well with the classification by Erdmant (1972).

The pollen of the eight E. milii varieties are *suboblate, oblate spheroidal, prolate spheroidal, subprolate,* and *prolate* (Table 1). The pollen shapes belong to determination of polar axis (P) index and diameter of equatorial sector (E), and they were a ratio of polar axis (P) length and equatorial sector (E) which is multiplied by 100 (P/E x 100) (Erdmant, 1972).

The pollen aperture of the eight *E. milii* varieties belongs to *colporate* type and the total is three, so it called *tricolporate* (Figure 2). This fact goes well with Globary (1984) research that informs us *E. milii* species has *tricolporate* pollen aperture. Huang (1972) also stated that aperture types of Euphorbia genus are *colporate*, *foraminoidate* and *nonaperture*.

Figure 2 showed pollen ornamentation is net-like (*reticulate*). It goes well with the research result of Globary (1984), *E. milii* species has net-like (*reticulate*) ornamentation. It is similar with the research result of Shubarani, *et al*. (2013), some of Euphobiaceae have net-like ornamentation (*reticulate*).

Based on the pollen morphology explanation of *E. milii* species which are differentiated by bractea colours, it is found that there are various sizes and shapes of pollen. This result is similar with observation result by Aprianty dan Kriswiyanti (2008), that the pollen of *Hibiscus rosa-sinensis* species which are differentiated by their corolla colours has various sizes and shapes.

4. CLOSING

4.1. Conclusion

Based on the observation result of the eight *E. milii* varieties pollen morphology, it can be concluded that the pollen of the eight varieties of *E. milii* have some similarities such as morphology structure, isopolar polarity, radially symmetric, *colporate* type of aperture, net-like ornamentation called *reticulate*, and released as *monads.*

Beside that, the dissimilarities of the eight *E. milii* varieties pollen are their sizes and shapes. The pollen has medium (*mediae*) to large size (*magnae*) and the shapes of the pollen are *suboblate, oblate spheroidal, prolate spheroidal, subprolate,* and *prolate.*

4.2. Suggestion

The next researcher is suggested to observe *E. milii* pollen morphology in other varieties. There are some pollen characteristics that were not observed yet such as *exine* and *intine*.

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ISBN 978-602-19877-3-5

MANAGEMENT ANALYSIS ON PLANTS MORPHOLOGY LAB WORK IN BASIC BIOLOGY LABORATORY OF STAIN BATUSANGKAR

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ABSTRACT

The main problem of this research focuses on how to manage a lab work activities of Plant Morphology in Basic Biology Laboratory of STAIN Batusangkar with the planning, actuating, and controlling stage. The purposes of the study are to describe, to analyze, and to conclude and to give recommendations based on the phenomenon in the focus of research. The method is descriptive with mixed methods designs and explanatory sequential design types, a quantitative data were collected and analyzed, followed by collecting and analyzing qualitative data and then interpret it. A quantitative data obtained through filling the questionnaire by the students and Plant Morphology lab assistant while qualitative data through interviews with lecturer, lab assistants, students, and lab work assistent. The results of data analysis, showed that the stages of planning, actuating, and controlling of Plant Morphology lab work relatively effective with ratings of 80, 76.2, and 78.1. Thus, the management of Plant Morphology lab work in Basic Biology Laboratory STAIN Batusangkar belong to effective criteria (78.1).

Index Terms: management analysis, Plants Morphology lab work, Basic Biology Laboratory

1. INTRODUCTION

Makes a biology laboratory is very important for a biology lab work. According to Huda, the laboratory in college can give support for the development of a certain skill, such as process skill, motoric skill and to shape a scientific attitude, especially to gain interest to do investigation, research and to learn about the nature deeply [1].

The existence of Biology Department is supported by the development of science laboratory in STAIN Batusangkar. Initially, there are only two science laboratory, and one of them is biology laboratory. In 2012, there are seven science laboratory provided, and three of them is biology laboratory. The biology laboratory in STAIN Batusangkar consist of three rooms: Microbiology Laboratory, Basic Biology Laboratory and Zoology Laboratory.

Since it was founded, the Biology Department students never did a research about Morphology lab work as an evaluation to the activity. Based on the observation done by the researcher, the major probem in Morphology lab work is lack of seriousness of the students, the limited fasilities in laboratory, the students do not understand the the work procedure, sometimes, the material in lab work doesn't deal with the material in the classroom, the laboratory management is not optimal yet. And also the problem is the lecturer. The lecturer is not always give the appropriate guidance to the students in laboratory. Besides, the time to the practical work in laboratory is very limited. It is not enough for some materials. Lastly, the lab work assistant is not capable enough to manage the laboratory. The problems found are assumed as the cause of the students low mark on Plant Morphology lab work. The table below shows the Students achievement on Morphology lab work.

Table.1 The second semester students average final score on plant Morphology lab work 2013/2014 academic year

Class	Average Score
Class A	62,3
Class B	50,7
Class C	65,1

Because of the problems, it is necessary to do a research about the lab work management in Basic Biology Laboratory as an evaluation toward students lab work. It can be about the management or the operational process in lab work. Based on the explanatin above, the researcher is interested to do a research entitled: "Management Analysis on Plants Morphology Lab Work in Basic Biology Laboratory of STAIN Batusangkar".

Generally, the purpose of the research is, to describe, to analyze, to make a conclusion and to give recommendation based on the phenomenon on the focus of the research. This research is necessary to do as an evaluation toward the students lab work on Plant Morphology. With this research, it can be seen the weaknesses on management of Lab Work in Basic biology laboratory. Besides, this research can show the effectiveness of management in Plant Morphology lab work and the result of the research can become a reference for a better lab work activity in the future.

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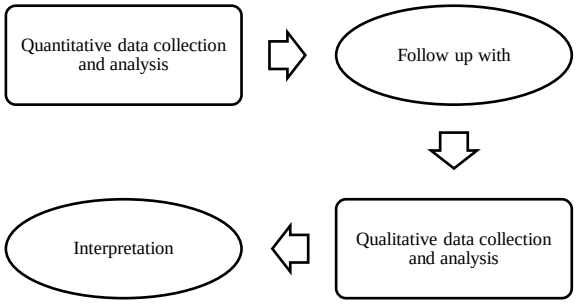
2. METHODS AND PROCEDURES

The research is done at the Basic Biology Laboratory of STAIN Batusangkar on 2014/2015 academic year. The kind of the research is a field research. The method used in the research is descriptive qualitative and descriptive quantitative research. The research try to describe about the management of Plant Morphology lab work on Basic Biology Laboratory of STAIN Batusangkar. The description of the lab work management can be seen from some aspects, such as planning stage, actuating stage and controlling stage. The design of the research is mixed methods designs and the type of the research is Explanatory Sequential Design. The table below shows the procedure of Explanatory Sequential Design[1].



Picture 1. Procedure of Explanatory Sequential Design

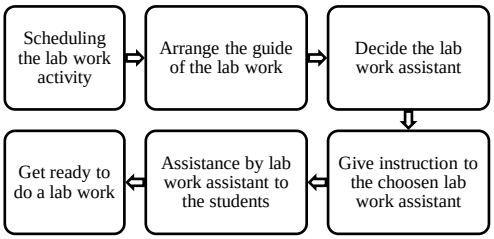
The design is used because in this research there are two kinds of data, they are qualitative and quantitative data that is used together. Quantitative data is some numbers collected from the questionnaire. Whiles, qualitative data is a non-number data, such as statement, voice recordings and pictures from the observations and interviews.

Quantitaive data is collected from the questionnare with 2 respondents of lab work assistant and 35 students respondent of Plant Morphology lab work (12 students of class A, 13 students of class B and 10 students of class C). Whereas, qualitative data is collected by interviewing 2 lecturers, 2 lab work assistant, 35 students of Plant Morphology Lab Work and 1 Basic Biology Laboratory Assistant. Besides, qualitative data is also collected through observation on Plant Morphology lab work activities for 14 meetings. The analysis of qualitative data use Miles and Huberman data analysis technique. And quantitative data is analyzed by using descriptive calculation. The data sources is collected by using purposive sampling and snowball sampling technique.

3. RESULTS

3.1. Planning Stage

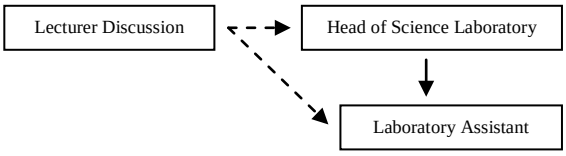
The activities on planning stage of Plant Morphology lab work can be seen on picture 2.



Picture 2. Flowchart of planning stage in Plant Morphology lab work activity at Basic Biology Laboratory of STAIN Batusangkar

3.1.1. Arranging Lab Work Activities

Arranging the activities of Plant Morphology lab work is done in the beginning of the semester. The arrangement of the lab work activities can be seen on picture 3.



Picture 3. Arranging activities of Plant Morphology lab work

Picture 3 shows that 3 lecturer of Plan Morphology discuss about needed laboratory devices, materials and the amount of the total meetings for plant morphology lab work. After that, the lecturer did the discussion with the Basic Biology laboratory assistant of STAIN Batusangkar about the time for the meetings, the amount of the meetings, and the provided devices for Plant Morphology lab work at Basic Biology Laboratory of STAIN Batusangkar.

Based on the result of discussion done by the Plant Morphology lecturer and laboratory assistant of Basic Biology Laboratory of STAIN Batusangkar, all the needed fasilities for Plant Morphology lab work are provided by Basic Biology Laboratory of STAIN Batusangkar. The table below shows the provided fasilities at Basic Biology Laboratory of STAIN Batusangkar.

Table 2. The provided fasilities for Plant Morphology lab work at Basic Biology Laboratory of STAIN Batusangkar:

No	Laboratory Fasilities	Explanation
1	Laboratory room	Large of the room 75,97 m^2
2	Table for Lab work	Middle table 5 and side table 2
3	Devices for practical a. Loop/magnifying glass b. Stereo Microscope c. Pincers	 There are 10 loop, broken 2 Only 1 There are ± 25 pinset

3.1.2. Arranging Lab Work Manual

The manual used for Plant Morphology Lab Work of 2014 academic year is the manual that is also used by the previous grade. The manual is adopted from the manual of Plant Morphology Lab Work of Padang State University (UNP). It is because Dra. Des M,

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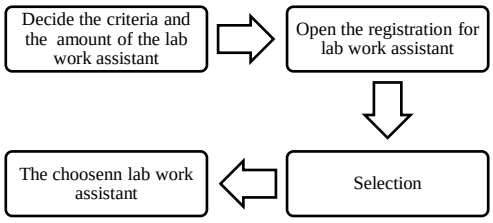
M.S one of Plant Morphology lecturer of STAIN Batusangkar is also the regular lecturer in UNP.

3.1.3. Deciding the Manager for Lab Work

The process of deciding the assistant for plant morphology lab work at STAIN Batusangkar can be seen in picture 4.



Picture 4. The process of deciding lab work assistant for Plant Morphology Lab Work

The criteria for Plant Morphology lab work assistant is the students who have finished Plant Morphology subject with the minimum grade is B and GPA score over 3. The amount of lab work assistant depends on the total amount of the students of each class that take Plant Morphology lab work. The needed lab work assistant this semester is 3.

The students who fulfill the criteria can registrate to Plant Morphology lecturer. The requirements for registration is students result study card which have the mark of Plant Morphology subject. Then, they follow an interview and a teaching ability test.

3.1.4. Giving Instruction to the Lab Work Assistant

After choosing the assistant for Plant Morphology lab work, the lecturer give instruction to the lab work assistant such as, the technical, assesment and test form for Plant Morphology lab work. Beside the lecturer, laboratory assistant also give instruction about the usage of the laboratory devices such as how to lend laboratory devices, how to keep and take care of laboratory devices and give instruction to clean the laboratory after doing the lab work.

3.1.5. Assistance for Plant Morphology Lab Work

A week before doing the lab work activities, lab work assistant give instruction to the students who take Plant Morphology subject. The assistant give general description and manners in doing lab work, divide the group work, introduction between the lab work assistant and the students, prepare the lab work, evaluation in lab work, task and report form for Plant Morphology lab work.

Based on the explanation above, it can be seen that the effectiveness of planning stage for Plant Morphology lab work fulfill the effective criteria. It is bacause in planning stage, each element involve in lab work activities (lecturer, laboratory assistant, lab work assistant) do a good coordination. It can be seen in table 3.

Table 3. Activities in planning stage of Plant Morphology lab work

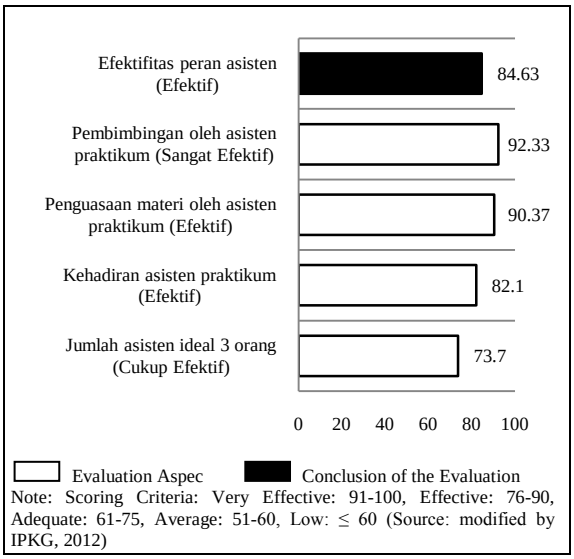
No	Aspect in Planning Stage	Implementation
1	Arranging lab work activities	Yes, in the beginning of semester
2	Arranging manual for lab work	No, manual from UNP
3	Deciding the manager of lab work	Yes, in the beginning of semester
4	Giving instruction to laboratory assistant	Yes
5	Assistance by laboratory assistant	Yes, a week before doing the lab work

3.2. Actuating Stage

Actuating of Plant Morphology lab work activities begin in the third week of the lecturing schedule of STAIN Batusangkar. The things that needed to observe are:

3.2.1. Effectiveness of Assistant's Role in Lab Work

The effectiveness of Assistant's Role in Plant Morphology lab work can be seen in picture 5.



Picture 5. Result of analysis toward the Effectiveness of Assistant's Role in Plant Morphology lab work

Based on picture 5, the effectiveness of Assistant's Role in Plant Morphology Lab Work belong to effective criteria (84,63). It is caused by guiding from the lab work assistant is very effective (92,33), materials mastery by the lab work assistant is effective (90,37), the presence of lab work assistant is effective (82,1), and the amount of the lab work assistant is 3 that belong to adequate criteria (73,7).

3.2.2. Effectiveness of Fasilities in Laboratory for Lab Work

The effectiveness of fasilities in laboratory for Plant Morphology lab work can be seen in picture 6 below:

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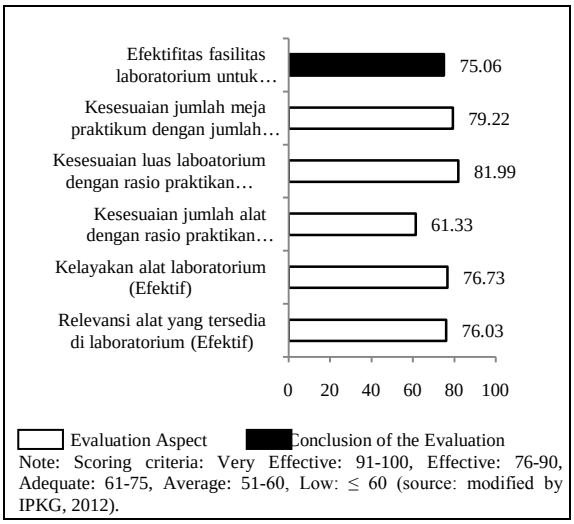
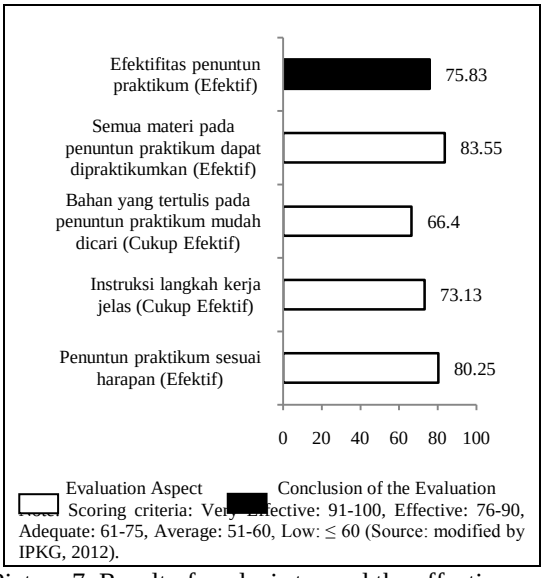


Picture 6. Result of analysis toward the Effectiveness of fasilities in laboratory for Plant Morphology lab work

Based on picture 6 above, the effectiveness of fasilities at Basic Biology Laboratory of STAIN Batusangkar for Plant Morphology Lab Work is belong to adequate criteria (75,06). It is caused by the provided relevant devices in laboratory is effective (76,03), the properness of the laboratory devices is effective (76,73), the appropriateness of the ratio of the amount of the devices and the total amount of the students is belong to adequate criteria effective enough (61,33), the appropriateness of the large of the room with the students is effective (81,99), and the appropriateness of the provided table with the group is effective (79,22).

3.2.3. Effectiveness of Manual for Plant Morphology Lab Work.

Effectiveness of manual for Plant Morphology lab work can be seen on picture 7 below.

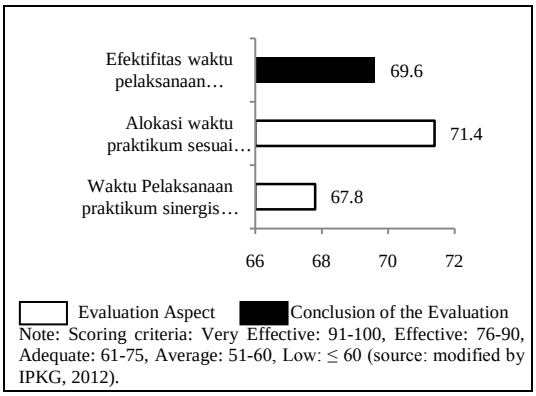


Picture 7. Result of analysis toward the effectiveness of manual for Plant Morphology Lab Work

Picture 7 above shows that the effectiveness of manual for Plan Morphology Lab Work is belong to adequate criteria (75,83). It is caused by all the materials in lab work manual can be realized effectively (83,55), the ease to find the materials in the manual belong to adequate criteria (66,4), the clearness of the instruction in lab work manual is belong to adequate criteria (73,13), and the appropriateness of the manual and the expected result belong to effective criteria (80,25).

3.2.4. Effectiveness of Time for Plant Morphology Lab Work Activities

Effectiveness of Time for Plant Morphology Lab Work activities can be seen in picture 8 below.

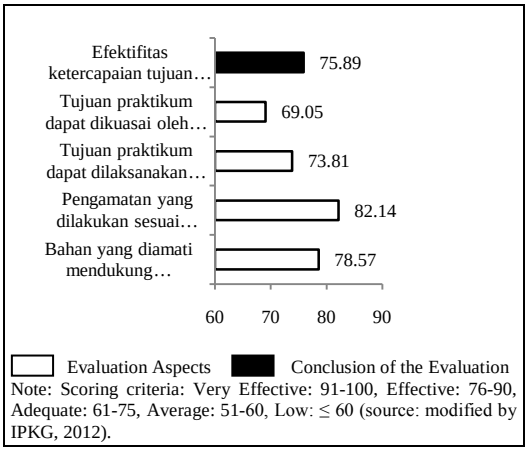


Picture 8. Result of analysis toward effectiveness of time for Plant Morphology Lab Work Activities

Based on picture 8, the effectiveness of time for Plant Morphology Lab Work belong to adequate criteria (69,6). It is caused by the allocation of time for Lab work is proportional that belong to adequate criteria (71,4), the time to do the lab work belong to adequate criteria (67,8).

3.2.5. Effectiveness of Purpose Achievement for Plant Morphology Lab Work

Effectiveness of purpose achievement for Plant Morphology Lab Work can be seen in picture 9 below.



Picture 9. Result of Analysis toward effectiveness of purpose achievement for Plant Morphology Lab Work

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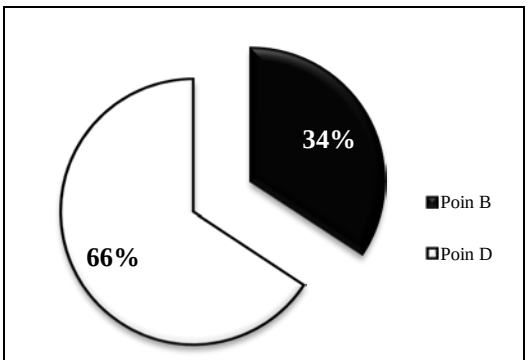
Based on picture 9, effectiveness of purpose achievement for Plant Morphology Lab Work fulfill the effective criteria (75,89). It is caused by the purpose of lab work can be mastered by the students. It belong to adequate criteria (69,05), the purpose of the lab work can be reached by the students also belong to adequate crteria (73,81), observation related to the purpose of the lab work belong to effective criteria (82,14), and the materials being observed support the purpose of the lab work. It belong to effective criteria (78,57)

3.2.6. Students Perception Toward The Expected Practical Models

The researcher give four options to the students, but the students only choose point B and D. The options are (A) Laboratory assistant gives explanation before the practical work, then demonstrate it, and the students do it directly, (B) Laboratory assistant gives explanation before the practical work, then demonstrate it, and the students do it directly with guidance of lab work assistant, (C) Laboratory assistant gives explanation before the practical work, then demonstrate it, and the students do it directly with guidance of the lecturer, (D) Laboratory assistant gives explanation before the practical work, then demonstrate it, and the students do it directly with guidance of lecturer and lab work assistant. The students' perception toward the expected practical models can be seen in picture 10 below.

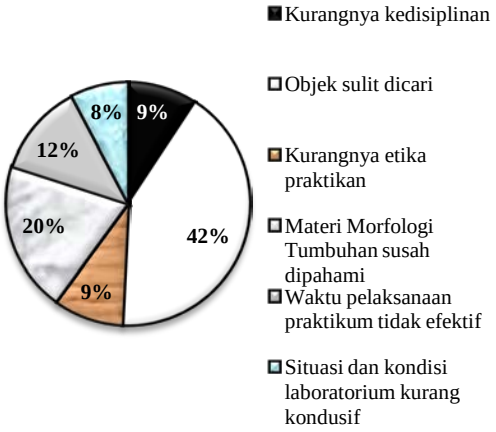


Note : laboratory assistant gives explanation before the practical work, then demonstrate it, and the students do it directly with guidance of lab work assistant. Poin D: laboratory assistant gives explanation before the practical work, then demonstrate it, and the students do it directly with guidance of lecturer and lab work assistant.

Picture 10. Students Perception Toward The Expected Practical Models for Plant Morphology Lab Work

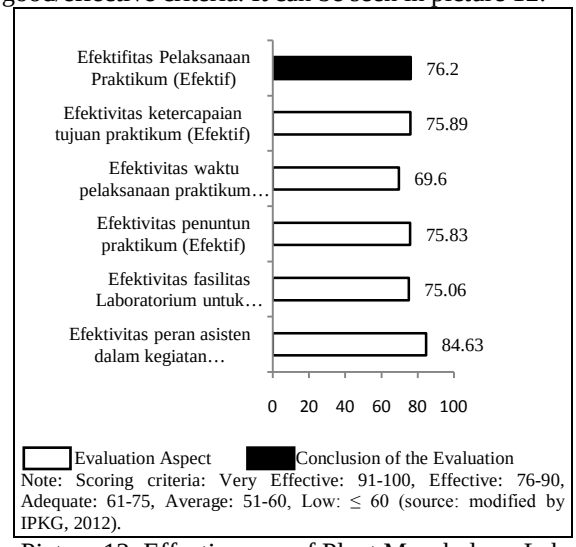
3.2.7. Students Perception Toward the Problems in Practical Work

Generally, there are 7 group of problems faced by the students during Plant Morphology Lab Work activities. The problems faced by the students in plant morphology lab work can be seen in picture 11 below.



Picture 11. The problem faced by the students during Plant Morphology lab work activities

Based on the explanation about actuating stage of plant morphology lab work above, the effectivenes of Plant Morphology lab work activities belong to good/effective criteria. It can be seen in picture 12:



Note: Scoring criteria: Very Effective: 91-100, Effective: 76-90, Adequate: 61-75, Average: 51-60, Low: ≤ 60 (source: modified by IPKG, 2012).

Picture 12. Effectiveness of Plant Morphology Lab Work at Basic Biology Laboratory of STAIN Batusangkar.

3.3. Controlling Stage

3.3.1. Evaluation in Plant Morphology Lab Work Activities

The table below shows the evaluation done by lab work assistant to the students in Plant Morphology Lab Work activities.

Table 4. evaluation form done by lab work assistant to the students in Plant Morphology Lab Work activities.

No.	Evaluation in lab work	Realization	
		Yes	No
1	*Pre test*	√	
2	Individual report	√	
3	Group presentation	√	
4	Resume	√	
5	Final test for lab work	√	

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3.3.2. Problems Faced in Controlling Lab Work Activities

Controlling the plant morphology lab work activites done by the lecturer and the lab work assistant. While, controlling the usage of the laboratory devices done by the laboratory assistant of Basic Biology Laboratory of STAIN Batusangkar. In controlling lab work activities, there are some problems found. Here are the problems faced by the lecturer and laboratory assistant during lab work activities

Table 5. Problems faced by the lecturer in controlling and guiding Plant Morphology lab work activities at Basic Biology Laboratory

No	Explanation of problems faced by the lecturer
1	Restircted reading materials about Plant Morphology
2	*Student center learning* is not running effectively
3	There are some students who do not bring the materias
4	The students do not observe and draw the object directly which cause the picture is not resemble the real object

Table 6. Problems faced by the laboratory assistant of Basic Biology Laboratory in controlling and guiding the usage of laboratory devices in Plant Morphology lab work

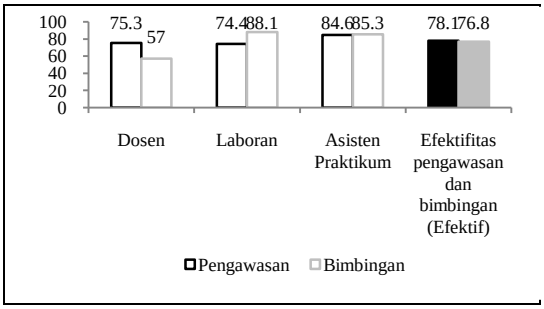
No.	Explanation of problems faced by laboratory assistant
1	The students do not put the devices in place after doing the lab work activities
2	The students do not clean the stereo microscope after using it
3	The students do not keep the laboratory clean
4	The students do not follow the rules in borrowing laboratory devices

Table 7. Problems faced by lab work assistant in controlling and guiding Plant Morphology lab work activities at Basic Biology Laboratory

No.	Explanation of problems faced by lab work assistant
1	Work distribution between lab work assistant is not clear in controlling and guiding lab work activities
2	The students are not serious in doing the lab work activities

3.3.3. Effectiveness of Controlling and Guiding in Plant Morphology Lab Work Activities

Effectiveness of Controlling and Guiding in Plant Morphology Lab Work Activities fulfill the criteria effective. It can be seen in picture 13 below.



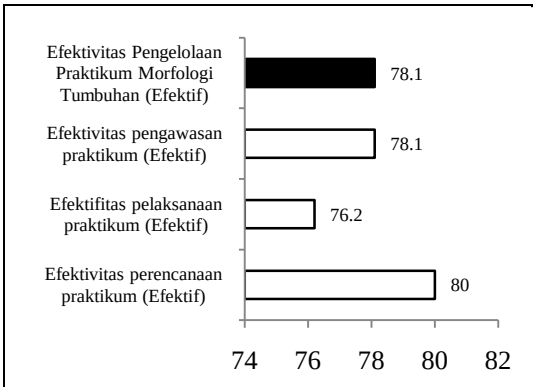
Note: Scoring criteria: Very Effective: 91-100, Effective:76-90, Adequate: 61-75, Average: 51-60, Low: ≤ 60 (source: modified by IPKG, 2012)

Picture 13. Result of analysis toward effectiveness of controlling and guiding in Plant Morphology Lab Work activities

Based on picture 13, effectiveness of controlling and guiding in plat morphology lab work fulfill the effective criteria (78,1 and 76,8). It is caused by controlling and guiding done by the lecturer belong to adequate and average criteria (75,3 and 57), controlling and guiding the usage of laboratory devices done by the laboratory assistant belong to adequate and effective criteria (74,4 and 88,1), and controlling and guiding done by lab work assistant fulfill the effective criteria (78,1 dan 76,8).

3.4. Effectiveneness of Management in Plant Morphology Lab Work

Effectiveneness of Management in Plant Morphology Lab Work can be seen in picture 14 below.



Note: Scoring criteria: Very Effective: 91-100, Effective: 76-90, Adequate: 61-75, Average: 51-60, Low: ≤ 60 (source: modified by IPKG, 2012).

Picture 14. Effectiveneness of management in Plant Morphology lab work at Basic Biology Laboratory of STAIN Batusangkar

Based on picture 14, Effectiveneness of Management in Plant Morphology Lab Work fulfill good/effective criteria ((78,1). It is caused by the effectiveness of Planning, actuating, and controlling of Plant Morphology Lab Work actvities fulfill effective criteria (80, 76,2 and 78,1).

3.5. Mapping of Management in Plant Morphology Lab Work Based on the Differences of Lab Work Lecturer

After analyzing the management of Plant morphology Lab Work at Basic Biology Laboratory of STAIN Batusnagkar, the researcher starts to do mapping process of management in Plant Morphology Lab Work based on the differences of the lecturer. There are 2 lecturer for Plant Morphology Lab Work: Mr. Aidhya Irhash Putra, S.Si.,M.P for class A and B, and

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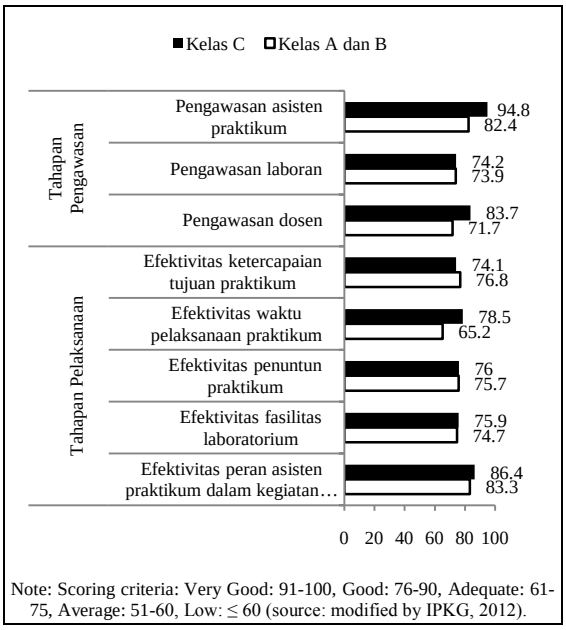
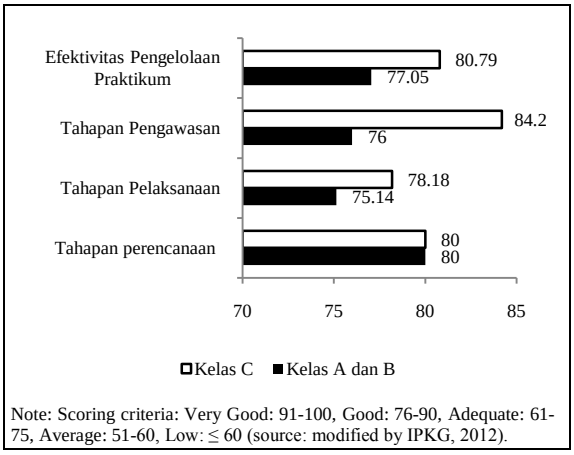
Mr. Rizki, S.Si.,M.P for class C. Here are the mapping of management in Plant Morphology Lab Work.



Note: Scoring criteria: Very Good: 91-100, Good: 76-90, Adequate: 61-75, Average: 51-60, Low: ≤ 60 (source: modified by IPKG, 2012).

Piture 15. Mapping of management in Plant Morphology Lab Work based on the difference of the responsible lecturer

Picture 15 shows that class C is better than class A and B on management of plant morphology lab work in actuating and controlling stage. It is caused by the amount of Class C is less than class A and B. There are 17 students in class C that make it easier to manage. During the lab work activities, the lecturer of plant morphology for class C always stay in laboratory to control the activities. The lecturer gives the materials of plant morphology before doing plant morphology lab work. While, the lecturer for class A and B is on the other hand. The management of Plant Morphology Lab Work can be seen in picture 16 below:



Note: Scoring criteria: Very Good: 91-100, Good: 76-90, Adequate: 61-75, Average: 51-60, Low: ≤ 60 (source: modified by IPKG, 2012).

Picture 16. Mapping of management in Plant Morphology Lab Work based on the difference of the responsible lecturer

4. CONCLUSION

Based on the result of the research above, it can be concluded that the effectiveness of management in Plant Morphology Lab Work, generally, fulfil the good/effective criteria (78,1). It is caused by the effectiveness of planning, actuating and controlling stage in Plant Morphology Lab Work has fulfilled good/effective criteria (80, 76,2 and 78,1).

5. ACKNOWLEDGEMENTS

I express my gratitude to everyone who help me in the research. My gratitude to my advisors Mr. Asmendri, S.Ag., M.Pd and Mrs. Maya Sari, M.Si. Thank you for the love to my family, my parents who always become a great motivator for me. And to my beloved sisters and brother, Hani Yusefia, S.Sos.I., Melya Rahma Resti, and Muhammad Ikhsan, thank you for supporting me.

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ISBN 978-602-19877-3-5

IDENTIFICATION OF AMYLASE-PRODUCING BACTERIA FROM THE SOIL OF WASTE IN PADANG

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ABSTRACT

Amylase is an enzyme that hydrolysis of starch into simple sugar. Amylase plays role in many industrial fields, such as the food industry, leather tanning, and detergent additive. Bacterial derived amylase are widely commercial used because it is easier to be isolated. Amylase used in the industry increase continiously up to 30% of the needs of the enzymes in the world. Amylase-producing bacteria found in various places in nature, such as hot springs, river water, and soil. Soil is habitat of a various of amylase-producing bacterial because the soil contains a various substrates required for bacteria growth, such as soils of waste in Padang. Soil containing various substrates will lead to high diversity of bacterial. Therefore, it will be isolation and identification of amylase-producing bacteria from soil of waste in Padang.

Index Terms---isolation of bacteria, identification of bacteria, amylase, soil bacteria

1. INTRODUCTION

Amylase is an enzyme that hydrolyze starch into simple sugars. Amylase roles in food and non-food industries, such as drug manufacturing industry, syrup, bread production, brewing, tanning leather, and detergent additive [2]. Used of amylase has reached 30% of worldwide enzymes needed [2]. Amylase is produced by a various plants, animals, and bacterial such as *Bacillus*, *Staphylococcus*, and *Acinetobacter*. Amylase-producing bacteria are widely used commercially because of the isolation of amylase from bacteria easier than plants or animals. The bacteria can be found everywhere, such as water, plants, animals, human feces, warm-blooded animals and on the ground [7]. The soil of the landfill in the city of Padang is a good habitat for bacterial growth because it contains growth substrate of various bacteria amylase. Therefore it is necessary for the isolation and identification of amylase-producing bacterial from the soil of waste in Padang.

2. GROWTH MEDIUM

Growth medium used were Nutrient medium 20 g / l, starch medium 1%, biochemistry assay medium and sterilized by autoclave 121 °C for 15 minutes.

3. SAMPLE ISOLATION

Soil samples were taken at 4 location of the soil of waste in Padang. Soil samples were put into the sample bottle and were measured the temperature and pH of the soil. Measurement of soil temperature was done by punching holes in the ground as deep as 10 cm at any point on soil sampling locations.

4. BACTERIA SUSPENSION DILUTION

1 g soil put into a test tube, added 9 ml of distilled water and vortex to form a homogeneous suspension. 1 ml 10^{-1} suspension was taken using a sterile pipette put into a test tube next to second dilution 9 ml of distilled water to form 10^{-2} dilution. The same procedure is performed to obtain 10^{-7} dilution [6].

5. ISOLATION OF BACTERIA

Bacteria isolation was carried by spread plate method, 1 ml suspension of 10^{-7} was spread on the surface of the medium and flattened using glass drill. It incubated for 24 hours at 37 ° C. If bacterial growth, it was planted into selective medium starch agar and incubated for 24 hours at 37 ° C. Iodine solution was given to formed clear zone and the clear zone was measured using calipers and subsequently counted as amylolytic index [8].

6. IDENTIFICATION OF BACTERIA

The identification of bacteria was done by microbiology and biochemistry of the bacterial isolates which have the most extensive amylolytic index. Microbiological identification both macroscopic and microscopic were observed. Biochemically identification was done by doing some biochemical assay, such TSIA assay, urea asay, citrate assay, lactose assay, glucose assay, sucrose assay, maltose assay, MR-VP assay, oxidation assay, fermentation assay, and nitrate assay [3].

ISBN 978-602-19877-3-5

7. RESULTS

Soil bacteria isolated in 4 locations included 23 isolates and 13 isolates that showed amylase activity. (Table 1).

Table 1. Results of Soil Bacteria Isolation at 4 Locations and amylolytic index

No	Soil location	Isolates code	Φ bacteria (mm)	Clear zone (mm)	Amylolytic index
1	T1	T1.1	-	-	-
2		T1.2	-	-	-.
3		T1.3	-	-	-
4		T1.4	-	-	-
5		T1.5	-	-	-
6	T2	T2.1	4.30	9.90	2.30
7		T2.2	3.70	6.20	1.67
8		T2.3	4.36	4.90	1.12
9		T2.4	3.20	8.83	2.75
10.		T2.5	4.13	9.03	2.18
11	T3	T3.1	4.00	10.13	2.53
12		T3.2	8.40	10.83	1.28
13		T3.3	-	-	-
14		T3.4	3.83	20.26	5.28
15		T3.5	3.86	10.63	2.75
16		T3.6	-	-	-
17		T3.7	2.90	16,58	5.81
18	T4	T4.1	-	-	-
19		T4.2	-	-	-
20		T4.3	-	-	-
21		T4.4	2.86	7.63	2.65
22		T4.5	2.73	7.40	2.71
23		T4.6	5.73	10.03	1.75.

Bacteria isolate T3.7 have the widest amylolytic index (5.81 mm) and the bacteria isolate T2.3 has the smallest amylolytic index (1.12 mm) can be seen in Figure 1.

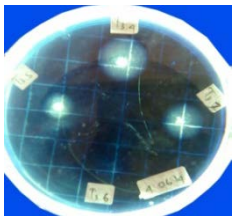

Figure 1. Clear zone of bacteria isolate T3.7

The results of microbiological identification with macroscopic observations on bacterial isolates T3.7 round shape, flat ledges and elevation convex colonies. Microbiological identification by microscopic observation at T3.7 bacterial isolates were classified into positive bacteria, rod-shaped cells, and had endospores (Figure 2).

Figure 2. Gram staining bacteria isolate T3.7

Results of biochemical identification of the isolates T3.7 through several biochemical assay can be seen in Table 2.

Tabel 2. Biochemical assay at bacteria isolate T3.7

No	Biochemistry assay	Results
1	TSIA	k/k
2	SIM	+
3	Urea	-
4	Citrate	-
5	Laktose	-
6	Glukose	-
7	Sukrosa	+
8	Maltose	-
9	MR	+
10	VP	+
11	Oxidation	-
12	Fermentation	-
13	Nitrate	+

Based on Table 2 above can be seen that after biochemically assays with some biochemical assays that isolates T3.7 showed yellow color in the slant and butt TSIA media. In the SIM assay, sucrose VP assay, isolated T3.7 shows a positive reaction and the lactose assay T3.7 bacterial isolate showed a negative reaction. MR test at T3.7 isolate showed positive reaction.

Based on microbiology and biochemical identification was T3.7 isolate from the soil of waste in Padang.belonging to the genus *Bacillus*

8. DISCUSSION

Amylase-producing bacterial had beeen shown 13 isolates. The bacterial isolates was gotten from the soil of waste with temperatures ranged 32 °C – 36 °C and pH ranged 6 - 8. Optimum growth temperatures 30 °C – 45 °C such as mesophilic bacteria found in water, the body of vertebrates and soil [5]. Indications amylase-producing bacteria was shown by the formation of a clear zone round the bacterial colonies after iodine solution drops.. Amylolytic index measurement showed the soil bacterial isolates had different results. Bacterial isolates had T3.7 and T2.3 largest amylolytic index had the smallest amylolytic index.

The size of diameter of clear zone was formed on each isolate was different due to each bacteria have different capacities to hydrolyze starch [4]. T3.7 bacterial isolates had the widest amylolytic index because it came from a new litter soil which in growth nutrient. *Bacillus* is a rod-shaped, gram-positive bacteria, can grow in an aerobic and some types can grow under facultative anaerobic state, produces endospores which resistant to heat [3]. *Bacillus* motility assay result was positive, it was generally not able to produce urease, distinguished by the ability to break down the type of sugar, was able to produce 2,3-butanediol in the VP (Voges-Proskauer) assay, and able to reduce nitrate to nitrite.

ISBN 978-602-19877-3-5

9. ACKNOWLEDGEMENTS

The authors would like thank to Kopertis X for laboratory facilities used on this research.

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ISBN 978-602-19877-3-5

BACTERIOLOGICAL TEST OF SOME COOKED GRINDING SEASONINGS IN THE PASAR RAYA PADANG

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ABSTRACT

The modern life makes the habit patterns changing for using natural products from direct processing by self to fast processing product in the market, but it also can be served quickly, safety, and healthy. The busyness housewife who works as a career woman caused lack of time to grind seasoning by themselves. In the Pasar Raya, a market in Padang city, was found the quality of some natural products that processing to be grinding seasonings that could not be cleaning and hygienic for public consumption category. This study aimed to test bacteriological some cooked grinding seasonings that sell in Pasar Raya Padang. This research was observed from June to July 2014 in the Laboratory of Microbiology Department of Biology, Faculty of Mathematics and Natural Sciences, State University of Padang. This study was observed on four samples of cooked grinding seasonings (onion, galangal, garlic and ginger) from different points of market, with using the descriptive methods to observed there is or not the bacteria *Escherichia coli* and Coliform. Most Probable Number (MPN) method was used for sample processing in laboratory with combine 5:1:1. The results counting of bacterial colonies in the total sample of some cooked grinding seasonings that sell in Pasar Raya Padang was found variation of total bacteria in each sample. The grinding onions contain bacteria $59x10^5$ cfu/ml (sample A), $63x10^6$ cfu/ml (sample B) and $47x10^5$ cfu / ml (sample C). The grinding galangals contain bacteria $38x10^5$ cfu/ml (sample A), $87x10^5$ cfu/ml (sample B) and $45x10^5$ cfu/ml (sample C). The grinding garlics contain bacteria $123x10^7$ cfu/ml (sample A), $83x10^7$ cfu/ml (sample B) and $113x10^7$ cfu/ml (sample B) and the grinding gingers contain bacteria $67x10^5$ cfu/ml (sample A), $103x10^5$ cfu/ml (sample B) and $74x10^5$ cfu/ml (sample C). The MPN value of *Escherichia coli* and Coliform from all food grinding seasonings in Pasar Raya Padang was poor in cleaning and hygienic quality. The cooked grinding seasoning that sell in Pasar Raya Padang was not fulfill the eligibility requirements for consumption. All samples of food grinding seasoning that tested was contaminated by *Escherichia coli* and Coliform bacteria and with poor quality based on MPN values.

***Index Terms*- Bacteriological test, cooked grinding seasonings, MPN value**

1. INTRODUCTION

The modern life makes the habit patterns changing for using natural products from direct processing by self to fast processing product in the market, but it also can be served quickly, safety, and healthy. As the development of technology, the seasoning instant products are delighted by people because simple, quickly, and inexpensive. One is the raw material that is processed into material that has been grinded. Based on the results of market surveys that have been conducted on traders of the cooked grinded seasonings in Pasar Raya Padang, they often have not sold out in one day. The traders generally keep the rest in their stalls only in a closed container without any ice, generally the containers are plastic buckets and sacks. Although the placement of ground seasonings in a sealed container that could reduce dust and microbes contamination during storage, but the room temperature conditions without ice could not inhibit decomposed microbial growth during storage, but it was ineffective to inhibit damage of seasonings.

In the Pasar Raya was found in quality management of cooked grinded seasonings could not be categorized cleaning and hygienic seasonings for public consumption. In fact such as peeling, washing is not perfect, use the same water over and over again for the next wash seasoning, there were also traders who do not wash it first seasoning and spice merchant stalls adjacent to the merchant broilers.

Foodstuffs could be contaminated by microorganisms before harvesting or cutting (primary contamination) or after harvesting or cutting (secondary contamination). Secondary contamination could be occurred during the processing, selling and preparation. The procedural food storage during treatments processing and selling was the main thing in determining the safety and quality of microbiological aspects [1]. Sanitizing indicatoral bacteria are bacteria that the presence in the food that indicated the water or food was contaminated by human feces [2]. Waterborne bacteria that commonly live in duct digestion and excreted through feces [3]. Sanitizing indicatoral bacteria is bacteria that are generally prevalent and live in the human gut. Thus, the presence of these bacteria in water or food never had contact with the feces derived from human intestine and therefore may contain other harmful pathogenic bacteria.

E. coli is one of a group of bacteria that is avoided in the presence of an object that is associated with human interence, even though it came from precisely these bacteria from human feces. Other

ISBN 978-602-19877-3-5

species of this group, among others, are included Aerobacter and Klebsiella. Based on the source and characteristic bacteria, the group of E. coli are divided into two groups, namely E. coli fecal such as Escherichia truly derived from human feces, and E. coli non-fecal likes Klebsiella and Aerobacter that does not come from human feces, but may from other sources [4]. The Escherichia coli as an indicator of biological contaminants in the presence of objects (water, foodstuffs, etc.) that associated with human interence, and it is not expected. Because of the presence of this bacteria group on an object indicates that the object has been contaminated/subjected by fecal matter (stool, stool or feces) [4].

Some specific microorganism, especially bacteria and microalgae, its presence can be used as a parameter to the presence of organic pollutants. The presence of faecal matter (from faeces) in the water can be seen in the presence of coliform bacteria group [4]. Coliform bacteria belonging to the family Enterobacteriaceae are Gram-negative, rod-shaped, ferment lactose, facultative anaerobic and optimum temperature of 37° C. These bacteria is used until now as an indicator of the level of sanitizing food products and a drink that consumed by animals and humans [5]. Suriawiria [4], explains that the presence of Coliform as a natural indicator in determining the level of pollution caused by these bacteria-borne bacterial pathogens simultaneously along with fecal matter. Its presence is not so dangerous, but when it is found in a large population, estimated to be potentially pathogenic bacteria.

The tests to detect Coliform bacteria, using selective and differential media greatly help efforts to detect water proofing Coliform organisms. In this research consisted of three steps, namely test estimators (Presumptive Test), test the amplifier (Confirmed Test), and the complementary test (Test Completed) [3]. In the increased activity of life, the Indonesian people generally required the practice everything, including the fulfillment of the needs of the processed material. The cooked grinded seasonings were one of the chosen alternatives to need in the kitchen. With respect to the maximum limit microbial contamination in food, the authors conducted a study to determine how the feasibility and quality of the cooked grinded seasonings. It was closely related to hygiene and the source of water that was used in the processing of ground seasonings. This study aimed to test bacteriological of some cooked grinded seasonings that sale in Pasar Raya Padang.

2. METHODS

This research was observed from June to July 2014 in the Laboratory of Microbiology Department of Biology, Faculty of Mathematics and Natural Sciences, State University of Padang. This research was conducted with descriptive method was to see whether or not E. coli and Coliform bacteria in samples of ground seasoning Onion (*Allium cepa*), Galangal (*Alpinia galanga*), Garlic (*Allium sativum*) and Ginger (*Zingiber officinale*). For sample processing in the laboratory used a method MPN (Most Probable Number) with combination 5: 1: 1. The tools were used the incubator, water bath, autoclave, hot plate, spritus lights, pumpkin erlenmeyer, measuring cup 100 ml, test tubes, petri dish, pipette measure, the Durham tube, *sengkelit* (OSE) and the digital camera as a documentation tool. The materials were used media Lactose Broth (LB 1 and 2), Brilliant Green Lactose Broth (BGLB), Nutrient Agar (NA), Endo Agar (EA), Alcohol 70%, minced ginger and distilled water.

Sample some herbs grinding randomly purchased by 3 samples at different points of sale for each market Raya Padang. Each sample was purchased as much as 100 g, and then taken to the laboratory for analysis. 1 ml samples were taken, and then inserted into a test tube containing 9 ml of sterile distilled water. The dilution was using a vortex until 8-10 times dilution. 1 ml dilution pour plate implanted with medium NA into petridish, which instilled a result of the dilution of 5-10 to 8-10 times dilution and incubate for 24 hours at room temperature. Then count the number of colonies that exist by using a colony counter. After incubation, the total count of bacteria (BO) which grow on the medium Nutrient Agar, which ranges between 30-300 colonies on the last dilution series. The total of bacteria was calculated using colony counter. The numbers of bacteria carried by observing the numbers of tubes of positive test results, estimation, affirmation and complementary. Furthermore, the numbers of bacteria from each tube were positive in the match with MPN.

The data were analyzed descriptively by the presence of coliform bacteria bacteriological test some cooked grinding seasonings from market Raya Padang. Data obtained by looking at the Test Estimation (presumptive test) and compared with the MPN table 5: 1: 1. If you have obtained the index MPN per ml per 100 ml of the sample that followed by determining the quality of the sample.

3. RESULT AND DISCUSSION

The results of bacteriological tests have been done on several samples of cooked grinding seasoning that sold in Pasar Raya Padang, was showed total counting bacterial colonies on a few samples of cooked grinding seasoning with varying amounts (Table 1).

Table 1. Total Bacteria in the cooked grinding seasoning sold in Pasar Raya Padang

No.	Seasoning	Sample	Total Bacteria (cfu/g)
1	*Allium cepa*	A	59×10^5
		B	63×10^6

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		C	47 x 10^5
2	*Alpinia galanga*	A	38 x 10^5
		B	87 x 10^5
		C	45 x 10^5
3	*Allium sativum*	A	123 x 10^7
		B	83 x 10^7
		C	113 x 10^7
4	*Zingiber officinale*	A	67 x 10^5
		B	103 x 10^5
		C	74 x 10^5

In the table 1 it can be seen samples of grinding onion contained bacteria with number 59 x 105 cfu / ml (sample A), 63 x 106 cfu / ml (sample B) and 47 x 105 cfu / ml (sample C). The grinding galangal contained bacteria with the number 38 x 105 cfu / ml (sample A), 87 x 105 cfu / ml (sample B) and 45 x 105 cfu / ml (sample C). The grinding garlic contained bacteria with the number 123 x 107 cfu / ml (sample A), 83 x 107 cfu / ml (sample B) and 113 x 107 cfu / ml (sample B) and on the grinding Lengkuas contained bacteria with the number 67 x 105 cfu / ml (sample A), 103 x 105 cfu / ml (sample B) and 74 x 105 cfu / ml (sample C).

This can be caused by the processing of seasoning ingredients not washed with running water, in a spice mill that added water, the equipment is not clean, which is less hygienic storage and merchant stalls adjacent to the cooked grinding seasoning stall chicken traders. Kartina[6] , most traders do not wash the equipment with clean water, do not drain the appliance clean cloth and did not wash his hands before the process.

Broadly speaking, the total bacterial colonies that was obtained can be caused by various sources, among others, can be derived from the raw materials, storage management and unhygienic as well as the water used for washing the same water over and over, and grinding tools used are not clean. Rosaria[7], merchants selling cooked grinding seasonings in new containers and placed in a plastic bag when the consumer buys. The cooked grinding seasoning container was usually made of plastic such as the basin without the lid, it could provide a great chance of contamination. Buckle [1], the way the food storage during various treatment processes and the level of sales is the main thing in determining the safety and quality aspects of bacteriology. Value MPN Coliform and Escherichia coli on some cooked grinding seasonings sold in Pasar Raya Padang can be seen in Table 2.

In the estimation test of this research, all samples cooked grinding seasonings have positive results that marked by characteristic Lactose Brouth medium becomes turbid and contained gas bubbles in the Durham tube. The Durham tube serves captured gases that occurred as a result of fermentation of lactose to acid and gas, CO2 gas as a result of the expenditure of carbohydrates and amino acids [8]. Coliform bacteria are bacteria that are able to ferment carbohydrates, whereas in this medium carbohydrates only in lactose. This means murky medium and the presence of gas bubbles indicates the growth of bacteria that are able to ferment lactose.

Estimation of the test, the tubes that produced gas bubbles followed by a confirmation test. Confirmation test performed if the results of the estimation test that used a tube containing Lactose Broth media was found any gas bubbles. At the confirmation test showed that the difference between the temperature of incubation at 37o to 44oC. The tube produced gas bubbles that indicated the existence of coliform bacteria in all samples taken. Suspected of air or gas bubbles was the resulting of the activity of coliform bacteria that fermented lactose. Widiyanti and Ristiati [2] , coliform bacteria were used as indicators of pollution, waste and the conditions were not good for water, food, dairy and other products. The presences of coliform bacteria in foods/drink were showed the possibility of microbes that are enteropathogenetic or toxigenic that were harmful to health. Nisa [9] stated in her work on the analysis of steeping tea drink that coliform MPN value based on the test resulted proving the assertion of CO2 gas bubbles the fermentation of lactose in Durham tubes.

Table 2. Value MPN Coliform and *Escherichia coli* on Some Food SeasoningsMilled sold in Pasar Raya Padang.

No.	**Seasoning**	**Sample**	**NPM/100 ml**			
			Kolifo rm	**Result**	***E. coli***	**Result**
1	*Alium cepa*	A	240	Ugly	38	Ugly
		B	240	Ugly	240	Ugly
		C	240	Ugly	240	Ugly
2	*Alpinia galanga*	A	27	Ugly	96	Ugly
		B	21	Ugly	38	Ugly
		C	240	Ugly	96	Ugly
3	*Allium sativum*	A	240	Ugly	27	Ugly
		B	29	Ugly	96	Ugly
		C	96	Ugly	4	Ugly
4	*Zingiber officinale*	A	27	Poor	38	Poor
		B	96	Ugly	96	Ugly
		C	16	Ugly	12	Ugly

E. coli could ferment lactose, the presence of acid and gas in the tube were inoculated after 48 hours of incubation at 37° C was an approximate evidence for the presence of *E. coli* and thus, contamination of dirt. If the lactose was not fermented, it assumed that *E. coli* of the sample was free from fecal contamination [10]. Based on the test results and the estimation of the assertion, it was evident that there could have taken samples of grinding seasonings was contaminated by coliform bacteria species and *E. coli*. The assertion of the test, the tubes was detected to contain coliform and *E. coli* bacteria in all samples grinding seasonings reinforced by macroscopic observation at Completion Test that used the medium

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Endo Agar (EA). In this research showed that quite clear, that colonies of *E. coli* on Endo medium order for colored metals and coliform lightning pink. The results of research that has been done [11], about the qualitative isolates of *E. coli* that were visible colonies that growth on the medium Endo order lightning red metal.

Pink colony was suspected to be a group of coliforms. Because of this colony were still able to grow in media Endo order while not producing colonies such as E. coli. Megahati [11] said Endo order for a medium that was selective against gram-positive bacteria but was very good for the growth of gram-negative bacteria. Each of these bacterial colonies could be identified from the color inflicted on Endo medium order such as E. coli will produce pink or shiny metal.

Food hygiene and safety is the most important requirement is shared by all the food that will be consumed by all of people. The guarantee food security is a consumer right, because food is a basic need of consumers. The importance of maintaining the quality and hygiene of a food, that consumers avoid foods that can be harmful to health, because the consumer must be keen in purchasing. So that people avoid foods and drink that can be harmful to health, the government has set the standards and requirements for food and drink feasible and safe for consumption by the NII in the community. In this case was expressed in Law Number 23 Year 1992 on Health Article 21 paragraph 1 "Observation of food and beverages held to protect the public from food and drinks that do not meet health requirements" [12].

In order to avoid diseases that could endanger the health, should be the food we eat should be protected from bacterial pathogen which at times can harm us. Total plate count is still high is also not in accordance with the terms that have been determined. Where the number of germs or bacteria limits for food that is processed according to the Food and Drug Monitoring Agency (BPOM) of the Republic of Indonesia on the maximum limit microbial contamination in food HK.00.06.1.52.4001 numbers in 2009, concerning the food mentioned that food standards for the number of colonies bacteria / gram sample is 1 x 104.

4. CONCLUSION

1. The cooked grinding seasonings that were sold in Pasar Raya Padang did not have the eligibility requirements for consumption. In accordance with the decision of the Minister of Health No. 1098/Menkes/SK/VII/89 on the limit microbial contamination in food, and BPOM Republic of Indonesia on the type and maximum limit microbial contamination in food HK.00.06.1.52. 40011 No. 2009.
2. All samples of cooked grinding seasonings that tested was contaminated by Coliform bacteria and *Escherichia coli* were considered ugly by MPN values obtained results.

5. SUGGESTION

It is hoped that the government can conduct surveillance and further review of the processing of cooked grinding seasoning up to the society.

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FIGURES

Figure 1. Resulting test of coliform (a) and *E. coli* (b) in the grinding onion (*Allium cepa*).

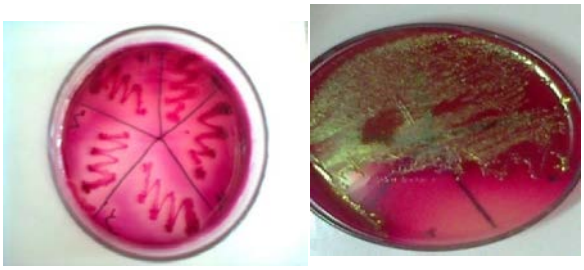

Figure 2. Resulting test of coliform (a) and *E. coli* (b) in the grinding Galanga (*Alpinia galanga*)

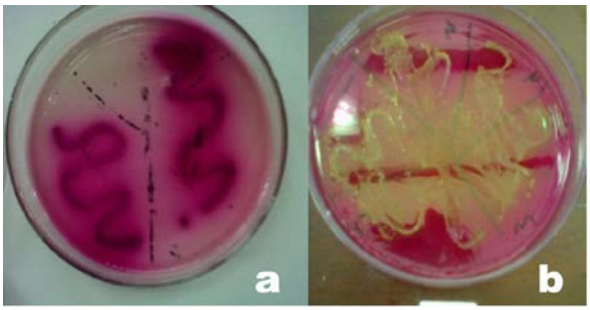

Figure 3. Resulting test of coliform (a) and *E. coli* (b) in the grinding *Allium sativum*

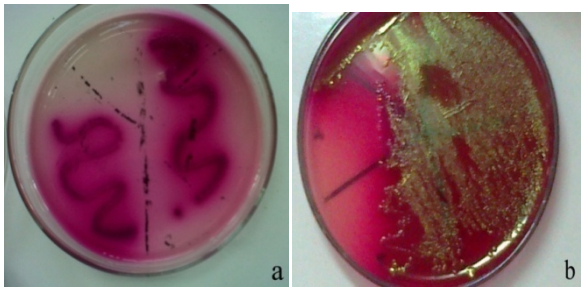

Figure 4. Resulting test of coliform (a) and *E. coli* (b) in the grinding *Zingiber offcinale*

ISBN 978-602-19877-3-5

TETRA PRIMER-ARMS-PCR CONSTRUCTION TO DETECT SNP RS290487 TCF7L2

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ABSTRACT

A Gene which reported to be associated with the expression of diabetes mellitus type-2 is Transcription Factor 7 Like 2 (TCF7L2). TCF7L2 gene have many polymorphisms (SNP). One of TCF7L2 gene polymorphisms that mostly study to detect diabetes mellitus is SNP rs290487. The objective of the research is: primer construction to detect SNP rs290487 TCF7L2. The main steps of the research are: DNA isolation, design tetra primers for SNP rs290487 TCF7L2 with primer designer software, SNP rs290487 TCF7L2 gene amplification with Tetra Primer-ARMS-PCR method, direct DNA sequencing method and bioinformatics analysis.Based on the data analysis, can be concluded that four primer has successfully constructed, and they are FOPRS29, ROPRS29, FIPRS29 and RIPRS29. FOPRS29 and ROPRS29 are external primer which amplify the fragments of the gene TCF7L2 contain SNP rs290487 (the size band that formed is 443 bp), then FIPRS29 used to amplify allele C (PCR product size is 208 bp) and RIPRS29 primer used to amplify the T allele with the size of the product is 293 bp.
That constructed primer can recognize SNP rs290487 TCF7L2 when using Tetra Primer-ARMS-PCR Method.

Index Terms-- *SNP rs290487, TCF7L2 and Tetra Primer-ARMS-PCR*

1. INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia due to abnormal secretion or insulin action, or both[1].
Patients with diabetes mellitus in the world each year has increased, including in Indonesia and West Sumatra. The prevalence of diabetes mellitus in the world in 2000 amounted to 2.8% (171 million people) and projected in 2030 by 4.4% (366 million people). Estimated number of people with diabetes mellitus in Indonesia in 2000 amounted to 4.1% (8.4 million people of Indonesia's population of 205.132.000) and the projection of 2030 increased by 7.8% (21.3 million out of 273.219.200 people). Estimates of diabetes mellitus in Indonesia ranks fourth after Indian, China and the United States [2].
Diabetes mellitus is distinguished into four types including type-2 diabetes mellitus (T2DM). Type 2 diabetes is influenced by several factors: family history of diabetes, obese, lifestyle *risk*, lack of rest, and stress. Diabetes mellitus type-2 will appear in a person with a genetic defect after a genetic change in a long time. Acceleration and deceleration process of genetic change is highly dependent on environmental factors that influence it. Developing genetic markers toward deterioration but has not lead to impaired glucose tolerance (IGT) can be identified through DNA analysis. DNA analysis is required to perform genetic data in the form of genes associated with type-2 diabetes mellitus [3].
In Denmark, Europe, India, Thailand and Malaysia have reported robust genes associated with type-2 diabetes mellitus among genes Transcription Factor-7 Like 2 (TCF7L2) on chromosome 10q [4,5,6]. TCF7L2 consists of 2.24.429bp DNA. This gene encodes a box of high mobility group (HMG) which is a transcription factor that play a key role in the wnt pathway. Protein transcription results TCF7L2 implications on blood glucose homeostasis. [7,8]. TCF7L2 variant form of single nucleotide polymorphisms (SNPs) can be used as genetic markers for type 2 diabetes. Appropriate markers will be able to give an indication of increased susceptibility of individuals to type 2 diabetes mellitus.
One variant TCF7L2 suspected association with type 2 diabetes mellitus is the SNP rs290487 TCF7L2.RS290487 sequence is: GTACAAATCATGGTGACACCA[C/T]CAAAATT GAAAATGAGAAAGG(NCBI) The presence of the T-allele in rs290487 is indicative of increased susceptibility to type 2 diabetes mellitus [9,10].
To determine the presence of T-allele used method tetra-primer ARMS PCR, where the primary is one of the key success factors of detection using PCR method. In the method of tetra-primer ARMS PCR primer is used four forward outer, referse outer, referse inner and forward inner.
The research objective is the construction of four primers used in the method tetra-primer ARMS PCR to detect the SNP rs290487 TCF7L2 that is fast, easy and inexpensive.

2. RESEARCH METHODS

Stages of research preceded by constructing four kinds of primers will recognize the SNP rs290487 namely: FOPRS29, ROPRS29, FIPRS29 and RIPRS29. Researchers describe the results of the

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primary construction and confirmation of the primary capabilities amplify the desired region of the primer and the ability to detect SNP rs290487. This research was conducted in the Biomedicine laboratory of the Medicine Faculty, Andalas University and Biotechno logy Laboratory of the Biology Department, Padang State University.

Data from the primary construction and the ability to amplify the desired area on the SNP rs290487 TCF7L2 analyzed qualitatively.

2.1. Primer Construction

The primary construction is done by utilizing the TCF7L2 gene sequences *Homo sapiens* as a reference (NCBI) [8]. The primary construction process is done by using the software "primary designer". The primary results of this construction will eventually recognize and detect SNP rs290487. Before the primer used on clinical samples, tested by computerized primer specificity to see the possibility of primary mis prime with other regions in the genome of *Homo sapiens* apart from the area to be amplified. If not found then the next possibility misprime primary construction results ready to be synthesized into the oligonucleotide primer.

2.2. SNP rs 290 487 TCF7L2 Detection

To determine the ability of primer constructed in detecting SNPs rs290487, then tested with the following stages: isolation of genomic DNA using a kit from Invitrogen. DNA isolation and primer that has been constructed, then amplified using PCR tetra-primer ARMS. PCR reaction mix was made by PCR RTG. PCR amplifi cation results were analyzed by agarose gel electrophoresis 1.5% technique[11].

If the sample used is not experiencing it on agarose SNP will produce two fragments of different size. Conversely, if there is only one fragment length means there is a mutation / SNP. The next few selected samples were sequenced for verification and confirmation of the results of the method tetra-primer ARMS PCR. Sequencing or process of determining the base sequence of DNA amplification is done in the laboratory Macrogen, Korea. DNA base sequences were obtained and analyzed weeks to determine the level of similarity with existing data in the Gene Bank and then clicking characterized using several bioinformatics programs.

3. RESULTS AND DISCUSSION

3.1 Results

It has been successfully constructed four primary pieces that FOPRS29, ROPRS29, FIPRS29 and RIPRS29. FOPRS29 and external ROPRS29 a primer will amplify fragments of SNP rs290487 TCF7L2 with 443bp PCR product size. FIPRS29 and ROPRS29 used to amplify the C allele with a 208bp PCR product size. Primary RIPRS29 and FOPRS29 used to amplify the T allele the product size 293bp. Results of the primary construction can be seen in Table 1.

Table 1. Results of construction tetra-primer ARMS PCR for detection of SNP rs290487 TCF7L2.

Primer sequence	Tm (ºC)
FOPRS29	
160 AAAGAGCAGATTGTTATTCCTTGGATGG 187	66
ROPRS29	
602 GTTTTCTCCTCTCATGCTGCTCATTTTT 575	66
FIPRS29	
396 AACCCAGTACAAATCATGGTGACACAAC 423	66
RIPRS29	
452 TCAAACACCTTTCTCATTTTCAATTTTTCA 423	66

Two of the four primer is a specific primer for areas experiencing SNP. The 3 'end of this primer is exactly the sequence of the mutated point. If the sample used is not mutated/ SNP it will produce two fragments of different size. Conversely, if there is only one fragment length means that have occurred in the rs290487 SNP.

To determine the ability of primer constructed in detecting the SNP rs290487 polymorphism in the primary test is then performed using the *soft ware*, the result can be seen in Figure 1.

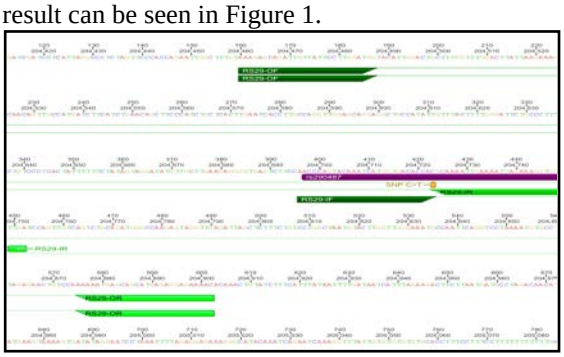
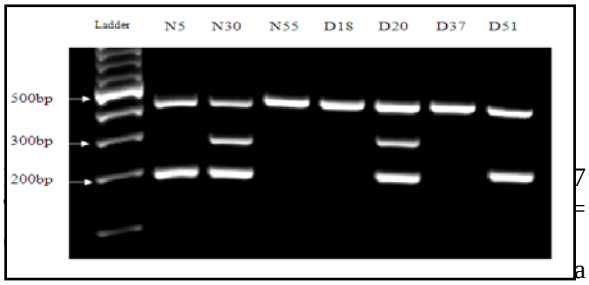


Figure1.Tes primer for tetra-primer ARMS PCR for detection of SNP rs290487 TCF7L2

Based on the primary test can be seen that the four primer design results can stick well and do not occur misprimer, thus the primer is good and ready to book.

Following the optimization of PCR with gradient PCR method. Initially performed optimization for primary FOPRS29 and ROPRS29, then sequentially in the primary FIPRS29 and ROPRS29; RIPRS29 and FOPRS29. Finally done for the four primary. Once the optimization is complete obtained optimum conditions of the PCR reaction as follows:



primer ARMS-PCR method, also *sequencing* which can be seen in figure 3.

ISBN 978-602-19877-3-5

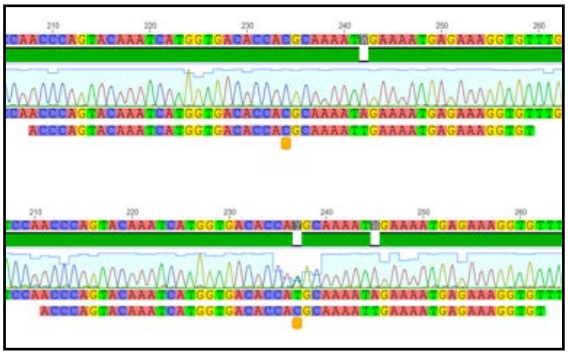


Figure 3. *Alignment* sequencing results with motifs snp TCF7L2 gene rs290487; a. Samples do not polymorphism so that there are similarities with the sequencing results snp rs290487 motif; b. Samples were subjected to polymorphism resulting in a change in the base C into T.

3.2 Discussion

The success of a reaction Tetra-ARMS-PCR in detecting the mutation/ SNP is highly dependent on the specificity of primer constructed. Selection of the appropriate primer will make it easier to identify and analyze the presence / absence of SNPs in a sample. Inaccuracy in selecting the primer will result in different regions are amplified so that it will affect the quality of the results of tests performed [12]. If the selected primer is not specific to a region or a particular SNP, the detection process can not be done. Therefore the primary construction process is the first step and is crucial in detecting the mutation/ SNP in a gene.

Primer function is initiation DNA polymerization reaction in vitro. Appropriate primer will provide the correct *annealing* process and is a prerequisite for Taq DNA polymerase enzyme reactions. Without a proper primer, taq DNA polymerase enzyme is not possible to start the process of synthesizing the complementary strand DNA template. Besides primer also serves to limit the fragment to be amplified in the PCR reaction [13].

Some of the things that must be considered in constructing the length of primer, GC base content and TM [13]. Length of oligonucleotides used as primers are generally 18-28 nucleotides and has a G + C content of 50-60% [14]. In this range can work in specific primer and more easily recognize the template DNA to be amplified. Primer size that is too short will reduce the specificity of primer, the reverse primer is too long also cause PCR reaction was not effective [13].

From the results of the four primary construction can be seen that all the primary has been under ideal conditions. The content of GC base and TM of the primer is quite good, there is no possibility of hairpins and dimmers. Run (the course of reaction) primer is also quite good. Based on the primary analysis of computerized it can be seen that in theory the 4th ideal primer used in multiplex PCR reactions.

The principle of the Tetra-ARMS-PCR method were used to detect the SNP is a multiplex PCR reaction. Where four or more primer used to amplify a region of DNA simultaneously. Two of the four primer is a specific primer to identify SNPs. The occurrence of SNPs in a region can be determined by constructing specific primers recognize that experienced SNP position. This can be done by positioning the 3 'end of this primer sequence is exactly the experience SNP/ point mutations[13].

To determine the ability of primer constructed to detect the rs290487 polymorphism on further testing by the reaction of T-ARMS-PCR. Visualization of the results of electrophoresis of PCR products using a combination of primary FOPRS29, ROPRS29, FIPRS29 and RIPRS29 can be seen in Figure 2.

Confirmation of ARMS-PCR test results are based on the presence or absence of PCR products the target area (polymorphism). This is what eventually will be used as a reference to declare the existence of SNP in a gene. From Figure 2 is seen that the DNA samples taken from the normal (control), the reaction Tetra-ARMS-PCR were performed produces one, two and three ribbons / fragments. The third band is estimated to be the position of ± 443bp, 293bp and ± 208bp. While the test results using DNA from patients with DM, only seen one tape pieces are amplified (± 443bp). Such data indicates that the sample only produce a single long band (± 443bp) has occurred polimorfisme/ SNP. SNPs or single nucleotide change in the target (at the threshold of 3 'primer) primary cause is unable to recognize the area. With the presence of these SNPs, primers FIPRS29 and RIPRS29 can not (work) So in this case the work is just primer pairs FOPRS29 and ROPRS29 so there is only one band formed. While the DNA sample that has not changed, the third primer can still recognize the area and make the process of amplification.

4. CONCLUSION

Has successfully constructed four primer namely FOPRS29, ROPRS29, FIPRS29 and RIPRS29 primer. The four primary constructed capable of recognizing SNP rs290487 TCF7L2 Tetra-ARMS-PCR methods.

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ISBN 978-602-19877-3-5

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ABSTRACT

Plant is an important ecosystem component that capitalize to the present of nutrient. Association between plant expecially tree has an dominant impact to the nutrient suplay. Bukit 12 National Park is one of ecosystem that has many change in land use and still rarely in reasearch. The paper aim to study the diversity, abundance, and association of tree plant in Bukit 12 National Park, Jambi. We found that Euphorbiaceae were the most species diverse for three site. Ochanostachys amentacea Mast (Oleaceae) become the dominant species in NF2 and NF3, whereas the other site (NF1) there are no dominant species. Positive association occured in all site, whereas negative association occurred only on NF2 and NF3.

Index Terms— abundance, dominant, species diversity, species association.

1. INTRODUCTION

Natural forest in Sumatera, Indonesia especially in Jambi province rapidly loss and degrading. Illegal logging and transformation system from natural forest to plantation cause of decreased of natural land/habitat. This Transformation system will affect to biodiversity, include plant vegetation. Vegetation composition of plants in an ecosystem will affect the passage of ecosystem functions contained in the ecosystem. Land use changes (such as natural forests into plantations) would change the composition of plant vegetation.

Natural forests are usually dominated by woody plants that have roots deep enough and large canopy size to maintain the availability of soil nutrients. The high amount of litter which roots deep and wide will prevent leaching that occurs due to rain. Rooting can also be a source of soil nutrients, through death or root damage which will undergo decomposition. In addition to the areas of natural forest has a variety of plants, ranging from trees to grass plants. The diversity of these plants will also affect the passage of the components of the ecosystem.

According to Hooper and Vitousek [1], compositional differences cause variations in the dynamics of plant production in an ecosystem. So the plant composition is very important to note because it is closely related to nutrient availability and plant production course. Ogunkunle and Awotoye [2] adds that there is a relationship between soil nutrient availability to plant vegetation, where the vegetation cover increases the nutrient content of the soil in an ecosystem. Mature forest ecosystems and intercroping brown that has a high diversity of vegetation, soil nutrient concentrations which is much higher than in monoculture teak plantations dominated by teak plantations.

The vegetation established by the existence and the interaction of several plants in it. One form of interaction between plant species is association. Plant association will impact to the present of nutrient in it. Association is typical community type that found in the same conditions and repeated in several locations. Associations characterized by resemble of floristic composition, uniform physiognomy, and spreading has distinct habitats [3]. Association is divided into positive associations and negative associations. Positive association occurs when a plant species present simultaneously with other plant species and will not be formed without the existence of other plant species. Whereas negative association occurs when particular type of plants are not present simultaneously [4]. Studies of plant association include flora diversity are still rarely found especially in Jambi, Indonesia. Therefore, the study of vegetation in this region is very important.

Forests in Jambi province has many converted into plantations, it is of course as previously described nutrient cycling and will change as well as interfere with the diversity of plants in the ecosystem. Bukit 12 National Park (TNBD) is one of the tropical rainforest in Jambi province that has undergone changes in vegetation growth due to changes in land use. Before becoming TNBD, the area consists of permanent production forest, limited production forest areas and other uses. At this time TNBD region dominated by secondary forest, only in the northern region there is still a natural forest.

Knowledge of the composition of plant natural forest vegetation needs to be done, as the initial information to determine the contribution given by the

ISBN 978-602-19877-3-5

crop nutrient to nutrient availability, which will affect nutrient cycling in an ecosystem. Further research on the composition of forest plant vegetation include plant associations in TNBD at Sarolangun district is still very limited therefore conducted this research on the composition of plant vegetation on oil palm plantations and natural forests in the Bukit 12 National Park Sarolangun Jambi. We studied plant species responses to environment condition in different slope of Bukit 12 National Park, Jambi in order to describe relationships between species composition/diversity and underlying site gradients.

2. METHODS

Study site

The study was conducted from September 2012 to November 2012 in Sarolangun district, Jambi province. The Bukit 12 National Park is a relatively small national park that covers 605 km^2 in Jambi (Indonesia), which represent the lowland tropical rain forests in Jambi province. Only the northern part of this park consists of primary rainforest, while the rest is old-growth forest with selective logging activities. In the past, the forest area was functioned as a permanent production forest, limited production forest, and other forest land uses which were later merged to a National Park.

The study site of this research was Bukit 12 Nasional Park in three different slope area, with the following specific plot location coordinates:

1. NF1: (S 01°59’42.5’’ E 102°45’08.1’’) 37˚ of slope nearest Desa Baru village,
2. NF2 (S 01°94’285’’ E 102°581 26) (102 m dpl), 3˚ of slope
3. NF3 (S 01°94’150’’ E 102°580 99) (105 m dpl), 10˚ both of slope, both (2 and 3) nearest Pematang Kabau village with undulating land around.

in Sarolangun district, Jambi province (Figure 1). The average monthly rainfall is 291.08 mm. The daily humidity and solar radiation ranged between 77-91% and 41.5%-64.25%, respectively. Climate data were acquired from the *Badan Meteorologi Klimatologi dan Geofisika* (BMKG) Climatology Station of Jambi, at Jl. Raya Jambi-Muara Bulian Km 18, Simpang Sungai Duren, Jambi.

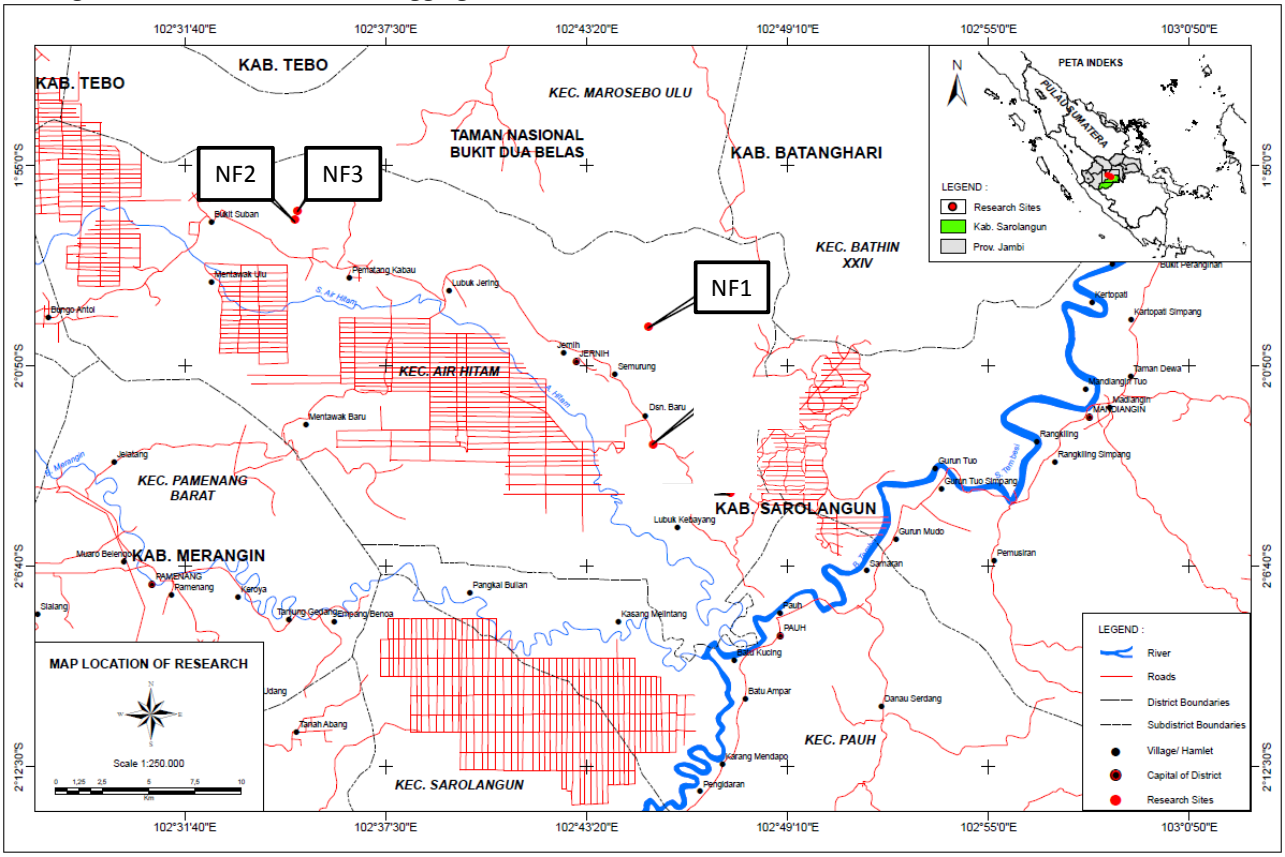

Figure 1. Map of study site of natural forest (NF) (Bukit 12 National Park) at Jambi, Indonesia

Experimental approach

Field Data Collection

For study of biodiversity the selected site were divided into three difference slope area (3˚ of slope, 10 ˚ of slope and 37˚ of slope). Sampled were collecting from 50 m x 50 m of each plot and it is divided into 25 subplots (10 m x 10 m each subplot) for identify tree. The data were used for computation of analytic feature such as: basal area, density, frequency, abundance, important value index (IVI). Diameter at breast height (DBH at 1.3 m from the ground) of all the trees was measured and recorded for each species.

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The importance value index (IVI) for the tree species was determined as the sum of the relative density, relative frequency and relative dominance [5]. The ratio abundance to frequency for different species was determined to show the distribution patterns [6]. The tree species diversity was determined by using Shannon-Wiener information function (H') [7]. Concentration of dominance was measured by Simpson's index [8].

Association analysis were recorded from the seven species tree that have highest important value index in each plot by using contingency table 2 x 2 [9]. The contingency table of 2 species plant is:

Table. 1. Contingency table 2 x 2 of two species.

		relevé 1		
		presence	absence	∑
relevé 2	presence	a	b	a+b
	absence	c	d	c+d
	∑	a+c	b+d	∑

Note: a = the number of subplot that found species A and B, b = the number of subplot that found species A, c = the number of subplot that found species B, d = the number of subplot that not found species A and B, ∑ = Total number of subplot.

To find tendency of associations we use Chi-square Test (X^2t) :

$$\text{Chi} - \text{square Test} = \frac{N\,(ad-bc)^2}{(a+b)(a+c)(c+d)(b+d)}$$

Chi-square Test is compare with chi square table value in one degree of freedom. The theoretical chi-square value for 1 df at the 5 % probability level is 3.84. If chi-square test value > 3.84, it is means that the co-occurrence of species A, B is independent and conclude that they are associated [9].

To calculate the level of association, we use form:

$$L\,(a) = \frac{(a+b)(a+c)}{N}$$

There are two type of associations:

1. Positive – if observed a > L (a), that is, the pair of species occured together more often that expected if independent.
2. Negative – if observed a < L (a), that is, the pair of species occured together less often that expected if independent.

Calculation of tree species association that has IVI ≥ 10% showed in matriks diagram form and than this result test with association indeks [9].

$$IO = \frac{a}{\sqrt{a} + b\sqrt{a} + c}$$

3. RESULTS

Floristic Biodiversity of Tree

The result showed that there are 109, 136, and 125 individual trees which consisted of 32, 21, and 26 of family and 69, 41, 54 species identify of NF1, NF2 and NF3 respectively, and 15 species un-identified (Table 2). We found that Euphorbiaceae were most species diverse among family, it is found in NF1 (17 species), NF2 (9 species) and NF3 (7 Species), whereas the other family has below 6 species for all of site.

Table. 2. Plant groups of tree in the tropical rainforest in Bukit 12 National Park, Jambi.

Family	Number of spesies		
	NF1	NF2	NF3
Anacardiaceae	0	2	3
Arecaceae	2	2	0
Alangiaceae	1	0	0
Anacardiaceae	1	0	0
Annonaceae	2	1	2
Apocynaceae	1	0	0
Burceraceae	4	2	3
Connaraceae	1	0	0
Dipterocarpaceae	2	3	4
Ebenaceae	2	0	1
Elaeocarpaceae	0	1	1
Euphorbiaceae	17	9	7
Fabaceae	1	1	1
Fagaceae	2	2	0
Lauraceae	5	4	3
Leguminosae	0	1	2
Malvaceae	0	0	1
Melastomataceae	2	0	1
Meliaceae	2	0	1
Moraceae	2	1	1
Myristicaceae	3	2	3
Myrtaceae	2	2	6
Oleaceae	1	1	1
Palmae	1	0	0
Rosaceae	2	0	1
Rubiaceae	1	0	0
Rhizophoraceae	1	1	1
Rutaceae	0	0	1
Sapotaceae	2	1	3
Sapindaceae	2	0	1
Sterculiaceae	0	1	2
Styracaceae	1	2	0
Theaceae	0	0	1
Thymelaeaceae	1	0	2
Tiliaceae	1	0	0
Urticaceae	2	0	0
Violaceae	1	2	1
tidak teridentifikasi	7	4	4
Total	75	45	58

Oleaceae family (*Ochanostachys amentacea* Mast) has the highest relative frequency, relative density, and IVI for NF2 and NF3, whereas in NF1 there is no family that has the higest value of RF, RD, and IVI. Whereas for RD found in NF3 family Annonaceae (*Sp.1*), and NF2 Myrtaceae (*Eugenis sp.8*) and for NF1 kayu papan (local name) become the highest.

We found that there are 4 species which have highest important value in NF2 are: *Ochanostachys amentacea* Mast (Oleaceae) (28.18), *Baccaurea sp.2* (Euphorbiaceae) (23.87), *Rinorea sp.1* (Violaceae) (23.37), *Eugeina sp.8* (Myrtaceae) (22.08), and. On NF3 we found 3 species that had the highest important value are: *Ochanostachys amentacea* Mast (38.45),

ISBN 978-602-19877-3-5

sp.1 (Annonaceae) (35.68), *Archidendron microcarpum* Benth. (Fagaceae) (20.20). In NF1, there are no dominant species in the plot. There are no highest value of IVI (Table 2). It's means that in NF1 have the highest biodiversity ($H^{'}$ = 1.79) than the other site (Table. 3). But if we see from the relative dominance value base on area basal, *Sp. 1 (*Annonaceae) (22.71%) become the dominance tree in NF3, followed by *Eugenia sp.8* (Myrtaceae) (18.14%) in NF2, and *Ochanostachys amentacea* Mast (Oleaceae) (12.58%) in NF3.

Table. 3 Seven dominant species of plants in each plot of tropical rainforest in Bukit 12 National Park. (NF1, NF2, and NF3, respectively)

Site	Species	Family	LBDS Total (m2/ 0.25ha)	FR (%)	KR (%)	DR(%)	INP
NF1							
1	*Voacanga sp.*	Annonaceae	0.98	5.13	6.40	3.48	15.01
2	kayu papan (local name)	-	2.35	3.42	3.20	8.34	14.96
3	*Ficus variegata BL.*	Moraceae	1.89	2.56	2.40	6.69	11.65
4	*Villebrunea sp.2*	Urticaceae	0.94	4.27	4.00	3.33	11.60
5	*Santiria sp.2*	Burceraceae	1.08	3.42	4.00	3.82	11.24
6	*Dyospyros sp.1*	Ebenaceae	0.45	3.42	3.20	1.61	8.23
7	*Endospermum malacense* Muell.Arg	Euphorbiaceae	1.35	0.85	0.80	4.79	6.45
NF2							
1	*Ochanostachys amentacea* Mast	Oleaceae	1.56	10.53	11.93	5.73	28.18
2	*Baccaurea sp.2*	Euphorbiaceae	0.96	8.42	11.93	3.52	23.87
3	*Rinorea sp.1*	Violaceae	1.58	8.42	9.17	5.78	23.38
4	*Eugenia sp.8*	Myrtaceae	4.96	2.11	1.83	18.14	22.08
5	*Canarium sp.1*	Burceraceae	2.49	4.21	3.67	9.10	16.98
6	*Archidendron microcarpum*	Fabaceae	0.48	7.37	7.34	1.77	16.48
7	*Aporosa bracteosa* Pax & K. Schum.	Euphorbiaceae	0.88	5.26	5.50	3.22	13.99
NF3							
1	*Ochanostachys amentacea* Mast	Oleaceae	4.77	12.10	13.77	12.58	38.45
2	*sp.1*	Anonaceae	8.61	6.45	6.52	22.71	35.68
3	*Archidendron microcarpum*	Fabaceae	1.33	7.26	9.42	3.52	20.20
4	*Scaphium macropadum* (Miq.) Beumee	Sterculaceae	3.67	1.61	1.45	9.69	12.75
5	*Rinorea sp.1*	Violaceae	1.08	4.03	5.07	2.84	11.95
6	kayu belimbing (local name)	-	3.76	0.81	0.72	9.92	11.46
7	*Eugenia sp.4*	Myrtaceae	1.59	2.42	2.90	4.19	9.50

Note. FR = Relative frequency, KR = relative density, DR = Relative dominancy

The species diversity (H') was recorded highest for *Ochanostachys amentacea* Mast (Oleaceae), followed by *Sp.1* (Annonaceae) both in in NF2, and minimum for *Endospermum malcene* Muell.Agr (Euphorbiaceae) in NF1. If we see from all of species in each site, we can see that NF1 has the highest diversity index 1.79 (Table. 4) and no dominant species of plant in it (Table 3.).

Table.4. Number of species, number of individu, basal area and biodiversity index.

Site	Number of species	Number of individu	Basal area (m^2/0.25 ha)	Diversity index (H')
NF1	117	125	28.22	1.79
NF2	95	109	27.32	1.48
NF3	124	138	37.89	1.53

The tree distributions base on diameter and height showed in Figure 2. The same patterns of tree distributions show for all site of the research. The highest number of plant recorded in <10 – 30 cm of class diameter it is about 77.60 – 80% followed by <30 – 50 cm (12.73 % - 17.60 %), <50 – 70 cm (3.20 % - 3.64 %), <70 – 90 (0.72 % - 2.73 %), <90 cm (0 – 1.45 %). In NF1 the highest height of plant only 37.40 m with 76.30 of diameters, whereas in NF2 and NF3, 46.70 and 109.81 cm, 44.30 m and 137.35 cm, respectively (Figure 2).

ISBN 978-602-19877-3-5

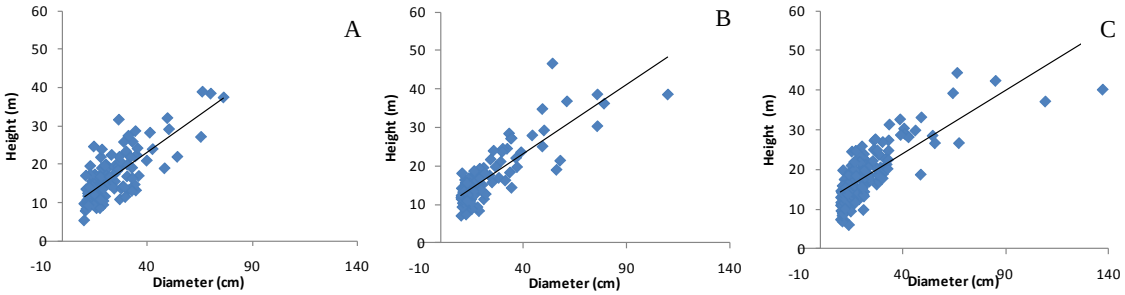

Figure.2. Distribution of plant base on diameter and height. A = NF1, B= NF2, C = NF3

Association of 7 highest IVI of tree

Association between plant need to be explain, association will help plant in terrestrial ecosystem fulfill their life cycle. There was only one type association (positive association) between plant with highest INP in NF1 (*Villebrunea sp.2* Vs *Santiria sp.1*) and have lowest association, it is only 0.48. In NF2 and NF3 have two type association, positive and negative. Positive association occured between *O. amentacea* Mast Vs *Rinorea sp.1* and *Baccaurea sp.2* Vs *A. microcarpum* with association value 2.40 and 2.52 respectively for NF2. In NF3 positive association occured between *sp.1* Vs *A. Microcarpum* and *S. macropadum* (Miq.) Beumee Vs *Eugenia sp.4*. Negative association occured between *Rinorea sp.1* Vs *Eugenia sp.8*, *Rinorea sp.1* Vs *Canarium sp.1*, and *Eugenia sp.8* Vs *A. microcarpum* in NF2, whereas in NF3, only *A. microcarpum* Vs *Rinorea sp.1*, that has negative association.

Table. 5. Association between 7 dominant trees in NF1, NF2 and NF3.

Association species		X^2t	AT	L(a)	Association species		X^2t	AT	L(a)	Association species		X^2t	AT	L(a)
NF1					**NF2**					**NF3**				
Voacanga sp.	Kayu Papan	0,0026 ns	nc	0,96	*O. amentacea*	*Baccaurea sp.2*	0,2604 ns	nc	3,6	*O. amentacea*	*sp.1*	1,1029 ns	nc	4,8
	F. variegata	0,1628 ns	nc	0,72		Rinorea sp.1	2,3392 **	+	2,4		*A. microcarpum*	1,4178 ns	nc	5,4
	Villebrunea sp.2	0,0505 ns	nc	0,83		*Eugenia sp.8*	1,5625 ns	nc	0,4		*S. Macropadum*	1,4493 ns	nc	1,2
	Santiria sp.2	0,0026 ns	nc	0,96		*Canarium sp.1*	1,6 ns	nc	1,6		*Rinorea sp.1*	0 ns	nc	3
	Dyospyros sp.1	0,0026 ns	nc	0,96		*A.microcarpum*	0,5291 ns	nc	2,8		Kayu belimbing	0,6944 ns	nc	0,6
	E. malacense	0,3289 ns	nc	0,24		*A. bracteosa*	1,0417 ns	nc	2		*Eugenia sp.4*	1,0101 ns	nc	1,8
Kayu papan	*F. variegata*	0,7621 ns	nc	0,48	*Baccaurea sp.2*	*Rinorea sp.1*	0,0434 ns	nc	3,24	*sp.1*	*A. microcarpum*	3,5858 *	+	2,88
	Villebrunea sp.2	0,1905 ns	nc	0,8		*Eugenia sp.8*	0,5859 ns	nc	0,36		*S. Macropadum*	1,023 ns	nc	0,64
	Santiria sp.2	0,2869 ns	nc	0,64		*Canarium sp.1*	0,4051 ns	nc	1,44		*Rinorea sp.1*	0,1838 ns	nc	1,6
	Dyospyros sp.1	0,2869 ns	nc	0,64		*A. microcarpum*	1,8863 **	+	2,52		Kayu belimbing	0,4902 ns	nc	0,32
	E. malacense	0,1984 ns	nc	0,16		*A. bracteosa*	0,0434 ns	nc	1,8		*Eugenia sp.4*	0,0028 ns	nc	0,96
F. variegata	*Villebrunea sp.2*	0,8523 ns	nc	0,6	*Rinorea sp.1*	*Eugenia sp.8*	2,2135 **	-	0,32	*A. microcarpum*	*S. Macropadum*	0,3237 ns	nc	0,64
	Santiria sp.2	0,2964 ns	nc	0,24		*Canarium sp.1*	2,6786 *	-	1,44		*Rinorea sp.1*	3,5156 *	-	1,8
	Dyospyros sp.1	0,6493 ns	nc	0,48		*A. microcarpum*	0,2329 ns	nc	2,52		Kayu belimbing	0,2329 ns	nc	2,52
	E. malacense	0,2964 ns	nc	0,24		*A. bracteosa*	0,2501 ns	nc	1,44		*Eugenia sp.4*	0,0487 ns	nc	1,17
Villebrunea sp.2	*Santiria sp.2*	6,5115 *	+	0,48	*Eugenia sp.8*	*Canarium sp.1*	0,142 ns	nc	0,12	*S. Macropadum*	*Rinorea sp.1*	0,5435 ns	nc	0,4
	Dyospyros sp.1	0,7621 ns	nc	0,48		*A. microcarpum*	2,2449 **	-	0,32		Kayu belimbing	0,0906 ns	nc	0,08
	E. malacense	0,5435 ns	nc	0,4		*A. bracteosa*	0,0906 ns	nc	0,08		*Eugenia sp.4*	2,9727 *	+	0,24
Santiria sp.2	Dyospyros sp.1	0,4649 ns	nc	0,36	*Canarium sp.1*	*A. microcarpum*	0,0481 ns	nc	0,84	*Rinorea sp.1*	Kayu belimbing	0,2604 ns	nc	0,2

Note : AT= Association type, nc = not calculated, ns = not significant

4. DISCUSSIONS

Euphorbiaceae were the most species diverse in our study, we know that Euphorbiaceae is one of the large and diverse family of flowering plant. There are at least 7.500 species in it, and has widespread throughout of Indonesia forest especially in Sumatera.

O. amentacea Mast is the dominant plant species in NF2 and NF3, it is commonly found in secondary lowland rainforest. It will growth luxuriantly in mixed dipterocarp forest on the undulating country or hill land with altitude up to 950 m, it is found on clay-rich, loamy or sandy, usually well-drained soils, apparently growing well on laterite, and is only rarely found in periodically in undated locations [10]. We know that

ISBN 978-602-19877-3-5

Sarolangun regency especially Bukit 12 National Park consist of undulating area, throughout of the way to the national park full of undulating land. Furthermore, in our site research we found that in NF3 has the most dominant *O. amentacea* Mast than others, that species of
Dipterocarpacea found in the highest number than the others site. The abundance and diversity of plant are by far influenced by the characteristic of landscape. Each species has a different and uniquely respons to the environment condition, such as abrupt change in altitude, slope, moisture gradient, temperature, rainfall, and hydrology [11], include land use change because of transformation system. As we can see that NF1 has more highest slope than the other site, it is one of factor that impact of biodiversity in teresterrial ecosystem. In this study we can say that, the slope will impact diversity of plant vegetation.

Differences in number of individual trees, species, families, total area basal, and vegetation composition may be due to differences in local environmental variables (disturbance gradients and vegetation characteristics). The project impact on forests of project influence area cannot recover the natural condition of the local environment but the effective implementation of environmental impact assessment mitigation measures could reduce the impacts. To meet the natural condition in project impact area, intensive control on human disturbance in forest and afforested areas as well as protection of natural regeneration of species may preserve integrity of local ecosystem [12].

Important value index is used to determine the overall importance of each species in community structure. *O. amentacea* Mast has the highest value of IVI, showed that *O. amentacea* Mast was the dominant plant in NF2 and NF3. It different in NF1, there are no dominant tree in it. It is support by diversity value, that NF1 has the highest diversity value than other (1.79). But if we see from RD value It is support by not relevant between IVI and RD value, we can see that base on IVI *O. amentacea* Mast become the dominant plant in the site, but if we see base on RD, *sp.1* (Annonaceae) become the dominant plant.

Tree distribution base on diameter showed the same pattern in all site of the research. All of site showed the decreased of numbers of plant followed by the increased of diameter and height of plant. From figure 1 we can see that Bukit 12 National park dominated by stratification 1 (plant with diameter <10 – 30 cm) and only 1.45% that include to stratification 3(diameter <90 cm). We can say that bukit 12 National Park include to secondary forest that still in suksesi phase, beside that we found in species *Macaranga* in the plot, that was one kind of type secondary vegetation. Furthermore we can see that there is no plant attained to 60 m of height. It's means that in Bukit 12 National Park is not an emergent plant, because there are no plant that achived to 70 m in height. Emergent trees represent nuclei of biodiversity and ecosystem functions distributed throughtout mature forest. Forest management should recognize large trees as significant management units for preservation of biodiversity and ecological functions [13]. Woody plant species richness would be favoured by actions that increase patch area and reduce anthropogenic disturbances particularly in lowland forests [14]. Futhermore Onaindia *et al* [15] suggest that plant species composition, percent cover of individual plant species, and the Simpson's diversity index (applied considering the different growth-forms and vertical layers) are suitable and complementary indices to evaluate disturbance at the studied woodlands.

Because of illegal logging and land use change to plantation, so many lands in TNBD destroyed. It is makes constriction of primary forest in it and of course change of ecosystem status. Strategic areas are important for predicting changes in the status of the ecosystem. Among the best ecological option in developing monitoring strategies is to target species of ecological significance within an ecosystem such as those species that are indicators of specific associations or plant communities [11]. Associations is one kind of way to know the contribution of plant to nutrient in terresterial ecosystem. Positive and negative associations are two kind of associations between plant that will determine the survive plant or not and will impact to life cycle in it.

Positive and negative association showed in NF2 and NF3, and only positive association showed in NF1. Positive association means that the couple of plant showed tolerances to leaves together in the same area or there is a mutualism interaction between both plants especially in distribution of life space**.** Whereas negative association means that there arenot tolerance between the couple plant to leaves togetehr example competitions.

We know that NF1 is more sloping than the other site. Slope area will impact to associations between plant. According to Badano *et al* [16], negative associations was decreased from mesic (~30%) to xeric (~16%) slope. Species richness was higher on xeric than on mesic slopes. Although competition seems to be the main biotic force structuring communities on both mesic and xeric slopes, furthermore Badano *et al* [16] suggest that the decrease in importance of negative interactions from mesic to xeric habitats could produce an increase in diversity. We can see from the data that NF1 (more sloping than others), has the highest diversity than the other site (more flat area), there are no dominant tree on NF1 and only positive interactions occured. The highest diversity in NF1, makes lowed or even that no competition that happens between plant especially tree. The difference species of plant will make the difference of nutrition need include life cycle, it wil

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presseure of competition or negative interaction between them. It different with Filotas *et al* [17] said that mutualistic interactions dominate in communities with low diversity characterized by limited species dispersal and poor habitat quality. On the other hand, the fraction of mutualistic interactions decreases at the expense of exploitation and competition with the increase in diversity caused by higher dispersal and/or habitat quality. Furthermore Filotas *et al* [17] said that mutualism (positive interactions) is an essential component driving the origination of complex and diverse communities.

Positive interactions that result from neighbors buffering one another from stressful conditions are predictably important community forces in physically streeful habitats. Biogeographic biases have limited appreciation of the role played by positive interactions in intertidial communities. Most of the work that has formed the foundation of marine by the amelioration of thermal or desiccation stresses are likely more important in warmer climates. They argue that many important positive feedbacks operate at large spatial scales, not conducive to experimental study, and thus have escaped critical attention and general acceptance. They suggest that recognizing the role of positive interaction in communities may be keys to understanding population and community processes in physically stress full habitats, many scale-landscape processes and uncovering long-suspected linkages between biodiversity and community stability [18].

Positive interactions are incredibly diverse and have a well-documented influence on every ecosystem on Earth. We encourage ecologists to consider how facilitation modifies the ecological theory that they teach at even introductory levels and also how it might lead them to question other paradigms of ecology [19].

However, numerous studies indicate that the abundance, zonation, and perhaps even local existence of species are not simply due to abiotic conditions and competition, but are highly affected by direct positive interactions within the plant community and complex indirect positive interactions with consumers and mutualism [20].

According to Cranston *et al* [21], gender can affect the balance between competitive and facilitative interactions. Stronger facilitation by hermaphroditic Silene acaulis, coupled with a lower cost of harbouring beneficiaries, suggests that life-history traits and related patterns of resource allocation can influence the facilitative effects of a species.

5.CONCLUSIONS

Euphorbiaceae were the most diverse for three research site in Bukit 12 National Park. Ochanostachys amentacea Mast (Oleaceae) become the dominant species in NF2 and NF3, whereas the other site (NF1) was no dominant species. Positive association was occured in all research site, whereas negative association occurred only on NF2 and NF3.

6. ACKNOWLEDGEMENT

The study was the Postgraduate Scholarship Program (BPPS) from National Education Ministry of Indonesia. We are grateful to inhabitans of Desa Baru and Pematang Kabau Village Jambi, Indonesia for their sociability and also to all of the staff in Bukit 12 National Park, Jambi for their support during field work.

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ISBN 978-602-19877-3-5

1-PHASE INVERTER TRIGGER PULSE CONTROL DESIGN BASED ARDUINO MICROCONTROLLER IN THE HYBRID POWER PLANT REGULATOR SYSTEMS

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ABSTRACT

This paper suggests the development of a trigger pulse control of single-phase inverter systems to equip a renewable power plant system Inverter capacity is intended for household, it is easy to be realized or the boarding house procurement cost is affordable and easy to obtain its components in the local market. Ease and grace in the realization meant that the public interest to use them, so that in turn they understand and get used to using a system of this renewable source of electrical energy. Although the results of the design development of the inverter is expected to easily be operated and cheap, but do not ignore the factor of safety, security and health (K-3). These pulses trigger system using the Arduino microcontroller. To the microcontroller was loaded control program which will set the pulses trigger on the transistors power inverter. The control program is set such that it will produce a sine form output that is closer to a pure sine wave. This research was conducted using the circuit design, simulation using Proteus ISIS-7, prototype buildings and characteristics testing of the device. At the end of this study will produce a model system prototype trigger pulse control inverter 1 phase with sine form output is closer to pure sine. This trigger pulse control program using a pulse width modulation (PWM) program and combined with PID so that in addition to the pure more form of sine output and can also tackle voltage output fluctuations due to load changes.

Index Terms— Trigger, Arduino-Microcontroller, Inverter**.**

1. INTRODUCTION

The availability of fossil energy as the main source of energy is very limited and constantly under threat of scarcity because they use this energy on a large scale and continuously. Moreover the numbers of pollution resulting from the fossil fuel energy generation is enormous. Therefore, the need for alternative energy sources of new renewable energy sources to replace fossil. This fits well with the Republic of Indonesia government program of the which initiated the increase in electric energy source with a target of 35,000 MW until 2019.

New energy sources and renewable electricity, has been widely suggested by previous researchers as Tri et al. [1] and Radhityo [2], but for the realization of large-scale utilization in our country, especially in Indonesia has been delayed, as they relate to policy development priorities, as well as political and public understanding. In this study deliberately taken from the side that is relatively easily realized, for use in the household scale. Although the target utilization is only at household level, but if the greater part of every member of the household aware of Utilizing this system, certainly not least will contribute to national electric power needs of the future.

To be able to utilize the resources that relatively small electrical energy required an energy storage system regulator. The regulator is necessary to make the voltage or DC voltage generated energy sources, able to provide charging current to the battery. Battery or batteries to store electrical energy received from the source through the regulator. Inverter serves to amend the DC voltage that has been stored in the battery into AC voltage corresponding to the load that needs 220-240 V AC. This paper suggests a trigger pulse inverter design will be used in 1-phase inverter in the electric energy storage system of a hybrid regulator

2. LITERATURE REVIEW

Previous researchers have done studies on Prime Mover / regulator or stabilizer for use in hybrid renewable energy systems as proposed by Binddeshwar Singh with his colleagues in 2012 [3]. They reviewed the literature from 2009 up to 2012, and found as many as 30 pieces manuscript discusses Renewable energy resources as a prime mover; 34 pieces of Self Excited Induction Generator; 9 pieces of manuscript of AC / DC / AC converter; 14 pieces of manuscript about power factor; 10 pieces of manuscript about the switching frequency [3]. This

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shows that the trend of research about the prime mover / regulator occupies the second highest position after Self Excited Induction Generator coupled with 9 pieces of manuscript of AC / DC / AC converter which is closely associated with the renewable energy regulatory system.

Utilization of solar energy for residential purposes in one of the communities have been used in Peru expressed by [4] in his article titled "Technical and Financial Feasibility of a Stand-alone Photovoltaic System for Rural Electrification in the Andean South Region of Peru ". Meanwhile [5] has proposed a system of electric energy generation by wind turbines and Pico hydro turbine in a high-rise building combination, in his article titled "A Novel Approach of Electrification of the High Buildings at Dhaka City during Load Shedding Hours". Sekar in 2013 suggests an increase in the performance of the inverter without transformer with ISPWM techniques [6] and Karuppiah 2014 suggests Improved Full-Bridge Inverter-Based Transformer [7].

3. DESIGN CONCEPT

1-phase inverter consists of three main parts: the power or switching amplifier, driver amplifier and pulse controllers tirger. Power amplifier serves to provide enough power at a voltage level of 220 volts. Booster amplifier to deliver the appropriate voltage to the power amplifier so that the power amplifier can work as desired. Pulse controller triggers serves to set the pulses trigger transistor-transistor inverter power amplifier. This trigger pulse controller needs to be designed such that the output of the inverter is not disabled and with a frequency of 50 Hz.

Pulse controller consists of a Atmega 328 microcontroller (Arduino Mega), which forms the output pulse is set by adjusting the coding program or large based control signals received by the analog input when using the system Pulse width modulation (PWM).

In these systems, the microcontroller Arduino serves as a trigger pulse generator. Pulses are produced in accordance with the delay given to the program coding. Two kinds of programming is used for measurement and testing melakukana, namely programming and digital PWM output program. Frequency and duty cycle pulses trigger chosen our best to produce good output signal. Structuring the trigger pulse with the intention that such defects can reduce the signal and obtain optimum power output.

4. METHODOLOGY

This research was conducted through five stages: planning circuits, simulation, prototype, test characteristics and device performance testing . The stages of this study are shown in Figure. 1 flow chart of the research stages.

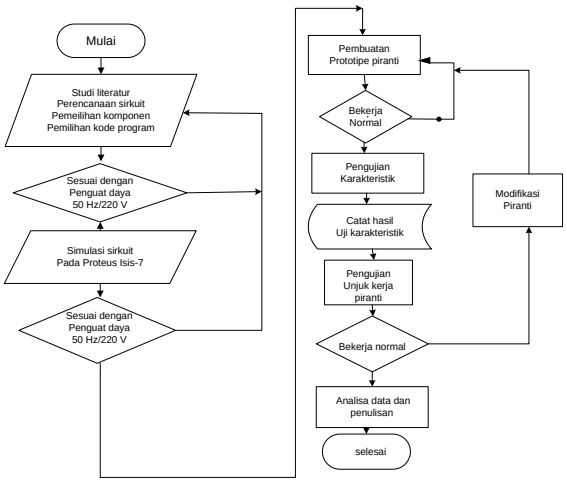

Figure 1. Research flowchart

Trigger pulse control circuit consists of a pulse generator and driver amplifier. As the pulse generator is used microcontroller Arduino mega and as a booster amplifier used amplifier circuit Darlington bipolar transistor of Tip 2SC 1161 and 3055 as shown in Fig.ure 2.

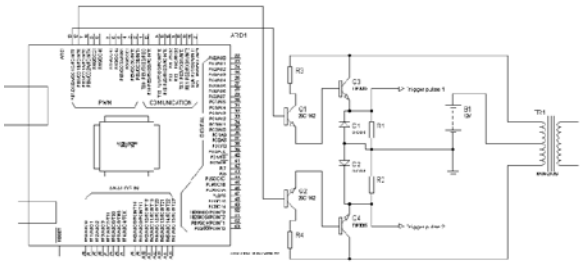

Figure 2. Triggerring pulse control circuits

5. RESULTS AND DISCUSSION

By using the Arduino microcontroller program code generated PWM on pin 12 and pin 13 as shown in Figure 3. In the numbers it is seen that the length of each period to pin 12 and 13 is 10 mS. If the results are summed second period is 20 mS. Thus both the PWM period will generate a frequency of 1/(20 x 10^{-3}) ms = 50 Hz.

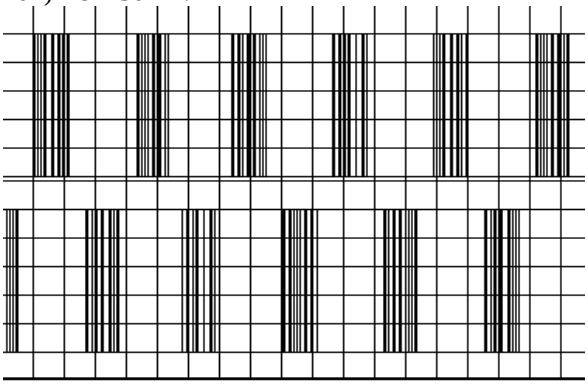

Figure 3. Arduino PWM output signal

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Figure 4 is depict PWM pulse oscilloscope photograph of Arduino real measurements. In real measurements obtained a PWM pulse periode amount 9.14 ms only.

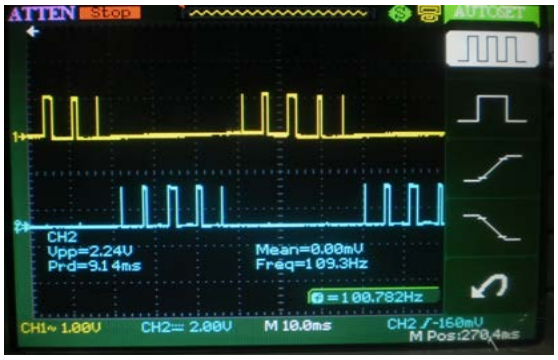

Figure 4. PWM pulse oscilloscope photograph of real measurements

By connecting all circuits are pulse generator , drivers and power amplifiers, then obtained signal simulation on the inverter output in the full wave sine form as shown in Figure 5. Output signal has 106.5 V effective voltage and 30 ms periods at 12 v DC voltage source. If given a DC voltage source of 24 V, the voltage output will reach 213 V as shown in Figure 6.

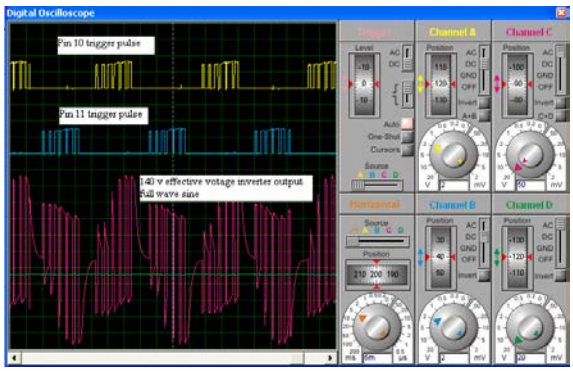

Figure 5. All simulation pulse trigger and full wave inverter output

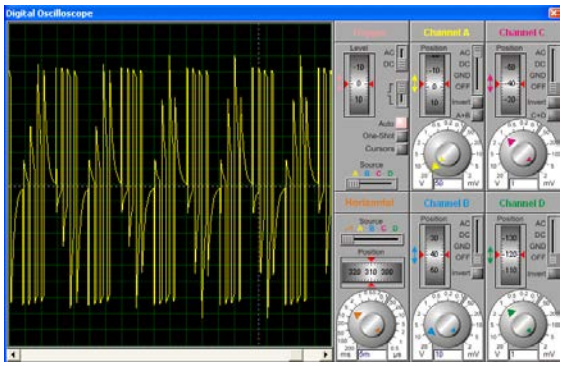

Figure 6. All simulation of trigger pulse and full wave inverter output with 12 V DC voltage source.

This inverter is equipped with the RC filter circuit. This RC filter with frequency cut off (Fc) 50 Hz selected 10 uF capacitor value so that the value of the resistor can be calculated referring to:

$$Fc = 1(2\pi RC)$$

Thus obtained 316 Ω resistor value, then the transfer function is:

$$G(s) = \frac{316.455696203}{s+316.455696203}$$

with a cut-off frequency = 50.3654883202 Hz. Meanwhile Bode diagram and Transient analysis are shown in Figure 9 and Figure 10 respectively.

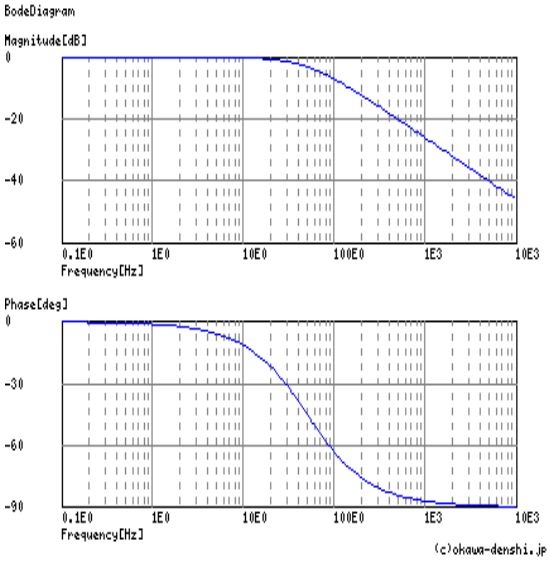

Figure 7. RC low pass filter Bode diagram

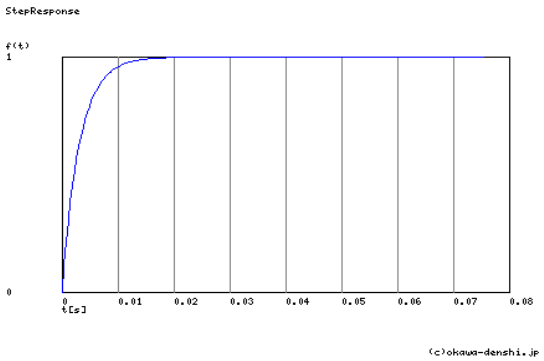

Figure 8. RC filter transient analyses

Once paired the filter to the inverter circuit then obtained sine output signals as shown in Figure 11. Figure 11 explains that with the addition of filters make the inverter output signal closer to purity.

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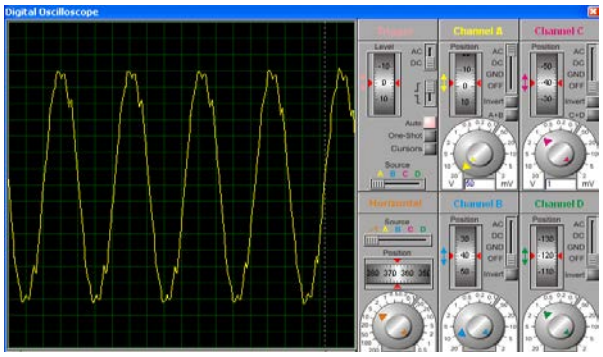

Figure 9. Inverter output with filter

6. CONCLUSION

In this research, simulation and hardware design of single phase inverters with PWM Arduino microcontroller as control pulse, can be inferred that has been obtained 220 V sine wave inverter output voltage with a frequency of 50 Hz, in conditions of 12 V DC voltage source and 100 Hz PWM pulse control both frequency respectively. Besides that, by have relied to the cut-off frequency for 50 Hz, the obtained value of resistor and capacitor filter RC 316 Ohm and 10 uF respectifely.

7. ACKNOWLEDGEMENTS

Acknowledgements of support for this research by Hibah bersaing DIKTI 2015.

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ISBN 978-602-19877-3-5

GEOGRAPHICAL INFORMATION SYSTEM HANDYCRAFT APPLICATION BASED ON MOBILE IN DEPOK CITY

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ABSTRACT

Indonesia is famous for its art and culture. There are so many form of art. One of them is handycraft. There are all sort of handycraft. Every area has different kind of handycraft. Most of the times, the handycraft can be easily found. But sometimes there is also a handycraft area that isn't well-known. That is why the geographical information handycraft application based on mobile in Depok city is made. This application is made to make it easier for its user to find the information about the handycraft in Depok city. Geographical information handycraft application based on mobile in Depok city is made using Java and XML programming language for Android. The making of this application used Android Studio that is equipped with Android SDK (Software Development Kit).

Index Terms :

1. PREFACE

Indonesia is a county that is rich in art and culture. Every place is unique on its own so that it attracts local tourist and also international tourist. Every region in Indonesia has a lot of variety when it comes to handycraft. One of the region is Depok city. Depok city is one of the most visited city when it comes to travelling and there are a lot of handycraft there.

To fulfill the needs of geographical information regarding the position of the place that provides handycraft, Geographical Information System Handcraft Application Based on Mobile in Depok City is made. With this mobile application, the user can use this application easily wherever and whenever they wanted and they can retrieve the information with ease.

With the making of Geographical Information System Handcraft Application Based on Mobile in Depok City, it is expected that it can help the producer of the handycraft to market their handycraft better and to make the user of this application easier to find the location of said producer.

The scope of the problem is only the handycraft that is located in Depok city. The program that is used to make this application is Android Studio.

The purpose of this application is to make a geographical information system handcraft application based on mobile in Depok city to make it easier to find the location of places that sell handycraft in Depok City.

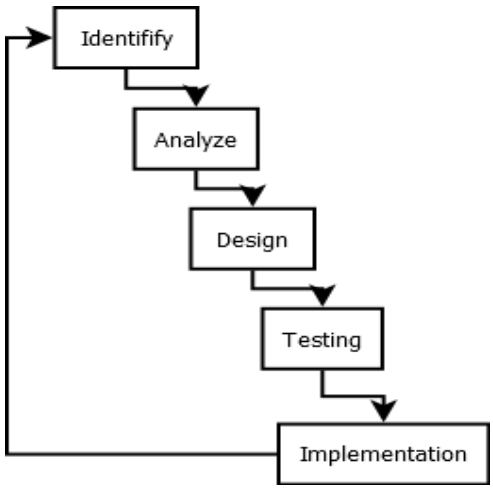

Figure 1.1 SDLC (*Software Development Life Cycle*)

The method that is used in this scientific writing is SDLC method (Software Development Life Cycle) by using several steps in figure 1.1.

Identify : Collecting data and information regarding handycraft in Depok city and the making of mobile based application by collecting the references in library and article in the internet.

Analyze : To analyze all materials from books, scientific writing, websites, and all documentation that is related with this project.

Design : In this step, the application's layout and content is designed.

Testing : In this step, Android Studio is used to make the application. The output os this application will be showed using Mobile Virtual Device.

Implementation : In this step, the application will be tested on several Android based smartphone.

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2. THEORETICAL BASIS

Depok is a city in West Java province, Indonesia on the southern border of DKI Jakarta in the Jabodetabek metropolitan region. The "de" in Jabodetabek refers to Depok, while the word "depok" itself comes from Sundanese language meaning hermitage or abode of one living in seclusion.There is also a saying that the Depok word is an acronym of De Eerste Protestants Onderdaan Kerk.

It has an area of 200.29 km2 and at the 2010 Census had a population of 1,751,696 people, with a density of 8,746 people/km2.

The city is divided into eleven districts (kecamatan). The seat of the regency is located at Depok Jaya.

A handicraft, sometimes more precisely expressed as artisanal handicraft or handmade, is any of a wide variety of types of work where useful and decorative objects are made completely by hand or by using only simple tools. It is a traditional main sector of craft, and applies to a wide range of creative and design activities that are related to making things with one's hands and skill, including work with textiles, moldable and rigid materials, paper, plant fibers, etc. Usually the term is applied to traditional techniques of creating items (whether for personal use or as products) that are both practical and aesthetic.

Collective terms for handicrafts include artisanry, handicrafting, crafting, and handicraftsmanship. The term arts and crafts is also applied, especially in the United States and mostly to hobbyists' and children's output rather than items crafted for daily use, but this distinction is not formal, and the term is easily confused with the Arts and Crafts design movement, which is in fact as practical as it is aesthetic.

Handicrafting has its roots in the rural crafts—the material-goods necessities—of ancient civilizations, and many specific crafts have been practiced for centuries, while others are modern inventions, or popularizations of crafts which were originally practiced in a limited geographic area.

Many handicrafters use natural, even entirely indigenous, materials while others may prefer modern, non-traditional materials, and even upcycle industrial materials. The individual artisanship of a handicrafted item is the paramount criterion; those made by mass production or machines are not handicraft goods.

2.1 Mobile Application

A mobile app is a computer program designed to run on mobile devices such as smartphones and tablet computers. Most such devices are sold with several apps included as pre-installed software, such as a web browser, email client, calendar, mapping program, and an app for buying music or other media or more apps. Some pre-installed apps can be removed by an ordinary uninstall process, thus leaving more storage space for desired ones. Where the software does not allow this, some devices can be rooted to eliminate the undesired apps.

Apps that are not preinstalled are usually available through application distribution platforms, which began appearing in 2008 and are typically operated by the owner of the mobile operating system, such as the Apple App Store, Google Play, Windows Phone Store, and BlackBerry App World. Some apps are free, while others must be bought. Usually, they are downloaded from the platform to a target device, but sometimes they can be downloaded to laptops or desktop computers. For apps with a price, generally a percentage, 20-30%, goes to the distribution provider (such as iTunes), and the rest goes to the producer of the app. The same app can therefore cost the average Smartphone user a different price depending on whether they use iPhone, Android, or BlackBerry 10 devices.

2.2. Android

Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touchscreen mobile devices such as smartphones and tablet computers, with specialized user interfaces for televisions (Android TV), cars (Android Auto), and wrist watches (Android Wear).

The OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Despite being primarily designed for touchscreen input, it has also been used in game consoles, digital cameras, regular PCs, and other electronics. As of 2015, Android has the largest installed base of all operating systems.

Figure 2.1 Logo Android

2.3 Android SDK dan AVD Manager

The Android SDK (software development kit) is a set of development tools used to develop applications for Android platform. The Android SDK includes the following: Required libraries, Debugger, An emulator, Relevant documentation for the Android

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application program interfaces (APIs), Sample source code, Tutorials for the Android OS.

Every time Google releases a new version of Android, a corresponding SDK is also released. To be able to write programs with the latest features, developers must download and install each version's SDK for the particular phone.

The development platforms that are compatible with SDK include operating systems like Windows (XP or later), Linux (any recent Linux distribution) and Mac OS X (10.4.9 or later). The components of Android SDK can be downloaded separately. Third party add-ons are also available for download.

Although the SDK can be used to write Android programs in the command prompt, the most common method is by using an integrated development environment (IDE). The recommended IDE is Eclipse with the Android Development Tools (ADT) plug-in. However, other IDEs, such as NetBeans or IntelliJ, will also work. Most of these IDEs provide a graphical interface enabling developers to perform development tasks faster. Since Android applications are written in Java code, a user should have the Java Development Kit (JDK) installed.

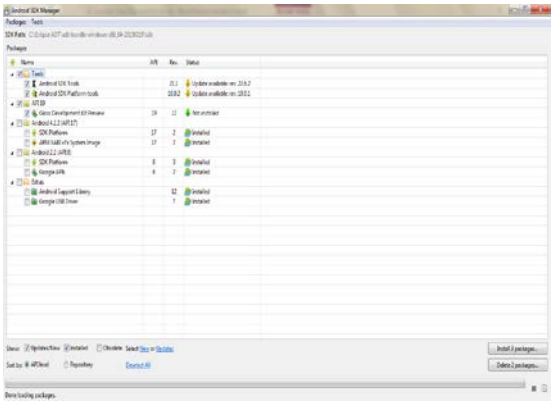

Figure 2.2 Android SDK Manager

An Android Virtual Device (AVD) is an emulator configuration that lets you model an actual device by defining hardware and software options to be emulated by the Android Emulator. An AVD consists of:

a. A hardware profile: Defines the hardware features of the virtual device. For example, you can define whether the device has a camera, whether it uses a physical QWERTY keyboard or a dialing pad, how much memory it has, and so on.
b. A mapping to a system image: You can define what version of the Android platform will run on the virtual device. You can choose a version of the standard Android platform or the system image packaged with an SDK add-on.
c. Other options: You can specify the emulator skin you want to use with the AVD, which lets you control the screen dimensions, appearance, and so on. You can also specify the emulated SD card to use with the AVD.
d. A dedicated storage area on your development machine: the device's user data (installed applications, settings, and so on) and emulated SD card are stored in this area.

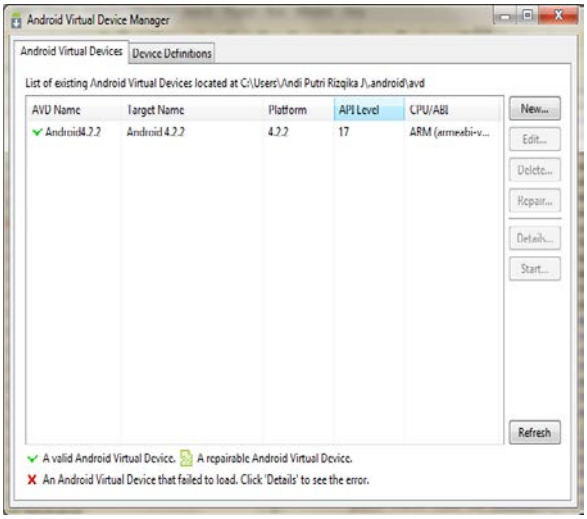

Figure 2.3 Android Virtual Device Manager

2.4 JAVA

Java is a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. It is intended to let application developers "write once, run anywhere" (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. Java applications are typically compiled to bytecode that can run on any Java virtual machine (JVM) regardless of computer architecture. As of 2015, Java is one of the most popular programming languages in use, particularly for client-server web applications, with a reported 9 million developers.[citation needed] Java was originally developed by James Gosling at Sun Microsystems (which has since been acquired by Oracle Corporation) and released in 1995 as a core component of Sun Microsystems' Java platform. The language derives much of its syntax from C and C++, but it has fewer low-level facilities than either of them.

The original and reference implementation Java compilers, virtual machines, and class libraries were originally released by Sun under proprietary licences. As of May 2007, in compliance with the specifications of the Java Community Process, Sun relicensed most of its Java technologies under the GNU General Public License. Others have also developed alternative implementations of these Sun technologies, such as the GNU Compiler for Java (bytecode compiler), GNU Classpath (standard libraries), and IcedTea-Web (browser plugin for applets).

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Figure 2.4 Logo Java

2.5 XML

Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. It is defined by the W3C's XML 1.0 Specification and by several other related specifications, all of which are free open standards.

The design goals of XML emphasize simplicity, generality and usability across the Internet. It is a textual data format with strong support via Unicode for different human languages. Although the design of XML focuses on documents, it is widely used for the representation of arbitrary data structures such as those used in web services.

Several schema systems exist to aid in the definition of XML-based languages, while many application programming interfaces (APIs) have been developed to aid the processing of XML data.

2.6 Android Studio

Android studio is an IDE (Integrated Development Environment) to develop software dan and it can be run in all platform. (platform-independent).

Figure 2.5 Android Studio Logo

Android Studio was in early access preview stage starting from version 0.1 in May 2013, then entered beta stage starting from version 0.8 which was released in June 2014. The first stable build was released in December 2014, starting from version 1.0.

Based on JetBrains' IntelliJ IDEA software, Android Studio is designed specifically for Android development. It is available for download on Windows, Mac OS X and Linux, and replaced Eclipse Android Development Tools (ADT) as Google's primary IDE for native Android application development.

2.7 Google Map

Google Maps is a desktop web mapping service developed by Google. It offers satellite imagery, street maps, 360° panoramic views of streets (Street View), real-time traffic conditions (Google Traffic), and route planning for traveling by foot, car, bicycle (in beta), or public transportation. Google Maps offers an API that allows maps to be embedded on third-party websites, and offers a locator for urban businesses and other organizations in numerous countries around the world. Google Maps satellite images are not updated in real time; however, Google adds data to their Primary Database on a regular basis. Google's support website states that most of the images are no more than three years old.

Figure 2.7 Google Maps Logo

Google Maps began as a C++ desktop program designed by Lars and Jens Eilstrup Rasmussen at Where 2 Technologies. In October 2004, the company was acquired by Google, which converted it into a web application. The same month, Google acquired Keyhole, a geospatial data visualization company whose marquee application suite, Earth Viewer, emerged as the highly successful Google Earth application in 2005 while other aspects of its core technology were integrated into Google Maps. In September 2004, Google acquired ZipDash, a company that provided realtime traffic analysis. Google Maps was launched shortly thereafter in February 2005.

Google Maps uses a close variant of the Mercator projection, and therefore cannot accurately show areas around the poles. The current redesigned version of the desktop application was made available in 2013, alongside the "classic" (pre-2013) version. Google Maps for mobile, in August 2013, was the world's most popular app for smartphones, with over 54% of global smartphone owners using it at least once.

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3. DESIGN AND IMPLEMENTATION

When the application is being run, the first page that's going to be showed is the splash screen. Then the application will be directed to the main menu. There are four options in the main menu, they are map, list of places, help, and about. The map option is embedded in the symbol of Depok city. If the user pressed that button, the application will show a map of Depok city with markers indicating the places of the handycraft. If the user choose list of places, the user will be directed to another page that shows the list of districts, they are Cilodong Districts, Cipayung Districts, Cimanggis Districts, Sukmajaya Districts, Pancoran Mas Districts, Beji Districts, Limo Districts, and Sawangan Districts. In each districts, there will be a list about the handycraft. The amount of handycraft may vary in each districts due to the different amount of data acquired. If the user choose one of those options, the application will show a more detailed information about the handycraft. The information includes business name, address, phone number, picture of location and short description of each handycraft. Beside that, there is also a button that when it's pressed will showed the location of that handycraft in the map. If the user choose the help button, then a page about how to use the application is showed. And if the user choose the about button, a page about why the application is made and who made it will be showed.

3.1 Navigation Structure

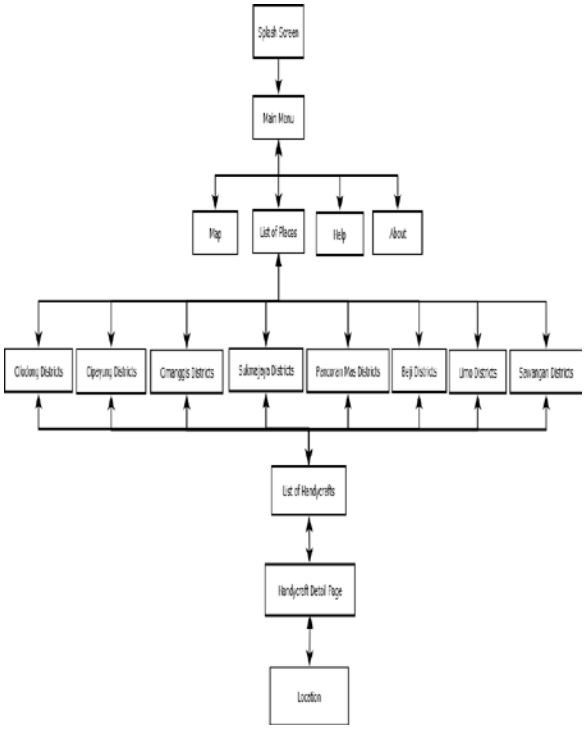

Figure 3.2 Navigation Structure

Further explanation of the navigation structure :

a. When the application is being run, the first page that's going to be showed is the splash screen.
b. The application will then proceed to the main menu. The main menu consist of four options. They are maps, list of places, help, and about.
c. If the user choose map, the application will show a Google Map with markers indicating the location of the handycraft.
d. List of locations has eight sub-menu, they are Cilodong Districts, Cipayung Districts, Cimanggis Districts, Sukmajaya Districts, Pancoran Mas Districts, Beji Districts, Limo Districts, and Sawangan Districts.
e. On each districts menu, there is a list containing the name and variety of the handycraft. Each districts have different kind of handycraft.
f. If we choose one of the choices from that list, then the application will show a new layout that will provide detailed information like the name of the handycraft, address, phone number, picture of the location and short description of each places. And there's also a button that will refer to Google Map.
g. The application will open Google Maps application to show the location.
h. If the user chose the help menu, the application will show a page that will explain the user about how to use this application.
i. If the user chose the about menu, the application will show a page that will explain the user about who made this application and why this application was made.

3.2 Opening Layout Design

Figure 3.3 is the opening layout design when the user run the application. This page is the splash screen. In this page, the background color is red. There is also the logo of the application and a progress bar.

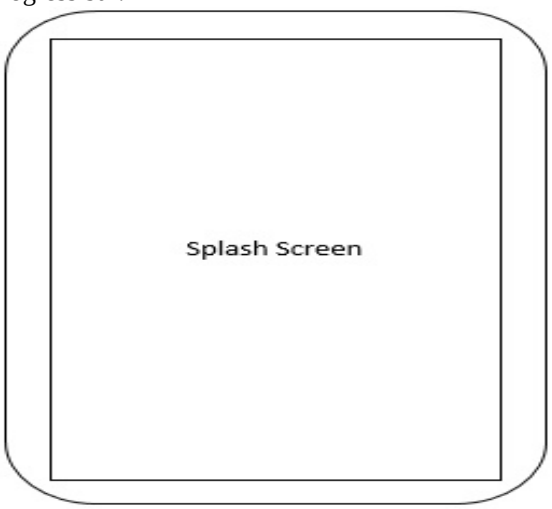

Figure 3.3 Splash Screen Design

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3.3 Main Menu Layout Design

Figure 3.4 is the layout of main menu that is showed after the splash screen. In the main menu, there is a button that is embedded in Depok city city symbol and three other buttons. They are List of Places, Help, and About. The four buttons are made using Pallete Image View. If we press the Depok City city symbol, then the app will go to MapsActivity class that will open a map and markers indicating the location of the handycraft. The maps that is used is Google Maps. By using Google Maps, the map can be accessed through this application without the help of the third party app. And if the List of Places button pressed by the user, the app will go to Location class. If the Help button pressed by the user, the app will go to Help class. If the About button pressed by the user, the app will go to About class.

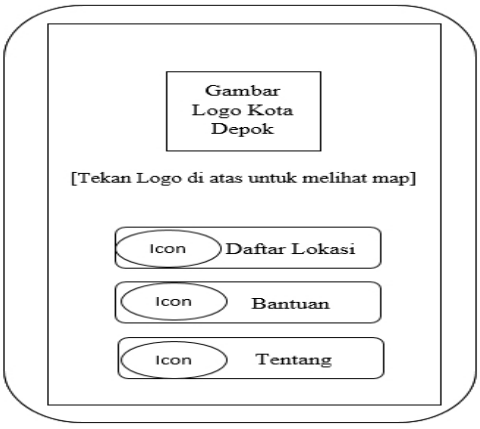

Figure 3.4 Main Menu Design

3.1.1. List of Places Layout Design

Figure 3.5 is the layout for List of Places that is showed after the main menu if List of Places is selected from the main menu. In this page, there's a picture in the top of the page which is a picture of the gate of Depok city. Underneath, there are eight buttons that the user can pick, which is the name of districts in Depok city. These buttons are made using the list view. Each button will refer to its designated districts. In this application, there are only eight districts. They are Cilodong Districts, Cipayung Districts, Cimanggis Districts, Sukmajaya Districts, Pancoran Mas Districts, Beji Districts, Limo Districts, and Sawangan Districts. Each districts have its own **class, but these classes are using the same layout.**

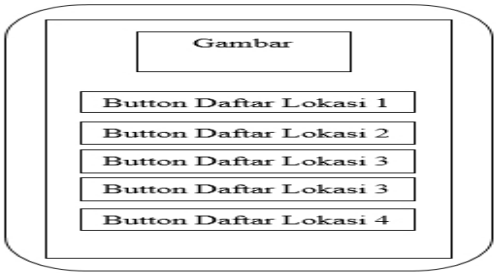

Figure 3.5 List of Places Design

3.1.2. Sukmajaya Districts Layout Design

Figure 3.6 is the layout design for one of the districts which is Sukmajaya districts. This page will be showed after the user choose Sukmajaya Districts in List of Places. In this page, there are buttons that is made using list view. In each button, there is a business name, icon, and the kind of handycraft. If the user choose one of the button, the application will show a new page where it will provide more detail about that particular handycraft/

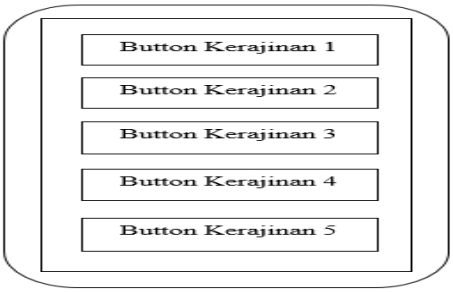

Figure 3.6 Sukmajaya Districts Design

3.1.3. Handycraft Layout Design

Figure 3.7 is the layout design for handycraft layout design. This page will be showed after one of the button in one of the districts is pressed. In this page, there is a header that consist of business name and the icon of the handycraft. Underneath, there is the business name, address, and phone number. The image is showed using image view. There is also a short description of each handycraft location that is made using text view. In the bottom of this page, there is a picture of a compass that is a button. If the button is pressed, the application will show the location of that handycraft in Google Maps.

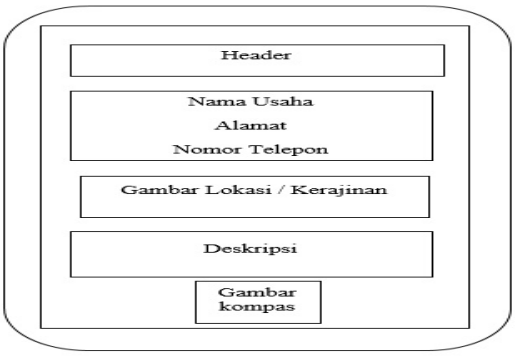

Figure 3.7 Handycraft Layout Design

3.1.4. Map Design Layout

Figure 3.8 is the layout design for the map. This page will be showed if the user pressed the Depok City symbol in main menu. The map that is used in this page is using Google Maps. When the map is loaded, the default position is Depok city. In this map, there are markers that indicate the location of the handycraft in Depok city. These markers have different icons that is varied by the kind of handycraft.

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On those markers, it also shows the address of the handycraft.

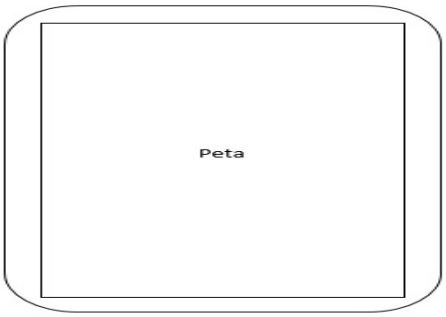

Figure 3.8 Map Design

3.1.5. Help Layout Design

Figure 3.9 is the design layout for help. This page will be showed after the main menu if help is selected from the main menu. This page main purpose is to explain the user of this application about how to use this application. In this page, there are several text that include the explanation. The text are made using text view. To show the application logo in this page, image view is used.

Figure 3.9 Help Design

3.1.6. About Layout Design

Figure 3.10 is the design layout for about.This page will be showed after the main menu if about is selected from the main menu. This page consist of application logo, application name, why this application is made, the author of this application, and the year this application made.

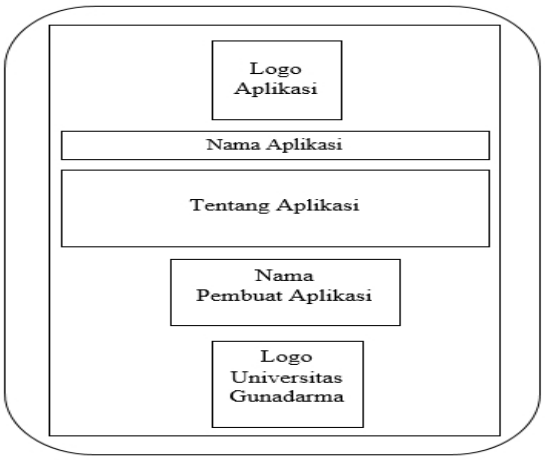

Figure 3.10 About Design

3.1.7. Hardware and Software Specification

The hardware specification that is used is Intel(R) Core(TM) i5-5200U CPU @2.20GHz (4 CPUs), ~2.2GHz, AMD Radeon R 5 M230, RAM 4GB, Monitor 14", Harddisk 500GB.

The software specification that is used is Windows 8.1 Pro 64-bit, Android SDK Revision 24.2, Android Studio 1.2.2, Microsoft Office 2013, Adobe Photoshop CS6, Dia.

3.1.8. Pembuatan Aplikasi

This application is made using Android Studio. The programming language that is used are Java and XML. The first step to make the application is to create a new project in Android Studio by choosing new project in the menu. In the new window, insert the name of application, module name, package name, and the directory to save project files. Set the minimum SDK to run the application and click finish. And the new project is done.

Android Manifest is an XML file that consist of information regarding the information of this application. The information in this file consist of application version, package name, SDK level, icon and the name of the application. This file is used to declare all of the java files that is used in this application. The importance of this file is to inform the system about the component that is used in this application.

3.1.9. Application Testing on Emulator

Application testing on emulator is one of the way to test the application. To do so, configure the Android Virtual Device that will be used to test the application. The Android Virtual Device that is used to test this application is JB4.2.2. Press Shift + F10 on your keyboard or press the play button on the toolbar to start emulating the application in emulator.

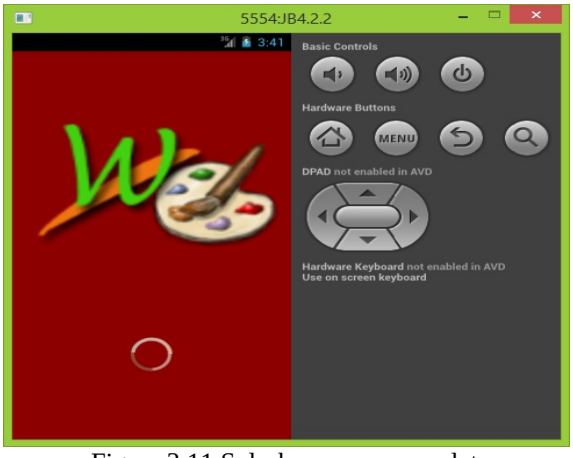

Figure 3.11 Splash screen on emulator.

Splash screen on figure 3.11 will only appear for a couple of seconds and then the application will direct to main menu screen.

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Figure 3.12 Main menu screen on emulator

Figure 3.12 is the layout of the main menu. There are four buttons in the main menu. They are maps in that is embedded in Depok city symbol, list of places, help and about. On the emulator, only the three buttons that are showed on the screen because the screen resolution is different. However, the fourth button is still accessible using the emulator.

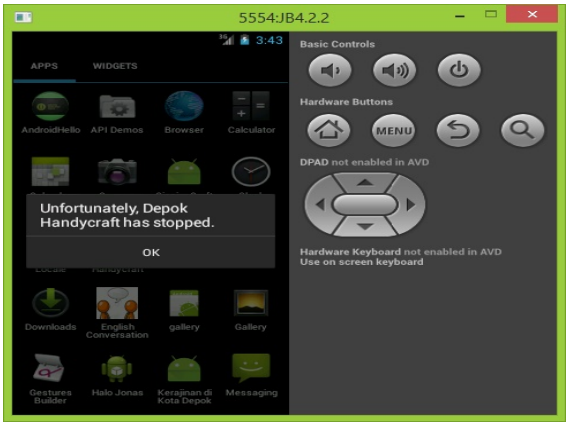

Figure 3.13 Map screen on emulator.

When maps is chosen by pressing Depok city logo in the main menu, the emulator will show the error message in figure 3.13. Android Virtual Device didn't support the map so the application is force closed. The map is only accessible in smartphone only.

Figure 3.14 List of Location on emulator.

Figure 3.14 is the layout for List of Places. In List of Places, there is a picture of Depok city gate. In List of Places, there are eight districts that can be chosen, they are Cilodong Districts, Cipayung Districts, Cimanggis Districts, Sukmajaya Districts, Pancoran Mas Districts, Beji Districts, Limo Districts, and Sawangan Districts.

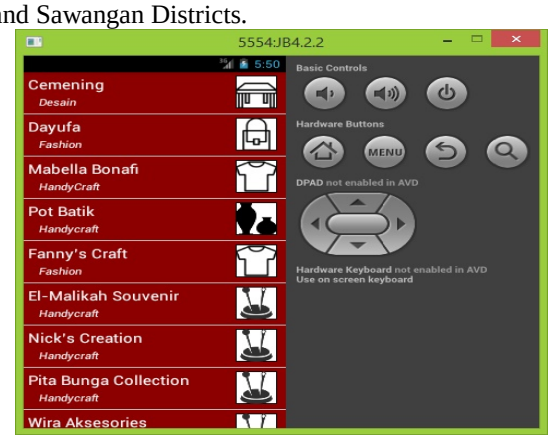

Figure 3.15 Tampilan Kecamatan Sukmajaya pada Emulator.

Figure 3.15 is the layout when Sukmajaya Districts is chosen from List of Places. In this page, there are a few choices like the name of the handycraft that is located in that districts. There is the business name, type of handycraft, and an icon that is suited for that type of handycraft.

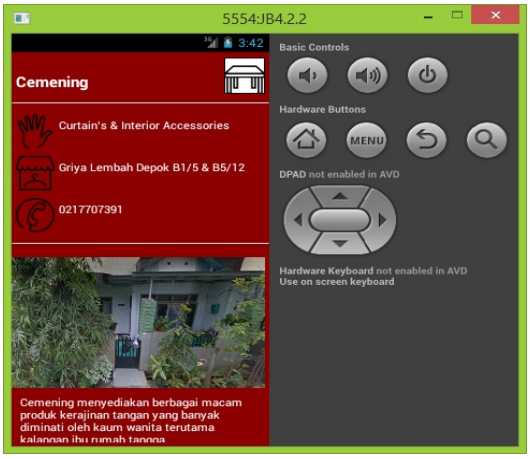

Figure 3,16 Cemening Handycraft Layout on Emulator.

Figure 3.16 is the layout that is showed after Cemening Handycraft in Sukmajaya Districts. There is a business name, address, and a phone number. There is also a picture of the handycraft or the location of that handycraft. A short description of each handycraft is written below the picture. In the bottom of the page, there is a compass icon. The compass icon is not visible in the emulator due to the difference of the screen resolution.

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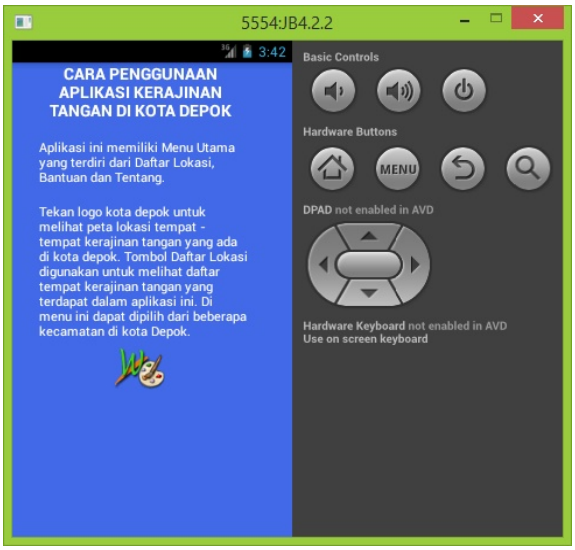

Figure 3.17 Help layout on the emulator.

Figure 3.17 is the layout of Help page that is showed after the main menu if Help is chosen. In this page there is the instruction to use the application and application logo.

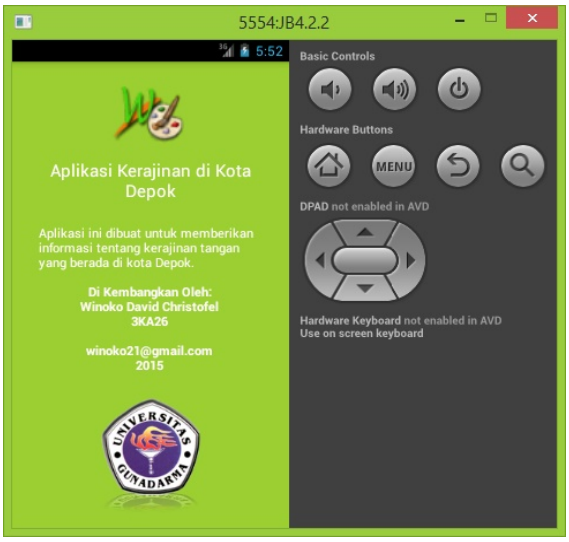

Figure 3.18 About layout on the emulator.

Figure 3.17 is the layout of About page that is showed after the main menu if About is chosen. In this page there is the purpose of this application and the information about the author of this application. There is a logo of Gunadarma University as well.

3.1.10.Application Testing on Smartphone

After we tested the application on emulator, the application will also be tested on Android based smart phones. This testing on smart phones purpose is to know whether the app can be run well on some specific phone models. Figure 3.19 is the implementation of Depok Handycraft application on Lenovo A7000 smart phone.

Figure 3.19 Hasil Uji Coba pada smartphone Lenovo A7000

Table 3.2 is a comparison table of how the app is installed on some Android based smartphones.

Tabel 3.2 The result of application testing on various Android based smartphone

No	Testing Result	Xiaomi Redmi Note	Lenovo A7000	Samsung Galaxy Grand Duos
1	Android Version	4.4.4	5.0	4.2.2
2	Screen Resolution	720 x 1280 pixels 5.5 inches	720 x 1280 pixels 5.5 inches	480 x 800 pixels 5.0 inches
3	Images	Proportionate to the screen resolutin	Proportionate to the screen resolutin	Proportionate to the screen resolutin
4	Maps	Working as intended	Working as intended	Working as intended
5	Error	None	None	None

3.1.11.APK File Installation on Android

*.apk *.apk is the file extension for android based smartphone application. This following steps are the procedures to install the *.apk file on Android based smartphone :

a. Transfer the *.apk file to your phone by using Bluetooth or cable data.

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b. After the *.apk file is transferred, the application is ready to install. Open that *.apk file on your phone to start the installation process.
c. Simply wait for the instalation to be done, and the application is ready to use.

4. CLOSING

4.1 Conclusion

The Depok Handycraft Application on Android based smartphone has been made, tested, and also implemented. This application can be used by the usr to find the location of handycraft in Depok city easily.

Depok Handycraft application based on Android feature is the ability to access Google Maps directly from this app without having user to open aother application. The user can also see all the markers in the map through the Google Maps. The user can also find the information about the handycraft through this application. Depok Handycraft application can be run on Android based smartphone whose Android version is 4.2 (Jelly Bean) and up.

4.2 Suggestion

Depok Handycraft application for Android based smartphone also have some flaws. This application can only be run on a smartphone whose Android version is 4.2 or up. It can't be run on older Android version. This application needs further development to add more content to this application because the number of information that is provided in this application is still limited. The amount of pictures that is shown in this app is also limited due to the lack of pictures. It is expected that this application will support more Android version in the future. May this application be useful and it can also be developed better in the future.

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ISBN 978-602-19877-3-5

THE TECHNIQUE OFVARIABLE PROJECTION AND RULES OF TEMPLE AREA IN OPERATION OF SERIES

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ABSTRACT

Learn and discuss the operation of series, we recognize about the operation series Gauss. In the operation series Gauss, Gauss theory cannot explain the change in his tribe series is not constant, Operations on power series and doing multiplication and division operations in a series. One way to complement the Gauss theory about it is to use rule temple area and using a variable projection techniques. The purpose of this study is to provide a description and prove that the technique is rules of temple area and techniques projections about the operating variable rank series and the series operations is not constant so as to complete the theory of Gauss series. This research method uses literature study. The result of this study is that the area temple rules technique and variables projection can describe and explain the series operations formulation especially operations and the operating series constant and operations on power series that his tribe not yet formulated the theory Gauss.

Index Terms **:**Variables Projection, Rules of Temple Area and Operation of Series

1. INTRODUCTION

There is an important lesson that we can draw from the history of arithmetic series, which is the simply city in thinking and the in genuity of the inventor of arithmetic series formula, Carl Fredericm Gauss. To find the formula to number of runs, Gauss obtained the operation of the two series with the operation of addition. In his theory of arithmetic series, Gauss expressed the opinion that "arithmetic series is a sequence that has a fixed difference between its parts" means the difference is constant, in which by Gauss was given notation "b". Gauss also introduced the notation "a" that represents the early parts of the series. Gauss formulate arithmetic sequences with

Un = a + b (n-1)
Un = nth part
a = the first number
b = different part of series
n = total of parts

For example, we will calculate arithmetic series using Gauss method as follows:
2 + 5 + 8 + 11+ …….+ 3n-1
By adding the same series in reverse order will be obtained:
2+5+8 +11+ …….....+ 3n-1
(3n-1)+(3n-4)+(3n-7)+(3n-10)+.....+2
(3n+1)+(3n+1)+(3n+1)+(3n+1)+.....+ (3n+1)

With the summation of both series is n (3n + 1), eachseries has the number of n (3n + 1) / 2.
However, there is an important question: How to count exponential numbers as follows:

$1+ 4 + 9 + 16 + 25 + \ldots\ldots + n^2$?

Arithmetic series is always based on Gauss theorem, which is, a peculiar trait to the nature of the arithmetic series is important in the discussion of the next series. The nature of Gauss invention is the nature of an arithmetic series, for instance, if two series are equal in total, will generate a constant sequence, that is the sequence of U1 to Un is as big (no change to its parts of numbers).

Example:
1+2+3+4+5+…..+n
Summed with itself will be obtained
1+2+3+4+5+……..+n
1+2+3+4+5+……..+n
2+4+6+8+10+……+2n

Question then re-emerges, that is, why the sum above does not produce a constant series? It is because Gauss rule is not applied. If the summation above is done as follows:

1+2+3+4+5+.....+ n
n+(n-1)+(n-2)+(n-3)+(n-4)+.....+ 1
(n+1)+(n+1)+(n+1)+(n+1)+(n+1)+.....+(n+1)

Which is by reversing the order of the other series parts will be obtained the sum of the sequence which is a constant series. The question will arise on how to operate the series if the rate change is not constant. Based on those facts, the formulations of the problem in this study are as follows:

Conclusion:
$^0Hn = 1^0+2^0+3^0+4^0+5^0+...+n^0$
$^0Hn = n$

a. How is the solution to solve the operation of series if the change is not constant?
b. How is the solution to solve the operation of power series?

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2. METHODS

Based on the purpose of the research which is to illustrate and prove Rules of Temple Area and Variable Projection Technique on the operation of power series, the changes in the operation of (suku) series is not constant and the number multiplication and division operations so as to complete the theory of Gauss series. This study uses literature study method.

3. RESULTS

3.1 Rules of Temple Area

Rules of the temple area is a technique done by assuming the imaginary series 1 as the area of one temple stone and real linear series on Gauss functions as shadow series. Rules of Temple Area can solve problems in the operating sequence, are as follows:

3.1.1 Series of Unit

If we assume the number 1 as the area of a square,the series 1 + 2 + 3 + 4 + 5can be described as the structure follows:

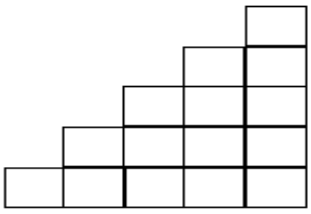
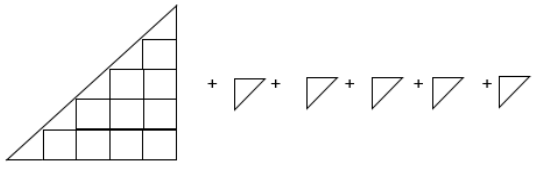


Figure 1. Structure temple

Then, assume this structure as a temple. The number of series 1 + 2 + 3 + 4 + 5 is equal to the area of the temple. The area of the temple above can be calculated as follows:
Base of the temple = 5, height of the temple = 5, and area of the temple = area of the triangle shadow + a unit area of a triangle as shown in the following structure:



The area of thetriangle shadow is ½ base x height
If the base is 5, height is 5, the area of the shadow triangle = ½ x 5x5
Then, the area of each triangle = ½ x1x1
Because the number of triangles = 5, then the total area of each triangle is 5 x (½ x1x1)
Keep in mind that the area of a square is 1x1. If there is a temple whose base is n, the height is n, what is the area of the temple?
The area of the temple is

$= (\frac{1}{2} \times n \times n) + \frac{1}{2} \times n \times (1x1)$
$= \frac{1}{2} n^2 + \frac{1}{2} n$
$= \frac{n^2+n}{2}$ I

A new discovery to the formula of the number of runs
Sn = 1 + 2 + 3 + 4 + 5 + ... + N
This series is named the series of units or real series because if we outline a series of arithmetic, real series will always appear.
Mathematically, real series is a series that has a = b = 1 which a = the first part, b = different.

3.1.2 The first series of parts equals to b

This series is also called linear series because this series is always connected linearly with real series. Two names on each denomination of the series give an illustration to the series. The first name's function is to give a physical description and the second one is to illustrate the existence or whereabouts of the other series. Linear series has physical characteristics of a = b ≠ 1
Examples of such series are:

a. 2 + 4 + 6 + 8 + 10 + ... + 2n
b. 5 + 10 + 15 + 20 + 25 + ... + 5n
c. 7 + 14 + 21 + 28 + 35 + ... + 7N

If the series above are illustrated as temples, those are the manifestations of a set of temples.
a. 2 temples
b. 5 temples
c. 7 temples
Furthermore, the formula of the number of linear series is as follows:
$Sn = b\frac{(n^2+n)}{2}$

3.1.3 Universal Arithmetic Series

At the outside of the temple rules of arithmetic as the series which has dimention. The formula of the series is formulated as follow :
${}^{z}Gun = (b.n + c)^{z}$
The formula sum of series degree z = z∈of positive integers

$$\mathbf{{}^{z}Gn = b^{z}.{}^{z}Hn + b^{(z-1)}.c.z^{(z-1)}Hn + b^{(z-2)}.c^{2}.\frac{z(z-1)}{2!}.{}^{z-2}Hn + b^{(z-3)}.c^{3}.\frac{z(z-1)(z-2)}{3!}.{}^{(z-3)}Hn + ... + c^{z}.{}^{0}Hn}$$

G is G series.
At universal Arithmetic series is difined as a series which the rotation changing is not similiar with earlypartsof theseries
Because of the lack of space for this jurnal, so that is why we do not discuss whole parts.
Example
Determine ${}^{2}Gn$!
Jawab :

${}^{2}Gn = b^{2}.{}^{2}Hn + b.c.2.{}^{1}Hn + c^{2}.{}^{0}Hn$
$= b^{2}.\frac{2n^3+3n^2+n}{6} + b.c.2.\frac{n^2+n}{2} + c^{2}.n$

Equality between Gauss and Candichudzaifah

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Jika **c = (a-b)**
maka :

$^2Gn = b^2.\frac{2n^3+3n^2+n}{6} + b.(a-b).2.\frac{n^2+n}{2} + (a-b)^2.n$

3.1 Technique of Variable Projection

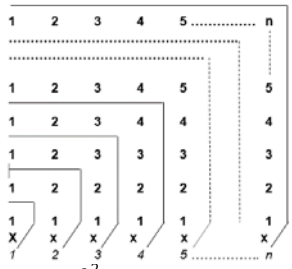
Technique of variable projection is an advanced theory that..... before we discuss the theory of this technique, we need to know the basics of the theory which are as follows:

3.1.3 Hardi Rules

HardiRules (2n-1) is used to locate ^2Sn and ^3Sn. This rule says the number of squares is like a mountain. It grows tall to the top of its destiny, and after that it returns to its origin. This idea comes from Surah Yasin: 39, that says *Wal-qamaraqaddarnahumanazilahatta 'adakal-urjunil-qadim,*meaning "and we have appointed stages for the moon till it returns in the shape of a dry old branch of palm-tree."
Mathematically, it can be written as follows:

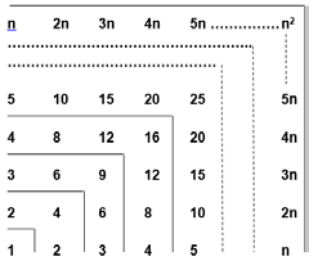
$1^2 = 1$
$2^2 = 1+2+1$
$3^2 = 1+2+3+2+1$
$4^2 = 1+2+3+4+3+2+1$
$5^2 = 1+2+3+4+5+4+3+2+1$
$n^2 = 1+2+3+4+5+\ldots.+ n +\ldots.+5+4+3+2+1$

In an example of a problem of Hardi Rules (2n-1) is used to find the formula to ^3Sn. If ^2Sn is presented in a matrix form,it will look like the picture below:



Gb.a. *The matrix of ^2Sn projection series multiplied by its variable*

If every matrix element in the set projection is multiplied by its variable, ^3Sn will be obtained in the form of matrix.
So that the matrix above will turn into a matrix as follows:



Gb.*b.* *Matrix of ^3Sn projection series*

Based on the picture, the sum of all ^3Snmatrix elements is:

$= \left(\frac{n^2+n}{2}\right) \text{ x } \left(\frac{n^2+n}{2}\right)$

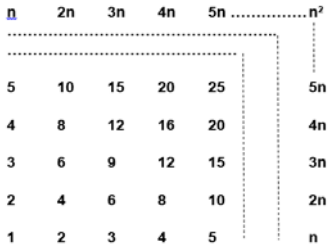
$= \frac{n^4+2n^3+n^2}{4}$

Conclusion:

$^3Sn = 1^3+2^3+3^3+4^3+5^3+\ldots\ldots\ldots+n^3$

$^3Sn = \frac{n^4+2n^3+n^2}{4}$

Which needs to be underlined in the rule 2n-1 is that it is able to present a ^zSn series in a matrix form. Presentation in the form of a matrix can be obtained by multiplying the ^zSn with its variable, similar to what has been done above.



Gb.c *Matrix of ^3Snseries*

Logically, the equation $^3Sn = x$ can be explained as follows:
1). Matrix projection on picture a. is the ^3Sn series in the form of a matrix projection series, which means the total number of its elements equals to the number of runs
$^3Sn=1^2+2^2+3^2+4^2+5^2+\ldots\ldots\ldots+n^2$.
2). If ^2Hn is multiplied by its variable, will be obtained
$^3Sn=1^3+2^3+3^3+4^3+5^3+\ldots\ldots\ldots+n^3$. If this multiplication is presented in the form of a matrix projection, it will look precisely like picture a. and the result is as shown in picture b.
3). After coming to the conviction that the matrix of projection series in picture b. is a ^3Sn series, we eliminate its lines of projection, and start thinking about the number of the elements of matrix series shown in picture c.
4). The number of the first laneof matrix in image c. = $=\frac{n^2+n}{2}$, total number of the second lane is $2(\frac{n^2+n}{2})$, the total number of the third lane is $3(\frac{n^2+n}{2})$ and so on.
Suppose $\frac{n^2+n}{2} = k$, so the total number of matrix elements is:

$^3Sn = \sum k + 2k+ 3k+4k+5k \ldots\ldots.nk$
$= k\sum 1+2+3+4+5+\ldots\ldots.n$
$= k\ (\frac{n^2+n}{2})$
$= (\frac{n^2+n}{2})\ (\frac{n^2+n}{2})$
$= \frac{n^4+2n^3+n^2}{4}$

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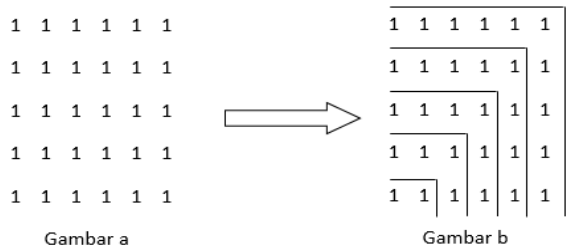
3.2.2 SubaryantoMatrix Projection (Matprobar)

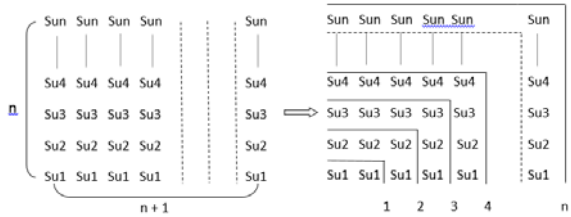
Before understanding Variable Projection, firstly we must create a matrix projection called Subaryanto matrix projection (Matprobar). If there is a sequence of numbers 1,1,1,1,1,1 lined in five lines, it will be obtained a matrix 5x6 because this certain matrix is composed of 5 rows and 6 columns as shown in the following picture.



In the matrix elements in picture a., will be created boundary lines which then are entitled *projection lines*. This line starts from the top left corner to the bottom right corner of the matrix. The horizontal line is at the top of the matrix and the vertical line is at the right side of the matrix. The projection lines areremade to the pattern as above on the sidelines of the matrix element until it can no longer be made another projection line as shown in picture b. Matprobar is a matrix which all of its elements are divided into several subsets, and each subset will increase the number of members with a clear pattern.

3.2.3 Matrix series

Matrix series is the continuation of Matprobar, the matrix which line is in a form of rows. This matrix is obtained from the product of a series with the constant c, with other series, with variable n and others. Matrix series always has n row, it can be understood as lane matrix derived from a series. Meanwhile, the column of the matrix is determined by the multiplier factor of the series.



Matrix shown in the picture is a matrix obtained from the multiplication of Sn with n + 1. Order of the sequence is n x (n + 1).

3.2.4 Matrix of Projection Series

Matrix of projection series is the matrix of seriesthat has been divided into subsets; subsets are marked with projection lines. The subset is lined starting from n = 1. The number of sets on the subsets is determined by the sum of the order matrix.

Example: If the order matrix projection is nx (n + 5), the subset to the sequence is n + (n + 5) -1. This ruleis obtained because the subsets in the matrix series are combination of the element of lanes and the element of matrix line. Meanwhile, the element of the matrix determinant is a member of the set of the lane and column of matrix.

3.2.5 Variable Projection

Projection is a series of variables that can change the variables to increase when multiplied and decrease when shared. Arithmetic series, if it is decomposed into multiple rows then there will always be series of units in it. The fact is that both of series units have dimension. In this case, the formula will be discussed the formulation of the number of series of unit that has z dimension and the variable projection used as its foundation.

Variable projection I:

If ${}^{z}Hn$ is a series of unit with power z, then multiplied by n + 1, there will be obtained a harmonic linear projection to ${}^{z}Hun$, which:

${}^{z}Hn$ = formula of the number of series,

${}^{z}Hun$ = formula of the part of series

$z \geq 0$

$(n+1)\ {}^{z}Hn = \sum n\ .\ {}^{z}Hun + \sum {}^{z}Hn$

To prove the first variable projection techniques then we can solve it by using an axiom method called ***RendyAksioma***. The technique appears remembering that there are two axioms in the series. Such techniques include the following:

1. If Hn is a formula to a number of series, then the formula to Hn to Hun = n-1 will be changed by replacing the index n to n-1.

Examples:

$Hn = \frac{n^2+n}{2}$ becomes $Hn-1 = \frac{(n-1)^2+(n-1)}{2}$

2. Hun is the last part of the series Hn, if Hnis reduced with Hun, it will be obtained Hn formula to the number of series Hun = n-1.

Example:

$Hn = \frac{n^2+n}{2}$ and Hun = n

$Hn - Hun = \frac{n^2+n}{2} - n$

$= \frac{n^2-n}{2}$

$Hn-1 = \frac{(n-1)^2+(n-1)}{2}$

Based on both axioms, we can prove as follows:

Axiom 1 Gn = (n+1)Hn

Gn-1 = {(n-1)+1}Hn-1

Gn-1 = n Hn-1

Axiom 2 Gn-1 = Gn-Gun

= (n+1)Hn – (n Hun + Hn)

= nHn + Hn – nHun – Hn

= nHn – nHun

= n(Hn-Hun)

Gn-1 = n Hn-1

The analogy of variable projection I with matrix projection to a matrix projection series is if Hn is dragged in a matrix line (determinant), so that the

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matrix is divided into two equal parts, it will be like in the picture A and picture B above. Picture A is a linear projection, the original series is Σ Hun becoming ∑ n. Hun. So, the definition of a linear projection is the enlargement of Hun that is proportional to n. Picture B is a harmonic projection event.

4. DISCUSSION

4.1. Comparison of the Solution to Series with Gauss Way and Rules of Temple's Area

4.1.1. Gauss Way

The general formula to arithmetic series isa+(a+b)+(a+2b)+.....+{a+b(n-1). Then, we write the formula in a reverse order

{ a+b(n-1)} + {a+b(n-2)} + {a+b(n-3)}+ .....+ a

Both of them are multiplied

a+(a+b)+(a+2b) +.....+ {a+b (n-1)}

{a+b(n-1)}+{a+b(n-2)}+ .....+ a

{2a+b(n-1)}+{2a+b(n-1)}+.....+{2a+b(n-1)}

The summation of both series: n {2a+b(n-1)} so the formula to arithmetic series is:

$$\mathbf{Sn = \frac{n\{2a+b(n-1)\}}{2}}$$

4.1.2. Temple's Area Way

Arithmetic series is a sequence that has a real series, this series is connected linearly with a linear series. The formula is as follows;

b + 2b + 3b + 4b + 5b +.....+ nb

In this case, it serves as a series of shadow. By adding (a-b), is obtained as follows;

b + 2b + 3b+4b.....+ nb

(a-b)+(a-b)+(a-b)+(a-b)+ .....+ (a-b)

a+(a+b)+(a+2b)+(a+3b)+ .....+ {a+b (n-1)}

Up until this part, we have found a standard formula of arithmetic series, mathematically, it can be written**Un = a + b (n-1).** Next, we have to determine the formula to the summation.

- We determine the formula to the number of real series by calculating the area of the temple, obtained:

  $Sn=\frac{n^2+n}{2}$ (1)

- Then determine the shadow linearly connected with the real series;

  $Sn= b\frac{(n^2+n)}{2}$ (2)

- By adding a helping series, we obtainthe formula to arithmetic series summation

  $\mathbf{Sn=(a-b)n+b\frac{(n^2+n)}{2}}$ (3)

4.2. Calculating Series of Unit of ^{0}Hnusing the technique of variable projection

^{0}Hn is the simplest series in the world; its existence is similar to a straight line. However, straight line is always considered as a set of real numbers, so the concept of limit and infinitely small quantities are known. As an initial illustration for the geometry application in the science of projection is considered as ^{0}Hn series. 1 symbolizes something considered as real and 0 symbolizes something that does not exist. Suppose we will spread an outline on paper it will look like as follows:

The question is: is the line actually as it looks?

For human eyes, it is possibly can be seen,but if we have a sharp vision, meaning we can see objects with 1Åsize, then the line shape will look like as follows:

1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1

It means that there are some equally big objects and they are lined. If we illustrate by stating,there will be a line of words. Exist, does not exist, exist, does not exist, exist, does not exist. We are not going to count something that does not exist. The previous line will be only exist, exist, exist, exist, exist, exist. If the line is written with numbers, it will be 1,1,1,1,1,1,1,1,1,1,1,1,1,1,1. If we count the number, it will be a series of numbers 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1. This is the series unit of zero power.

$^0Hn = \sum n^0$

$= 1^0+2^0+3^0+4^0+5^0+\ldots\ldots\ldots+n^0$

$= \underbrace{1+1+1+1+1+ \ldots\ldots\ldots\ldots+ 1}_{n}$

$^0Hn = n$

4.3. Calculating the Series Unit of ^{1}Hnusing the technique of variable projection

To calculate the series of unit of ^{1}Hn, we can use the following equation:

$^0Hn = n$ $\quad (n+1)Hn = \sum n \,.\, Hun + \sum Hn$

$^0Hun = 1$ $\quad (n+1)^0Hn = \sum n \,.\, {}^0Hun + \sum {}^0Hn$

$(n+1)n = \sum n.n^0+\sum n$

$= 2\sum n$

$\sum n = \frac{n^2+n}{2}$

$^1Hn = \frac{n^2+n}{2}$

The above equation is a method for determining the formula series choiprov, just like temple's area way. Conclusion:

$^1Hn = 1+2+3+4+5+...+n$

$^1Hn = \frac{n^2+n}{2}$

4.4. Calculating the Squared Series Unit (^{2}Hn) using the technique of variable projection

To calculate the series unit of ^{2}Hn, we can use the following equation

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$(n+1)^1Hn = \sum n \,.\, {}^1Hun + \sum {}^1Hn$

$(n+1)\frac{n^2+n}{2} = \sum n.n + \sum \frac{n^2+n}{2}$

$\frac{n^3+2n^2+n}{2} = \sum \frac{3n^2+n}{2}$

$\frac{n^3+2n^2+n}{2} = \frac{3}{2}\sum n^2 + \frac{1}{2}\sum n$

$\frac{n^3+2n^2+n}{2} - \frac{1}{2}(\frac{n^2+n}{2}) = \frac{3}{2}({}^2Hn)$

$\frac{2n^3+3n^2+n}{4} = \frac{3}{2}({}^2Hn)$

Conclusion:

${}^2Hn = 1^2+2^2+3^2+4^2+5^2+\ldots+n^2$

${}^2Hn = \frac{2n^3+3n^2+n}{6}$

4.5. Calculating the Series of Unit of ^{3}Hn using the technique of variable projection

To calculate the seriesof unit of ^{3}Hn, we can use the following equation

$$(n+1)^2 Hn = \sum n.Hun + \sum Hn$$

$$(n+1).\frac{(2n^3+3n^2+n)}{6}$$

Left Side :

$2n^4 + 3n^3 + n^2$

$\underline{2n^3 + 3n^2 + n \quad +}$

$$\frac{2n^4 + 5n^3 + 4n^2 + n}{6}$$

Right Side :

$$\sum n^3 + \sum \frac{(2n^3+3n^2+n)}{6}$$

$$\sum n^3 + \frac{1}{3}\sum n^3 + \frac{1}{2}\sum n^2 + \frac{1}{6}\sum n$$

Both sides :

$$\frac{2n^4 + 5n^3 + 4n^2 + n}{6} = \frac{4}{3}\sum n^3 + \frac{1}{2}\left(\frac{2n^3+3n^2+n}{6}\right) + \frac{1}{6}\left(\frac{n^2+n}{2}\right)$$

$$\frac{2n^4 + 5n^3 + 4n^2 + n}{6} = \frac{4}{3}\sum n^2 + \frac{2n^3+4n^2+2n}{12}$$

$$\frac{4}{3}\sum n^3 = \left(\frac{2n^4 + 5n^3 + 4n^2 + n}{6}\right) - \left(\frac{n^3+2n^2+n}{6}\right)$$

$$\frac{4}{3}\sum n^3 = \left(\frac{2n^4 + 4n^3 + 2n^2}{6}\right)$$

$$\sum n^3 = \left(\frac{2n^4 + 4n^3 + 2n^2}{6}\right) x \frac{3}{4}$$

${}^3Hn = \frac{n^4+2n^3+n^2}{4}$

4.6. Calculating the Series of Unit of ^{4}Hn using the technique of variable projection

To calculate the series of unit of ^{4}Hn, we can use the following equation

$(n + 1) = \Sigma\, n\ 3HN.\ Hun + \Sigma\ 3HN$

Left side:

$= (n+1)\ {}^3Hn$

$= (n+1)(\frac{n^4+2n^3+n^2}{4})$

$= \frac{n^5+2n^4+n^3+n^4+2n^3+n^2}{4}$

$= \frac{n^5+3n^4+3n^3+n^2}{4}$

Right Side:

$= \sum n\ {}^3Hun + \sum {}^3Hn$

$= \sum n^4 + \sum \frac{n^4+2n^3+n^2}{4}$

$= \sum n^4 + \frac{1}{4}\sum n^4 + \frac{1}{2}\sum n^3 + \frac{1}{4}\sum n^2$

$= \frac{5}{4}\sum n^4 + \frac{1}{2}(\frac{n^4+2n^3+n^2}{4}) + \frac{1}{4}(\frac{2n^3+3n^2+n}{6})$

Both Sides :

$\frac{n^5+3n^4+3n^3+n^2}{4} = \frac{5}{4}\sum n^4 + \frac{1}{2}(\frac{n^4+2n^3+n^2}{4}) + \frac{1}{4}(\frac{2n^3+3n^2+n}{6})$

$n^5 + 3n^4 + 3n^3 + n^2 = 5\sum n^4 + \frac{1}{2}(n^4 + 2n^3 + n^2) + \frac{1}{6}(2n^3 + 3n^2 + n)$

$5\sum n^4 = (\frac{6n^5+18n^4+18n^3+6n^2}{6}) - (\frac{3n^4+6n^3+3n^2}{6}) - (\frac{2n^3+3n^2+n}{6})$

$5\ {}^4Hn = \frac{6n^5+15n^4+10n^3-n}{6}$

Conclusion :

${}^4Hn = 1^4 + 2^4+3^4+4^4+5^4+\ldots\ldots+n^4$

${}^4Hn = \frac{6n^5+15n^4+10n^3-n}{30}$

${}^4Hn = \frac{6n^5+15n^4+10n^3-n}{30}$

4.7. Calculating the Series of Unit of ^{5}Hn using the technique of variable projection

Based on some reviews of literature, there are several methods for finding the formula to **^{5}Hn)**contained in the book Kalkulusdan *GeometriAnalitis*by*I Nyoman Susila*,in1999. The method is called with the falling number *method* but the equation is a little too difficult to understand. As a comparison between the methods, the falling number method will be compared to of variables projection methods. The following methods for determining the number of series of unit of ^{5}Hn is as follows:

Left side:

$(n+1)^6 - 1^6$

With the application of Binomium newton or paskal triangle:

$(n^6+6n^5+15n^4+20n^3+15n^2+6n+1) - 1$

$n^6+6n^5+15n^4+20n^3+15n^2+6n$

Right side :

$\sum [(n+1)^6 - n^6]$

$\sum (6n^5+15n^4+20n^3+15n^2+6n+1)$

$\sum 6n^5 + \sum 15n^4 + \sum 20n^3 + \sum 15n^2 + \sum 6n + \sum 1$

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$\sum 6n^5+15(\frac{6n^5+15n^4+10n^3-n}{30})+20$
$(\frac{n^4+2n^3+n^2}{4})+15(\frac{2n^3+3n^2+n}{6})+6(\frac{n^2+n}{2})+n$

Both sides :

$n^6+6n^5+15n^4+20n^3+15n^2+6n=\sum 6n^5+15$
$(\frac{6n^5+15n^4+10n^3-n}{30})+20(\frac{n^4+2n^3+n^2}{4})+15(\frac{2n^3+3n^2+n}{6})+6(\frac{n^2+n}{2})+n$
$=6^5Hn+30(\frac{6n^5+15n^4+10n^3-n}{60})+300(\frac{n^4+2n^3+n^2}{60})+150(\frac{2n^3+3n^2+n}{60})+180(\frac{n^2+n}{60})+(\frac{60n}{60})$
$=6^5Hn+(\frac{180n^5+450n^4+300n^3-30n}{60})+(\frac{300n^4+600n^3+300n^2}{60})+(\frac{300n^3+450n^2+150n}{60})+(\frac{180n^2+180n}{60})+(\frac{60n}{60})$
$=6^5Hn+(\frac{180n^5+750n^4+1200n^3+930n^2+360n}{60})$
$6^5Hn=(n^6+6n^5+15n^4+20n^3+15n^2+6n)-(\frac{180n^5+750n^4+1200n^3+930n^2+360n}{60})$
$=(\frac{60n^6+360n^5+900n^4+1200n^3+900n^2+360n}{60})-(\frac{180n^5+750n^4+1200n^3+930n^2+360n}{60})$
$=(\frac{60n^6+180n^5+150n^4-30n^2}{60})$
$^5Hn=\frac{60n^6+180n^5+150n^4-30n^2}{360}$
$^5Hn=\frac{2n^6+6n^5+5n^4-n^2}{12}$

The equation also can be solved by using variable projection method as a comparison to determine ^5Hn, as follows:

Left Side :

$(n+1)(\frac{6n^5+15n^4+10n^3-n}{30})$

With the distributive rule of multiplication upon summation, obtained

$$\frac{6n^6+15n^5+10n^4-n^2}{6n^5+15n^4+10n^3-n \quad +} \\ \frac{6n^6+21n^5+25n^4+10n^3-n^2-n}{30}$$

Right Side :

$\sum n^5+\sum(\frac{6n^5+15n^4+10n^3-n}{30})$
$\frac{6}{5}\sum n^5+\frac{1}{2}\sum n^4+\frac{1}{3}\sum n^3-\frac{1}{30}\sum n$
$\frac{6}{5}\sum n^5+\frac{1}{2}(\frac{6n^5+15n^4+10n^3-n}{30})+\frac{1}{3}(\frac{n^4+2n^3+n^2}{4})-\frac{1}{30}(\frac{n^2+n}{2})$

Both Sides :

$\frac{6n^6+21n^5+25n^4+10n^3-n^2-n}{30}=\frac{6}{5}{}^5Hn+\frac{1}{2}(\frac{6n^5+15n^4+10n^3-n}{30})+\frac{1}{3}(\frac{n^4+2n^3+n^2}{4})-\frac{1}{30}(\frac{n^2+n}{2})$
$12n^6+42n^5+50n^4+20n^3-2n^2-2n = 72\ ^5Hn+(6n^5+15n^4+10n^3-n)+(5n^4+10n^3+5n^2)-(n^2+n)$
$72\ ^5Hn = 12n^6+36n^5+30n^4-6n^2$
$^5Hn = \frac{2n^6+6n^5+5n^4-n^2}{12}$

Conclusion :
$^5Hn = 1^5+2^5+3^5+4^5+5^5+\ldots+n^5$
$^5Hn = \frac{2n^6+6n^5+5n^4-n^2}{12}$

5.CONCLUSION

Based on the results and explanations, some conclusions are obtained as follows:

a. Rules of Temple Area can be used to calculate arithmetic series thatthe change of its parts is not constant. So, it completes Gauss arithmetic series theory.
b. Technique of Variable Projection can be used to calculate the power of the operating series so as to complete the theory of Gauss and the falling number theory.

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ISBN 978-602-19877-3-5

LAMPIRAN

Choiprov I jugadapatdigunakanuntukmencarirumusjumlahderetharmoniksatuanpangkat z (^{z}Rn). Rumus-rumustersebutsepertiberikutini;

$^{0}Rn = 1^0+1^0+2^0+1^0+2^0+3^0+.....+1^0+2^0+3^0+4^0+5^0.....n^0$

$^{0}Rn = \frac{n^2+n}{2}$

$^{1}Rn = 1+1+2+1+2+3+....+1+2+3+4+5...n$

$^{1}Rn = \frac{n^3+3n^2+2n}{6}$

$^{2}Rn = 1^2+1^2+2^2+1^2+2^2+3^2+...+1^2+2^2+3^2+4^2+5^2... n^2$

$^{2}Rn = \frac{n^4+4n^3+5n^2+2n}{12}$

$^{3}Rn = 1^3+1^3+2^3+1^3+2^3+3^3+....+1^3+2^3+3^3+4^3+5^3...n^3$

$^{3}Rn = \frac{3n^5+15n^4+25n^3+15n^2+2n}{60}$

$^{4}Rn = 1^4+1^4+2^4+1^4+2^4+3^4+...+1^4+2^4+3^4+4^4+5^4...n^4$

$^{4}Rn = \frac{2n^6+12n^5+25n^4+20n^3+3n^2-2n}{60}$

Ada enam pokok fenomena baru,dan penemuan ini di kemas dalam satu nama '**CHOIPROV**' yaitu :

1. $(n+1)\ ^{z}Hn = \sum n\ .\ ^{z}Hun + \sum\ ^{z}Hn$
2. $\frac{Gn}{(n+1)} = \sum\{\frac{(n+1)Gun - Gn}{n(n+1)}\}$
3. $(Gn)^2 = \sum\{2\ Gn\ Gun - (Gun)^2\}$
4. $\sqrt{Gn} = \sum \frac{Gun}{\sqrt{Gn}+\sqrt{Gn}-1}$
5. $Fn \cdot Gn = \sum (Fn\ Gun + Gn\ Fun - Fun\ Gun)$
6. $\frac{Gn}{Fn} = \sum \left(\frac{Fn\ Gun - Gn\ Fun}{Fn\ \ Fn-1}\right)$

ISBN 978-602-19877-3-5

MODEL RULES OF STUDENT ACADEMIC ACHIEVEMENT WITH THE ALGORITHM C 4.5

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ABSTRACT

This research proposes a model rule of student academic data with achievement index in private colleges. The more dominant factors that affect the achievement index have yet to be surely known. The data were obtained obtained from academic database. In this study, the algorithm C 4.5 decision tree is applied in order to obtain a model rule that shows average scores of competence-based curriculum courses. The study shows the quality of academic achievement based on scientific courses and skills.

Index Terms— ***decision tree, model rules, an index of achievement***

1. INTRODUCTION

In learning teaching process, discovering the students' final scores has its own way,: by considering the absence percentage, giving assignment quiz, midterm test, final term test, study-program final test and thesis test.

The assessment of learning outcomes is represented with the letters a, b, c, d, and e; each is worth 4, 3, 2, 1, and 0.

Tertiary school curriculum is a set of plan and arrangements about the content as well as the material for research and courses and the strategy of delivering and evaluating used as a guide for the implementation of learning and teaching activities in tertiary schools. the competence-based course groups are personality development, science, skills, business skills, business behavior, and social life.

Some studies written in several journals or scientific researches about the uses of data-mining in tertiary schools saying that [9] had conducted a data mining survey in education between 1995 and 2005. They concluded that education related data mining was potential to study especially in e-learning. Multimedia, artificial intelligence and web database[6] conducted a research using data mining to identify students' behavior tending to fail in their academic achievement before the final test. [8] Used data-mining technique for the construction of the prototype of the performance assessment monitoring system (pams) to evaluate students performance. [10] Used data-mining technique to monitor and to predict students improvement achievement that were based on interest, learning behavior, time devotion and parents' support in tertiary schools.

This research is the application of data mining technique with algorithms C 4.5 in making the model rules of academic achievement based on curriculum courses on the basis of students' achievement index competence. The model rules obtained to classify the students effort ratings into: with praise, very satisfactory, satisfactory, and bad.

By using the algorithm C 4.5, this research will provide rules in the form of a decision tree for students who will increase the scores of the courses and achievement index in the coming semester. This research is expected to provide some contribution to private tertiary schools, in particular to informatics and computer management academy.

2. PROBLEMS

Based on the background above, the problem can be formulated in this research are as follows:

1. How to make curriculum-based model rules of students' achievement index by using algorithm c 4.5.
2. How to use the model rules to classify a student's final predicate based on students' achievement.

3. THEORETICAL REVIEW

Data mining is a terem used discover the knowledge hidden in database. Using statistical techniques, mathematics, data mining is a semi automatic process with atatistics techique, mathematics, artificial intelligence, and and machine learning to extract and to identify potential and useful knowledge information stored in big databases. [12] According gartner group, data mining is a relation discovering process that means a patern and a tendency of finding a variable in a mass of data storing spot by using pattern identifying techniques like statisyics and mathmatics [5].

The term data mining and knowledge discovery in the database (kdd) is iterchangably used to describe the process of extracting hidden information in a big database. In fact both the terms have different concepts, but related with each other. And one of the steps in overall process of kdd is data- mining. The kdd process can be outlined as follows:

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A. Data selection
B. Pre-processing/cleaning
C. Transformation
D. Data mining
E. Interpretation/evalution

This stage includes an examination whether the discovered patterns or information is contrary to the previous fact or research. The explanation above can be represented in figure 1

Figure 1. The process of data mining
Source: [11]

In the crisp-dm, a data-mining project has a living cycle that is divided into six phases, figure 2. The whole concutive phases are adaptive. The next phases in the sequence depends on the output .of the previous phases. The important relation of one phase with another is demonstrated with darts. For example, if the process is availale in the phase of modelling. Based on the behavour and the charateritic of model, the process can be back to data-preparation phase for further improvement to the data or move further to evaluation phase.

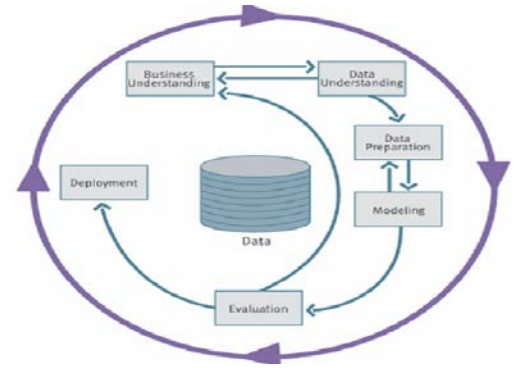

Figure 2.
Process data mining according to the CRISP-DM.
Source: [2]

The algorithm C 4.5 is one of the methods for making *decision tree* that is based on previously provided training data.. The algorithm C 4.5 is a developed form of id3. Several developments conducted to C 4.5 have led to the potential of overcoming missing value, continue data and prunning.
In general, algorithm C 4.5 used to build a decision tree is as follows:

A. Select the attribute as the root
B. Create a branch for each score
C. Devide cases in branch
D. Repeat the process for each branch until all the cases on each branch have the same class.

Selecting an attribute as a root is on the basis of the highest gain of the available attribute. To calculate the gain, formula 1 [1] is used.

$$Gain(S,A) = entrropy(S) - \sum_{i=1}^{n} \frac{\|si\|}{\|S\|} * entropy(Si)$$

With
S: The Set Of Cases
A: Attribute
N: Number Of Attribute A Partitions:
|si|: Number Of Cases In Partition To I
|s|: Number Of Cases In S
Whereas the calculation of the value of entropy can be seen
In formula 2

$$Entropy(a) = \sum_{i=1}^{n} - pi * \log_2 pi$$

With
S: Set Of Cases
A: Features
N: Number Of Partitions S
Pi: Proportion of SI against S

4. DATA COLLECTION PROCEDURE

In this case study, for the first set of data, the author collected data from sql the data-base server, compirising the average scores of the students' competence-based curriculum, the students who had received their "study outcome card" for semester 3 were those of 2008 to 2009, that consist of effort ratings, cumulative grade point, ratamkb, ratamkk, ratampk, ratambb, ratampb, and semester.

The first set of data can be seen in table 1
Table 1. The first set data display

No	Role	Name	Type
1	**Label**	**Predikat**	**Nominal**
	Regular	Ip	Nominal
3	Regular	Ratamkb	Nominal
4	Regular	Ratamkk	Nominal
5	Regular	Ratampk	Nominal
6	Regular	Ratambb	Nominal
7	Regular	Semester	Nominal

On table 1 effort ratings attribute as label is the *destination* of the attribute ip, ratamkb, ratamkk, ratampk, ratambb, and semester.

5. DATA PREPROCESSING

To obtain better input from data-mining technique, the author *conducted* several preprocessings for the data to be collected. The data are arranged in different tables that are linked in a single table. The combined table is:

A. Student tables
B. Course tables
C. Score tables
D. Cumulative grsde point tables

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The table obtained from the *field* selection of the four tables above, can be seen in table 2 below;

Table 2. Preprocessing table of the four – table combined data

Nim	Nama	MKB	MPK	MKK	MPB	MBB	Semester	IP
... ...	.....	.....	.....	.....	.....	.....	.....	... .

The table 2 data above are then simplified. Due to the enrolment numbers and the primary-key names, then the data are not used in the research , the selected data are available in table 3 by adding effort ratings *field* that is based on ip (cumulative grade point), in which the procedures are as follows:

No	Ip	Predikat
1	< 2,00	Bad
2	2,00 - 2,75	Satisfactory
3	2,76 - 3.50	Verysatisfactory
4	3.51 - 4,00	With compliments

Tabel 3 . Research data tabel

Predikat	IP	MKB	MPK	MKK	MPB	MBB	Semester
.....	... ...	.....	.....	.....	.....	.....	.....

6. THE EXPERIMENT RESULTS OF DECISION TREE

Sample model of decision tree rules with graph model of rapidminer software to be used can be seen in figure 3

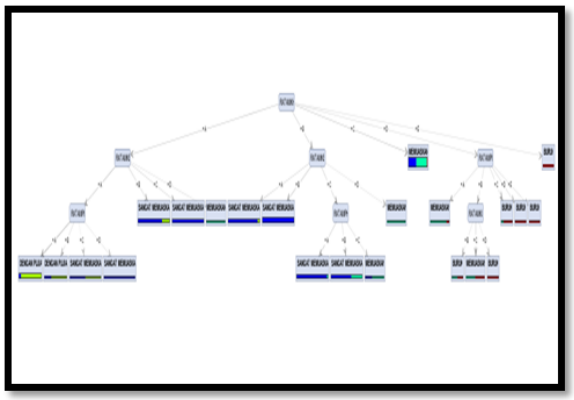

Figure 3. Graph decesion tree

From figure 3, it can be explained that the courses (mkk) have the greatest influence upon the data in this research. After experiment using rapidminer, it is discovered that mkk variable was on the top of all. Then they are compared with the average scores of mkk to obtain the effort ratings "with praise", very satisfactory, satisfactory, and bad. to see the simplification of decision tree in the form of model rules, the *induction rule* can be seen in figure 4

If ratamkk = b and ratamkb = b then verysatisfactory (95 / 0 / 0 / 0)
If ratamkk = b and ratampk = a then verysatisfactory (80 / 4 / 3 / 0)
If ratamkb = b and ratampk = b then verysatisfactory (44 / 10 / 1 / 1)
If ratamkb = b and ratamkk = c then verysatisfactory (29 / 6 / 0 / 0)
If ratamkk = b and ratamkb = a then verysatisfactory (15 / 0 / 0 / 0)
If ratamkk = c and ratamkb = c then satisfactory (18 / 101 / 0 / 1)
If ratamkb = c and ratamkk = a then verysatisfactory (37 / 0 / 0 / 0)
If ratamkk = a and ratamkb = a then with compliments (15 / 0 / 80 / 0)
If ratamkk = e then bad (0 / 0 / 0 / 38)
If ratamkb = b and ratamkk = a then verysatisfactory (27 / 0 / 12 / 0)
If ratamkb = c and ratampk = a then satisfactory (0 / 4 / 0 / 1)
If ratamkk = b and ratampk = b then verysatisfactory (26 / 16 / 0 / 0)
If ratamkk = d and ratamkb = d then bad (0 / 0 / 0 / 13)
If ratamkb = d and ratamkk = a then satisfactory (0 / 3 / 0 / 0)
If ratamkk = b and ratamkb = c then satisfactory (4 / 7 / 0 / 0)
If ratamkk = d and ratampk = d then bad (0 / 0 / 0 / 2)
If ratamkk = d and ratampk = c then bad (0 / 2 / 0 / 4)
If ratamkk = d and ratamkb = b then satisfactory (0 / 2 / 0 / 0)
If ratamkb = a then verysatisfactory (12 / 0 / 0 / 0)
If ratampk = d then bad (0 / 0 / 0 / 2)
If ratamkb = d and ratampk = a then satisfactory (0 / 1 / 0 / 0)
If ratampk = c and ratamkb = d then bad (0 / 1 / 0 / 2)
If ratamkb = d and ratamkk = c then satisfactory (0 / 3 / 0 / 1)
Else bad (0 / 4 / 0 / 5)
Correct: 632 out of 732 training examples.

Figure 4. Model rules of induction rule

From figure 4, it can be seen that the best rule can be simplified on the basis of effort rating *gain ratio*, like that in table 4 with the criteria that M means satisfactory, Sm means very satisfactory, Dp means with praise, and B means bad.

Table 4 rules of model simplification induction rule

Rule	Keterangan*rule*	Sm	M	Dp	B
1	If ratamkk = b and ratamkb = b then verysatisfactory	95	0	0	0
2	If ratamkk = c and ratamkb = cthen satisfactory	0	101	0	0

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3	If ratamkk = a and ratamkb = a then with compliments	0	0	80	0
4	If ratamkk = e then bad	0	0	0	38

From figure 4., it can be explained that very satisfactory rule ia obtained if ratamkk and ratamkb gain B and the score is "gain ratio 95". Satisfactory if ratamkk is, and ratamkb is C. "with praise" is obtained if ratamkb and ratamkk are a with gaint ratio 80. One is rated bad if ratamkk is E

7. CONCLUSION

This research generates some conclusions as follows:

A. It is obtained that a model rule can reveal connected rules o between the average grades of the courses with the students cumulative grade point index.
B. In the case study in the academic, it is discovered that the students gain poor effort ratings if their ratamkk are e, and they deserve with praise if the ratamkk is a, and the ratamkb is a.

8. ADVICE/SUGGESTION

Author's suggestions through this research are as follows:

A. To reach more varietive results, this research can be improved by using other *data-mining techniques* like fuzzy decision tree, genetic algorithm, association rule and knearest neighbor algorithm to discover a rule or approach model to be achieved.
B. In further research, the model rules test can employ the ssvm method (smooth support vector machine) as a means of testing the accuracy of the model rules
C. From the model rule approach, it can be seen that it is necessary for the academy management to consider and to decide which variable is required to improve the students effort rating index that the students are capable of gaining "very satisfactory and with praise.in this way they will feel sure of taking part in global job seeking competition.

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ISBN 978-602-19877-3-5

IMPROVING STUDENTS' ACTIVITIES AND LEARNING OUTCOMES IN NATURAL SCIENCE IN CLASS V by USING SOMATIC AUDITORY VISUAL INTELLECTUAL (SAVI) WITH SCIENCE KIT SEQIP IN SD NEGERI 25 SEROJA LINTAU

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ABSTRACT

This classroom action research was motivated by the students' low activity and learning outcomes in natural science. One of the reasons is the lack of teachers' ability in choosing appropriate learning approach and using of learning equipments in natural science learning process. Thus, the implementation of Somatic Auditory Visual Intellectual (SAVI) approach with science KIT SEQIP is one of the ways to solve this problem. The objective of this research is to improve the students' activities and learning outcomes natural science class V SDN 25 Seroja Lintau by using SAVI approach with science KIT SEQIP. This Classroom Action Research was conducted in two cycles. Test was carried out at the end of the cycle. The subjects of this research were 27 fifth grade students in SDN25SerojaLintau. The instruments of this research were the observation sheets of students' and teachers' activities, and the sheets of students' learning outcomes.The results showed that the percentage of students' activities improvement fromthe first cycle to the second cycle for group-activity indicator from 66.5% into 79.5%, 63% for asking-and-answering-question indicator into 83%, 53.5% for observation indicator into 74%, and 50% for making-conclusion indicator into 72%. In addition, the students' learning outcome in cycle I was 51.9% improved into 89% in the second cycle regarding its accomplishment percentage. It indicated that there was a significant improvement of students' activities and learning outcomes in natural science class by using Somatic, Auditory, Visual, and Intellectual approach (SAVI) with science KIT SEQIP.

Index Terms— Activity, learning outcomes, SAVI approach, science KIT SEQIP

1. INTRODUCTION

Education gives the possibility to the students to have the opportunity, hope, and knowledge in order to live better. These opportunity and hope depend on the quality of education taken. Education can also be a force for change in order to make a better condition. Quality education must engage students in active learning and direct the formation of values and learning outcomes required by students in experiencing life.

In carrying out teaching and learning process, teachers ought to consider the purpose of education. The intended objectives and learning outcomes must consider and adjust with national education goals stated in Article 3 of Law No. 20 of 2003 [1], namely: "The development of students' potency to become a human being who is faithful, devoted, noble, healthy, knowledgeable, capable, creative, independent, democratic, and responsible".

The knowledgeable, skilled, and creative potency of learners can be generated if the teachers realize that every child learnsby different means or activities. Children learning outcomes will be better if it involves emotions, activity of the whole body, all senses, and with all the depth and breadth of personal, by respecting learning style of each individual in the learning process, and support with adequate learning equipments.

Natural Sciences (IPA) is one of the subjects in elementary school (SD), which can develop the potency of students to be active in order to acquire knowledge and skills (learning outcomes) needed in life. IPA is related to how to find out about nature systematically by using observation tools, so that IPA is not only a mastery of knowledge in the form of a collection of facts, concepts, or principles but also a discovery. Natural science education is expected to become a means for students to learn about themselves and the environment, and then they can implement it in everyday life. The learning process emphasizes on providing direct experiences to develop competency in order to explore and understand the universe around them naturally. The goals of elementary science teaching in accordance with the National Education Standards Agency (BSNP) in KTSP [2] are to (1) obtain faith to the greatness of God Almighty based on the existence, beauty, and the natural order of creation, (2) develop knowledge and understanding of science conceptsthat are useful and applicable in everyday life, (3) develop curiosity, positive attitude and awareness of mutual influence among science, environment, technology and society. (4) develop process skills to investigate

ISBN 978-602-19877-3-5

the nature surround them, solve problems and make decisions. (5) raisetheir awareness to participate in maintainingand preserving the natural environment. (6) raise their awareness to appreciate nature and its regularity as one of God's creation. (7) acquire knowledge, concepts and skills of science as a basis for continuing education to Junior High School (SMP / MTs).

Knowledge and understanding of beneficial natural science concept (learning outcomes) will be obtained if the teacher can develop students' curiosity by utilizing all parts of body and students' senses to learn. If students able in utilizing their body and five senses by using suitable equipments means that teachers have successfully enabled students in the learning process.

Science learning process is emphasized on providing direct experience in order to develop student competencies and cultivate their ability to work and be scientific in gaining scientific knowledge about himself, as an important aspect of life skills, so that students learn and understand the nature surround them. Learning science is also an appropriate learning for brain and physical development of children, who are still experiencing a change toward a more mature quality that is called growth.

Based on the observation conducted in SD Negeri 25 Seroja Lintau, and interviews with the fifth grade classroom teachers, it was found out that there were still some obstacles in natural science learning. One of them was related to students' low activities which were triggered by teachers who only gave lectures and provided question and answering session and rarely use natural science KIT. It was known that lecturing is a teacher-centered learning process, and students just need to listen, write, and read the lesson. This method made students not actively involved in learning process, and it is just temporarily "kept" in students' mind. It was proven when the teacher asked the students about the material learn, not all of them were able to recall the material learned. In addition, the data showed that only a few of them (about 33.33%) were actively involved in learning process. Particularly, only smart students did contribute to teaching and learning process. They gave questions and stated opinion related to the topic learned, and also responded to their friends' opinion. Meanwhile, other students only listened, or did other activities which were not related to the topic discussed. This condition became the cause of students' learning outcomes which were not optimal and not as expected.

Based on the information acquired from classroom teachers in class V SD Negeri 25 Seroja Lintau, it was found out that the students' learning outcomes in daily tests have not reached the minimum completeness criteria (KKM). It was seen from the result of the second daily test in semester I in class V which revealed that among 27 students, only 12 students (44.44%) got scores above the minimum completeness criteria (KKM), and other 15 students got scores below KKM. KKM determined for natural science was 70.

Good activities and learning outcomes will be memorable and last longer in the minds of students. Of course, it will not be acquired if the teachers only used lecturing method. Students should be given the opportunity to move and interact with classmates by providing appropiate learning equipments. Knowledge will be obtained more easily when the students do activities by maximizing their body and mind and support by suitable equipments.

In learning science, teacher must think the way to keep students active in the learning process and obtain good learning outcomes. Thus, fun learning approach was needed in order to overcome the problems in class V SD Negeri 25 Seroja, Lintau. In other words, teachers should strive to create conditions of learning environments that encourage students to learn, or provide an opportunity for students to play an active role to understand the knowledge and concepts of science learned, so that it can develop their curiosity. This relates to the learning approach and provision of natural science equipments used by the teacher in the learning process in the classroom. Application of Somatic Auditory Visual Intellectual approach (SAVI) by using science KIT SEQIP is a learning approach that can be applied in the process of science learning to help teachers activate and obtain the students' expected learning outcomes in the learning process in the classroom.

Meier [3] states that, "SAVI approach is a learning approach by combining physical movement and intellectual activity and also the use of all sensory organs. SAVI is the acronym of Somatic (physic), auditory (voice), Visual (figure), and intellectual (contemplating). All elements of this SAVI will be able to create an effective and attractive learning. Suyatno [4] defines SAVI learning as "a learning which emphasizes on utilizing all sensory organs of the students."

Meier [3] states that young children are great learners because they use the whole body and all senses for learning. Learning based on the activities done means active movement by utilizing the senses as much as possible and making the whole body/mind engaged in the learning process. By using their body parts and sensory organs in learning science, the students will actively conduct investigations to understand and find a problem, string / use a tool (somatic), seek for information from various sources, write / draw observation result on the report (Visual), thinks and contemplate / solve / find the solution of a problem (Intellectual), and communicate the findings and observations (Auditory) in the classroom. The role of the teacher in learning shifts into a learning designer which enables students to actively search for new knowledge, and also as a facilitator or mediator so that the students can learn well.

ISBN 978-602-19877-3-5

Meier [5] states that SAVI models are implemented in four phases, namely: (1) preparation, (2) delivery, (3) training, (4) result presentation. The advantages of learning by using SAVI approach are: (1) raise the students' integrated intelligence through the combination of physical motion and intellectual activity. (2) bring a better, interesting, and effective learning atmosphere, (3) is able to generate creativity and improve psychomotor abilities of students. (4) maximize the sharpness of students' concentration through visual, auditory and intellectual learning. (5) the full involvement of learners.

KIT of natural science is a box which consists of natural science tools. These tools are designed that have series of tools of experiment for process skill in learning natural science. KIT of natural science is like three dimension media which can give a deep experience and understanding to the real goods. SEQIP is a type of equipment which is commonly used as a display tool to help students learn natural science better, so that they can understand its concepts easily. By using SEQIP, students will be able to understand natural science concepts taught by teachers.

Related to the development of students' potency by government, it is important and relevant to have the research on the application of SAVI approach with science KIT SEQIP to enhance the students' activities and learning outcomes. This is reinforced by the finding of Silberman [6] that from a group which consists of 30 students, there are about 22 students who can learn effectively if teachers provide visual, auditory and kinesthetic (somatic) activities. In order to determine how SAVI approach with using science KIT SEQIP can increase the students' activities and learning outcomes in natural science in class V SDN 25 Seroja Lintau, classroom action research needs to be conducted. This study is limited on students' activities in doing group work, asking and answering questions, observing and concluding natural science materials by using SAVI approach with science KIT SEQIP.

2. RESEARCH METHOD

This study uses a classroom action research with two cycles in which each cycle consists of planning, action, observation, and reflection. The research location is in SD Negeri 25 Seroja Lintau, Lintau Buo subdistrict, Tanah Datar district, West Sumatra. The subjects are 27 students of class V in SD Negeri 25 Seroja Lintau. Of 27 students, there are 12 female students and 15 male students. This research was conducted in four-time face to face meetings, which began on 14 to 26 January 2013. Source of data in this study were teachers and students who were involved directly in learning. The data were obtained from the observation of the implementation of SAVI approach with science KIT SEQIP in natural science learning as well as students' activities and learning outcomes. These data were gathered through observation sheets, and students' learning outcomes; meanwhile, the data were analyzed by using qualitative and quantitative model analysis.

The complete procedure of action research can be described as follows. In the planning stage, there was discussion with teachers and principals to determine when the research will be carried out, determine the material about "Simple Machine" as the teaching material for this research, design lesson plans with fifth grade teacher, prepare tools SEQIP and instructional media, teaching practice by using SAVI approach with KIT SEQIP, explain how to use the observation instrument for teachers and observers. Both researcher and observer recognize students' names, arrange study groups and their assignments, write students' workbooks, and prepare observation and learning outcomes sheets, and camera for documentation.

Implementation of actions is the implementation or application of the lesson plans by using SAVI approach with science KIT SEQIP. It started with the teachers who deliver the learning objectives and arouse students' interest in starting the lesson. Then, the teacher presents new materials in interesting, fun, relevant ways which suit all types of students' learning styles. At the beginning, the teachers assigned students to perform an activity using science KIT SEQIP related to the topic learned, then the teachers helped students to understand and integrate new materials by employing different ways. In order to check students' comprehension, teachers asked them to work in group and discussed the material learned by completing their worksheets. After that, teachers asked students to perform and explain the activities they did in more detail explanation. Other groups should pay attention on this explanation, in which the other groups then reported what they learned and heard from others' explanation. The students were then assigned to find the materials that are applicable in their daily life. At last, the students made conclusion of the learning process guided by teachers. Along learning process, teachers acted as the ones who facilitated, directed, and gave guidance to students.

Observation is done by two observers to observe the students' learning activities and the implementation of SAVI approach with science KIT SEQIP during the learning process. The implementation of this approach and students' learning activities were recorded on the observation sheets by the observer. These observations were carried out intensively, objectively, and systematically. At these observations, researchers and analysts tried to recognize, record the changes in students and teachers along the learning process with SAVI approach by using science KIT SEQIP; is it better or worse? Some of students' activities which were observed were: group work which used science

ISBN 978-602-19877-3-5

KIT SEQIP and students' worksheets, asking and answering question activities, observation activities as instructed in students' worksheets, and the activities of concluding and implementing the materials learned in daily life. These observations were continually conducted from cycle I to cycle II. The observation result of cycle I can be used as a consideration in determining actions in cycle II. Of course, this result should be discussed with observers as a reflection for the following planning. At the end of the cycle, test was given to the students in order to know their cognitive achievement in the level of knowledge and comprehension.

Reflection is held at the end of every action. On this stage, researcher and observers had a discussion about the action taken. Matters discussed were the reflection of the result acquired in natural science learning which was related to the analysis of students and teacher's activities after the learning process, analysis and difference of planning and action carried out, and conclusion for the data obtained. These data were used as suggestions for the next action. The result of reflection was needed to see the accomplishing of indicators. If the achievement indicator in cycle I had been acquired, the cycle was stopped in cycle II. However, it would be continued to the next cycle if it had not achieved the achievement indicators. In the discussion stage, the weaknesses of one cycle were brought into discussion, as well as found out the solution of this problem and betterment for the next cycle. It was based on the result of observation and evaluation.

The test results of each were analyzed qualitatively by calculating the average score of the class and the percentage of students who have achieved learning completeness, in which their scores ranged from 70 to 100. The observation results of students' and teachers' activities were analyzed by counting the scores, the average scores, and the percentage of the activities carried out of the total activities and total number of students.

3. RESULT AND DISCUSSION

3.1. Cycle I

In the first cycle, teaching material that was planned was the simple machine. The teaching material that was taught in the step of action at meeting 1 in learning natural science was about lever and in the second meeting was inclined plane by using SAVI approach with science KIT SEQIP. Time allocation in each of meeting was 2x35 minutes. The results of observation in this classroom action research were as follow:

3.2.1. The result of students' activities

The result of observation in the first cycle showed that the development of students' activity during learning process by using SAVI approach could be shown on Table 1.

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Table 1. The Percentage of Students' Activities

Indicator of Students' Activities	Meeting		Average
	1	2	
Doing Group work	63%	70%	66.5%
Asking/ answering question	59%	67%	63%
Observing	48%	59%	53.5%
Concluding the lesson	44%	56%	50%

Related to the data shown on Table 1, it can be seen that the percentage of students' learning activities on the part observed as follow:

a. There is a slight improvement of students' activity in doing group work from the first meeting 1 to the second meeting. Although at the second meeting the students' activity has achieved indicator of success that has been determined. The average of the students' percentage who are involved in group work is 66.5%, it means that a part of students have been able to do group work based on the task given. It is caused by the students have not been usual with the learning process which is done through group work by using KIT natural science and have not understood to the task that is in students' worksheet, so the task which is done on the work sheet less running well. Teacher also still has not been good enough to guide students to work in groups demonstrating the function or the use of lever and inclined plane.
b. The development of the activity in asking / answering questions to both meetings has not still run well. The average percentage of students who ask / answer questions is 63%. At this first cycle students have started to dare to do the activity asking / answering questions in learning lever and inclined planes, although there are still students who have not been able to ask / answer questions due to they are less braveand do not understand the task and the teaching material taught. Many students have not know where the load, the power, and the fulcrum of a lever and the inclined plane and also example of those applications in life. In the first cycle, teacher also looks unable to stimulate students to talk about the activities on the worksheet that discuss about the lever and the inclined plane, and also encourage students to ask questions about the activities that they do on the worksheets or motivate students to be able to answer the question.
c. The improvement of observation activityto both of meetingsis still low;it is only part of studentswho can perform well. The average of students'

ISBN 978-602-19877-3-5

percentage who observed was 53.5%.It is caused since the students do not understand the commandson the worksheet, so they get wrong in answering the questions that are related to the observation done.Besides, many students still do not observe seriously and do not know what things that should be observed in this activity.

d. The result of activity on making conclusion at the first cycle is still low.It shows that most of the students do not understand what they are learning.The average of students' percentage that was able to conclude a lesson on learning activities that have been taught was 50%. It is seen only a few students that were able to make conclusions on all the learning activities that have been done.Many students have not been able to see the application of lever and the inclined plane that are learned in their daily lives.

As shown at the first cycle, there are many students who have not done those activities. It is caused by the learning model used by teachers is different from the previous ones. The students are still not familiar with the learning approach used by the teacher in the learning process. The students have not been usual to use actively their limbs and senses to learn natural science in learning activities, so they get shy to do activities in the learning process.

3.2.2. The result of students' cognitive achievement

Based on the result of test at the first cycle, Table 2 shows the result of students' achievement in learning, the percentage of students that can pass the study, the percentage of students that cannot pass the study, the average of students' grade, the completeness of the students' achievement in classical style.

Table 2.The Completeness of Students' Achievement

Commentary	Total
The total students who can pass the study	14
The total students who cannot pass the study	13
The average of students' grade in a class	64
The percentage of students' completeness in learning	51,9%
Target	70%

As shown on Table 2, It can be seen that the percentage of students' achievement who can pass the study at the first cycle generally can be classified in the level of low and there were many students that were not able to achieve the minimum standard of natural science (KKM). The students who achieved grade more than the minimum standard of natural science were 14 students, it indicates that this result has not achieved the indicator of classical completeness is about 70% of students. It is caused that there were many students still get confuse with learning process by using SAVI approach with science KIT SEQIP. This finding can be associated with the students' activity during two meetings that can be seen still in the level of low. This result can give impact on the students' cognitive achievement in learning process. Since the students' activities in answering / asking, observing and concluding the lesson are still in the level of low that can give significant impact on the low ability of students' understanding to the teaching material that was learned, so there were many students who were able to achieve minimum standard of natural science because the students cannot answer question correctly. This phenomenon is also caused by teachers' skill that were not good in classroom management, stimulating the students to be active, guiding and facilitating the students to use their limbs and senses in learning process at the first cycle, and also the teachers were not good to implement teaching procedures of SAVI approach.

After the phase of action and observation done, the next step was reflection that was done by teacher and observer. This step was for discussing about the result of observation. After reflection, it can be identified that the teacher has not been able to teach and implement the teaching procedure by using SAVI approach with science KIT SEQIP correctly. The teacher cannot encourage the students to be more active in learning process. The teacher needs to improve his teaching skill, so the students can be encouraged to be more active/ more cooperative in using learning tools that were provided in their group, fostered their willingness to be more brave in asking and also they can answer the question correctly. It can be done through the teacher that helped his students by using a good technique in asking question. This technique was used especially for the students who got shy/ seldom asked question/ answered the question. The teacher is expected to be able to guide his students to do observation properly through the students' worksheet that has been revised (by attaching good picture and clear command) to help them to do and more clearly observe the learning activity properly. At the next cycle, the teacher is also expected to have good time management and be able to explain the teaching material more clearly to the students and give reinforcement to them, so they can get success in answering the questions on the test at the second cycle. The teacher should more frequently guide the students to be able to conclude the lesson and think about implementation of the material in their daily lives. For both of observers, they are suggested to do observation more carefully in observing the teacher and students' activities during teaching and learning process.

3.2. Cycle II

Based on the result of reflection at the first cycle, it is a must to make a better planning related to the teachers' skill and teaching and teaching procedures

ISBN 978-602-19877-3-5

by using SAVI approach with science KIT SEQIP, classroom and time management, improving the teachers' technique in asking question to students, fostering the students' motivation and guiding them to be able to ask/ answer and also doing observation by using their all senses. The result of discussion between researcher and the teacher, the improvement that should be done at the second cycle were making better students' worksheet than before, so the students are encouraged to be more active and cooperative in group work, observation activity, asking question and concluding the activities that are done in learning process. Moreover, it needs to make a plane to the teacher to give reinforcement on the learning process at the post teaching activity, so it is expected many students that can achieve minimum standard of natural science on the test of this cycle.

In implementing the step of action at the second cycle, the teacher taught material about pulley at the first meeting and wheel pivots at the second meeting by using SAVI approach with science KIT SEQIP. Observation was done by two observers by using observation checklist when action phase did. Based on the results of observation to the teacher in teaching, the data revealed that there were an improvement of teachers' skill in teaching and doing the teaching procedures of SAVI approach, guiding the students and encouraging them to be active and to work in group by using their worksheet and interesting learning tools from KIT of natural science, and also there is an improvement in encouraging the students to have high willingness to ask and tell about the activities that were done. The teacher has been good in guiding the students' group in observing and asking them to think about conclusion and implementation of pulley and wheel pivots in their daily lives by giving few command. The teacher has also reminded the students to re-read the material about pulley and wheel pivots at home , so at the end of this cycle they can answer the test. The result of observation at the second cycle can be seen as follow:

3.2.1. The observation of students' activities

Based on the data revealed by the observer, it can be seen that the improvement of students' activities during the second cycle presented on Table 3.

Table 3. The Percentage of Students' Activities

Indicator of Students' Activities	Meeting		Average
	1	2	
Doing Group work	74%	85%	79.5%
Asking/ answering question	78%	88%	83%
Observing	67%	81%	74%
Concluding the lesson	63%	81%	72%

Related to the data revealed on Table 3, it can be interpreted as follow:

a. There were 23 students or 85% of total students who have been active and preferable to be involved in group work, and they use KIT of natural science properly at second meeting. Many students have been guided by the teacher, so they were active to be involved in learning process based on the command on the students worksheet. They looked happy and active to arrange pulley and wheel pivots during learning activity (somatic activity).
b. There were 24 students or 88% of total students who have been involved in the activity of asking/ answering question related to the material of pulley and wheel pivots and they prefer to ask related to the material that was not understood. Moreover, there was an improvement on teacher's skill in encouraging his students to be able to answer the question correctly through technique of giving question. Such as, the students were able to answer where the load and power are. There are many students who are able to narrate enthusiastically the results of their observation related to pulley and wheel pivots (auditory activity).
c. There was an improvement on the activity of observation at the end of meeting of the second cycle; there were 22 students who have been able to do observation activity correctly related to the important things are in the installation and use of pulley and wheel pivots. There were many students that have been guided by their teacher, and they master to do observation by themselves during the activity was about pulley and wheel pivots, so they were able to answer the questions on the students worksheet correctly (visual activity).
d. Students' skill in making conclusion need to be trained by the teachers to improve their skill in thinking about examples of the implementation of pulleys and wheel pivots in their daily lives. Since, the teacher frequently helped his students to make conclusion of their learning properly,the students successfully has achieved indicator of success that was determined the end of this cycle activity. It is indicated that the students' intellectual ability get an improvement but it needs to be trained properly by their teacher to be able to think about problem solving/answer the problem given in learning process.

Related to the result of observation, it can be concluded that all the students' activities that are observed has improved and achieved the indicator that has been set in this study. Based on the data of this study, the process of learning and teaching activity using SAVI approach with science KIT SEQIP has been able to improve the students' activities.

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3.2.2. The result of students' cognitive achievement in learning

Test was administered at the second cycle after meeting 2 which it was supervised by a teacher. The result of the test is shown on Table 4. There were 24 students or 89% of total students that can pass the study, it indicates that the students have successfully achieved minimum standard of natural science. Learning natural science by using SAVI approach can significantly improve the students' achievement in learning. It is caused by the improvement of action that was done by the teacher at the second cycle, so it can give impact on the students' willingness to be more active in learning activity. Since the improvement of students' activity at the second cycle, it can give significant improvement on the students' achievement that the previous cycle. The improvement of students' learning achievement can be achieved because there were many students who were motivated and involved in arranging pulley and wheel pivots by using KIT SEQIP of natural science in the learning process of the second cycle. Moreover, the students have been able to observe the activity done, and they were active in asking and answering questions on the students worksheet. They got easy to answer question of the test at the second cycle because they have been able to do observation properly, to understand, to write, and conclude the implementation of pulley and wheel pivots in their daily lives. The questions on the test related to the activity that they have been done on the activity of both meetings at the second cycle.

Reflection was done after doing observation, and based on the data revealed and the results of discussion with teacher and observer at the second cycle, this research does not need to be continued to the next cycle because the indicator of students' activity and the students' cognitive achievement have been achieved.

Table 4.The Completeness of Students' Achievement

Commentary	Total
The total students who can pass the study	24
The total students who cannot pass the study	3
The average of students' grade in a class	85
The percentage of students' completeness in learning	89%
Target	70%

As stated by Meier (2005:92),"Optimal learning will be acquired if these four ways-somatic, auditory, visual, and intellectual- are employed in the learning process, and carried out simultanously." Since KIT SEQIP is designed attractively and colorfully, it can show physics indication which is being learned and it can make students to enjoy in learning activity of natural science.

4. CONCLUSION

Based on the finding and discussion of this study, learning natural science by using SAVI approach with science KIT SEQIP at grade V of SD N 25 Seroja Lintau could successfully improve the students' activities and their learning achievement on learning natural science. The result of this study can be concluded as follow: (1) The activity of students group work at grade V of SD N 25 Seroja Lintau in learning natural science could be improved by using SAVI approach with science KIT SEQIP, this improvement can be seen from the percentage of students' score at the first cycle is 66.5% whereas at the second cycle, the students' score improve 79.5%, (2) The activity of asking/answering question which is done by the students at grade V of SD N 25 Seroja Lintau in learning natural science by using SAVI approach with science KIT SEQIP could improve. The improvement of students' average score is 63% at cycle I and 83% at cycle II, (3) there was an improvement on the students' average score in the students' observation at grade V of SD N 25 Seroja Lintau, the score at cycle I was 53.5% and the score at cycle II was 74%, (4) The activity of asking/answering question which is done by the students at grade V of SD N 25 Seroja Lintau in learning natural science by using SAVI approach with science KIT SEQIP could improve. The improvement could be seen from the students' average score in concluding the lesson is 50% at cycle I whereas this score improved 72% at cycle II. The students' learning achievement could improve, it can be seen from the percentage of students achieved the minimum standard of natural science. The students who can pass the study is 51.9% of the total students at cycle I whereas the students who can pass the study is 89% of the total students at cycle II.

5. ACKNOWLEDGEMENTS

The writer delivers his massive gratitude to Youlaspi Arita, SM and Dola Romanpika, S.Pd. who have given. constructive suggestions and significant contribution for impovement this paper.

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ISBN 978-602-19877-3-5

DESIGN AND CONTRUCTION OF SIMPLE DISTILATION UNIT WITH REFLUX COLUMN MODEL FOR TIBARAU SUGARCANE (*Saccarum Spontaneus Linn*.) BIOETHANOL PRODUCTION

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ABSTRACT

Writing this article is to present the draft to build and develop a simple distillation unit with reflux column models. As well as part of the research objectives to produce bioethanol from the fermentation of the base material for the production of (biomass) in the form of plant cane tibarau (saccarum spontaneus Linn). The production of bioethanol in the context of the research-oriented development activities biofuels, which is referred to as gasohol consists of a mixture of bioethanol with premium. For this purpose, among others, we need a system that is trustworthy distillation equipment to obtain the quality bioethanol eligible. One system equipment in question is the model of reflux column. Results can then be applied to the design industry efforts household scale, so that the industry can cultivate and develop bioethanol raw materials are in short supply in their environment such as sugar cane plants tibarau that have untapped potential.

Index Terms :

1. INTRODUCTION

Awareness of the world's energy needs and the increasing tendency of the limited resources of primary energy today especially petroleum, encourage people to continue to seek and develop alternative renewable energy. Among others in this regard is to develop and adopt the use of biofuels.

As one form of renewable energy derived and processed from organic materials either directly from herbs/plants, or indirectly prepared from industrial waste and agriculture, then this form of energy is classified as biomass energy, where its presence can be either or in the form solid, liquid or gas.

Biofuels has the potential to be used as a substitute for fossil fuels such as petroleum and coal, mainly gasoline or diesel. These fuels can be produced through a simple scientific process without the need of sophisticated machinery and equipment as is required in the production of oil and gas. Biofuels can occur in a hydrocarbon compound with chemical formula CH_5OH, and known as ethyl alcohol produced from crops/plants, where the later type of fuel is more popularly known as bioethanol.

Bio Ethanol according to a series of process, formed by fermentation of sugar from sugar cane plant material or an extract of vegetables and fruits such as potatoes, corn, wheat and other things that contain sugar, and can be a source of raw material. In the context of this study used the type of base material of wild plants (shrubs) that its sugarcane tibarau (saccarum spontaneum Linn) as shown in Fig.1. According to Reza Fahlevi and Chakra DM (2009) research results, this plant contains glucose, cellusose and hemi cellulose, starting from the stem to the leaves, which is possible as a basic ingredient in the process and the formation of bioethanol.

Figure 1. Photo Plants Tibarau Sugarcane Characteristically Non-Crop Cultivation Growth in Suburb River

Changing the yeast enzyme simple sugars into ethanol and carbon dioxide by chemical reactions in fermentation activity is shown by the simple equation below. Actually, the process is very complex because of the existence of other substances that are formed, include oil glycerin, and various organic acids resulting in unwanted side reactions.

$$C_6H_{12}O_6 \rightarrow \mathbf{2C_2\ H_5OH + 2CO_2}$$

When ethanol is blended with gasoline (premium) to be used as fuel for cars, generally referred to as gasohol or biofuel. (Rosentrater, 2006). According Henniges and Zeddies (2006), most of the research for the development of bioethanol directed at pretreatment activity of the material extracted from the plant or energy plant, and no doubt this course

ISBN 978-602-19877-3-5

tibarau sugarcane. The pretreatment process aiming to improve the conversion rate of the base material, in order to obtain the results and efficiency in ethanol production more economical than plants and plant energy potential. It involves a variety of technologies to promote activities such pretreatment prior to the fermentation process. Included in this is the distillation of activity as an effort for the conversion of basic material intended.

After the fermentation process takes place and successful then the next stage will be followed by distillation (refining), namely, extraction and separation of ethanol from the mixture with water. In this case there are a number of techniques and methods, one of which is through the distillation in the column/tower reflux. This method is quite simple, without using a container-legged condenser coils (feedstock system) as long as it is widely known (traditional) in activity based condensing steam distillation.

2.1. Sustainable Biofuels as Energy Source for the Future

The production of biofuels has a beneficial impact in order to improve the sustainable supply (supply) of fuel for the future. Biofuel does not cause as much air pollution and environmental hazards created by fuel oil. This does not contribute to the greenhouse effect of carbon dioxide or to environmental problems such as global warming (Keeney and DeLuca, 1992). Ethanol is an octane booster agents and anti-knocking, which need digalakan development as a fuel.

Activities through the development of the biofuel production chain are economically able to provide employment and socio-economic development in rural areas. The use of ethanol as a fuel is able to reduce the foreign trade imbalance which is detrimental in contact provision and the needs of the domestic fuel supply and national energy security. Benefit ratio biofuel production costs may be higher than the fossil fuels but biofuels do not contribute to the greenhouse effect problem which is a major problem in today's world. Compared with other energy sources are already known, the development of fuel bioethanol project more credible as a biofuel (Colmac 2009; Van Gerpenet al, 2007).

The traditional method of distillation feedstock in the system involved the use of a condenser which consists of coils/rolls the pipe or pipe insertion in the jacket fins. Distilled in this way is usually characterized by a mix of products in the form of refined products is still relatively much water. Inevitably this way would require several times the process to obtain a better quality ethanol.

2.2. Description Results Design of Distillation Systems Unit

A bioethanol distillation tank is designed and constructed as shown in Figure 2. where the machinery or equipment system is planned and has the ability to process 150 liters of substrate (for weighing approximately 160 kg of sugarcane tibarau). Equipment units are designed to filter out material fermented products such as glucose, sucrose, and fructose derived from the juice (juice) sugar cane or (brix solution) as well as other products such as sugar cane waste material stems and similar products.

Is a model of distillation with Reflux Still Internal condensor (IRSC) in the form of peripheral equipment that is controlled by an internal process of re-distillation and separation of the final result. Cooling takes place through the circulation of water in the condenser pipe and using a water tank in the tower filled with the mediation of the transfer pump. The capacity of the pump power of 1.0 hp capable planned to raise water to the top of storage tank (reserevoir) and maintain a stable flow to circulate water in flow range 500 - 1000 liters/hour.

2. DESIGN AND CALCULATION ASSUMPTIONS

It takes a cylindrical-shaped tube is regarded as a boiler or evaporation tank for this refining system with a capacity to process about 150 liters of 160 kg tibarau raw material sugar cane. By the size of the volumetric capacity of the boiler is determined through a formula statement presented in equation (1) and (2). The maximum height of the tank was selected/designated as high as 0.9 m. Guided by the analysis of the draft proposed by Olaoye (2011) as well as a little modification based on a variety of other literary sources, it can be done analysis for the calculation of the following design requirements,

Distillation tank payload capacity (boiler) is calculated,

$$\mathbf{G_v = V_b \ \rho_b} \quad (1)$$

where, Gv = Capacity (mass) tank/boiler (kg)

Vb = Volumetric tank capacity (m^3)

ρb = density of the product/boiler (kg/m^3)

whereas the distillation tank volume is,

$$\mathbf{V_b = \pi r^2 h} \quad (2)$$

where,

Vb = capacity or volume of a cylinder/tank (m^3)

r = radius of the tank / boiler (m)

h = high boiler / tank; (set = 0.9 m)

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Thermal properties of ethanol and engineering materials, likely media boilers, thermal energy, and also sources as well as materials obtained from various sources distillation leteratur, consisting of: the specific heat capacity of ethanol is taken as (c_{eth} = 2.44 kJ/ kg-K) at the level of density (specific mass ; ρ_{eth} = 798 kg/m^3) ; latent heat of evaporation is approximately (L = 839,3 kJ/kg-mole) and the boiling temperature is 78.5 ° C (Misau,et al 2008, Diesel, 2009). While the source of thermal energy for distillation system will come from fuel wood, and / or may also be replaced with fuel briquettes from coal/charcoal and bagasse, its density is set around, ρ_{wood} = 208 kg/m^3 (Simetric & Co., 2009), as well as heating value of wood fuel is H_{wood} = 15,000 kJ/kg (Bilad, 2015).

The flow rate of water into the cooling jacket (the condenser pipe) is expected to be slower compared to ethanol vapor flow rate into the distillation column reflux to occur effectively. Based on the legal principle of continuity of the fluid flow in this case is constant, the rate of ethanol is planned at the level of the volumetric flow 0.003 m^3/sec and distilled water flow rate of the pump is much slower than ethanol steam flow, i.e at a rate of 0.001 m^3/sec.

To that end, selected the corresponding pump, in order to obtain effective cooling and also planned to pump in this case (function) to raise water into the storage tank can be controlled automatically high surface water to remain stable circulation. The amount or volume of water needed to cool the steam condenser ethanol in determining the volume of the water tank. In this case the volume of water is calculated by equating the amount of heat energy lost from ethanol steam with heat energy obtained/absorbed by water, (Equation 3).

The volume of water required at maximum operating capacity is 100 liters or (m_w = 100 kg) and the water reservoir tank elected capacity is 250 liters. Balance of heat energy (Principle Black),

$$\mathbf{m_w\ c_w\ (\ t_w\ -t_{28}\ )\ =\ m_{etha}\ .\ L_{etha}} \qquad (3)$$

where, m_w = mass of distilled water (kg)
c_w = specific heat of water (4,186 kJ / kg K)
T_w = highest temperature distilled water (80 ° C)

T_{28} = temperature of the room / water fresh (28^o C)

m_{eth} = mass ethanol evaporated (kg)

L_{eth} = the latent heat of evaporation ethanol (kJ / kg-mole)

Through the mediation of analytical results of calculation of the equation will be obtained mass amounts of ethanol evaporates.

2.1. Requirements and Heat Energy Source for Distillation Process

Heat energy required to raise the temperature of ethanol is taken out of the reach 28^o C to 78,5^o C, so the boiling temperature of ethanol is calculated by equation (4) and the quantity of heat energy, **q** to turn ethanol into steam at boiling stage is determined by using Equation (5) that,

$$\mathbf{q = m\ c\ \Delta t} \quad \text{and} \quad \mathbf{q = m\ L} \qquad (4)\ /\ (5)$$

where,

m = mass of raw material fermentation (kg)

c = Specific heat fermentation feedstock (kJ/kg K)

L = Latent heat of evaporation (kJ/kg)

Δt = change in temperatur (^{o}C)

The heat energy required to raise the temperature to the desired temperature, 78,5^o C is 7,972.02 kJ, while 1.846 kJ is the amount of heat energy required to convert ethanol into steam. So the total amount of energy required to evaporate the ethanol is 9.818,02 kJ/ sec. The mass amount of firewood / fuel needed to supply the amount of heat energy required to evaporate the ethanol was calculated from the fuel consumption is 15,000 kJ / kg. Therefore, the amount of fuel wood needed as much as 0.654 kg / sec

2.2. Flow and Capacity Water Pump

Ethanol vapor increased by 0.003 m^3 at reflux column every second. The amount of heat energy supplied/supplied, Q move the particles of steam at the level of kinetic energy. The speed associated with the increase in the volume of ethanol vapor in a reflux column presented by equation (6), while the reflux column diameter is determined by using equation (7) thus obtained:

The increase in volumetric steam in the reflux column,

$$\boldsymbol{V = \sqrt{\frac{2\ c\ \Delta\theta\ A^2\ t^2}{h}}} \qquad (6)$$

and reflux column diameter is determined by the following

formula, $$\boldsymbol{d = \sqrt{\frac{4\ V^2}{A^2\ \pi}}} \qquad (7)$$

Where,

V = the amount of evaporation volume (m^3/ s)

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A = the flow cross-sectional area (m^2)

c_{eth} = specific heat of ethanol (kJ / kg K)

h = length / height of the column (m)

d = diameter of the column (m)

$\Delta\theta$ = change distillation temperature (^{o} C) t = time (sec)

Rom Equation (6) and (7) obtained volumetric flow rate, in which ethanol vapor rises to the top of the reflux column and the diameter distribution pipe, i.e. column is calculated as 0.003 m^3/s and a diameter of 40 mm or 1.5 inch. Each pipe is made of copper material, chosen because of the nature of inertia (inertia), which could limit the reaction with ethanol evaporated. Reflux column (condeser part) has a surrounding water jacket for cooling influence the activity of ethanol vapor. Specifically on the outputs (condenser), the planned reflux column with two cooling methods that are based on the principle of heat exchange flow, that are opposite /counter flow model and counter & circular/multipass flow model.

To model the opposite flow, pipe refluxnya column contained a core pipe in which ethanol vapor flowing in the opposite direction of the flow of cooling water, that flowing on the side on the outside of the core pipe reflux column. As for the models of heat exchange in the opposite direction (counter & circular), in the core pipe essence flowing cooling water and around the flowing vapor ethanol, then in the outer portion of the pipe reflux condenser wrapped around the pipe / hose water additional cooling so that the vapor of ethanol chilled to double (from the outside and the inside).

A pump is required and installed to raise the water to a reservoir / tank which is placed on the tower so that the water circulation occurs through a condensation unit and a jacket reflux column. Pump capacity is determined based on the volume of water to be circulated from the reservoir continues to enter / for condenser or jacket water for cooling the column reflux, head total circulation and flowrate demand, as shown by (equation 8), which is applied according to Khurmi (2005) and force pump Recommended for 1 HP (or approximately 746 Watts).

P = ρ g H Q (Watt) (8)

where, P = propulsion pump (watt)

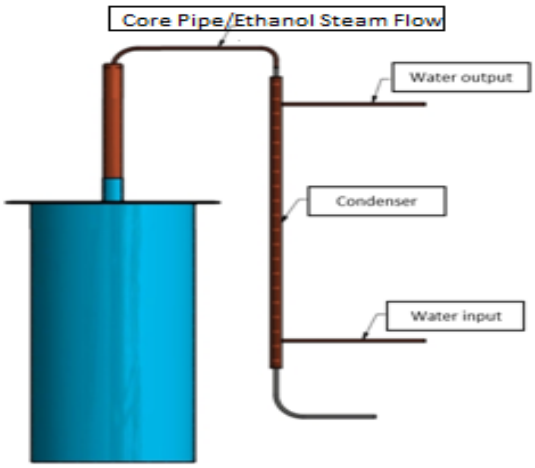
H = h + hf = height + increase in friction head (m)

Q = flow of water (m^3/ s)

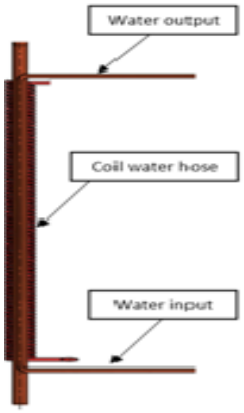
Orthographic projection images for the manufacture of refining system is presented in Fig. 2, which shows a front view of some components of the machine. Boiler tank was first made before the setting and connecting piping. The precision of certain options to allow the best materials to get a quality of the tank and the column along with the reflux condenser section, so that the resulting system of steam distillation and ethanol quality.

2.3. Manufacturing Process and Systems Distillation Unit

The construction of engineering results was carried out at the fabrication workshop of Mechanical Engineering Departement- Technical Faculty, Padang State University. The fabrication jobs consists of a number of activities, such as cutting sheet steel plate and stailess steel into desired size, as well as welding work on the same material based on the results of the design, along with other work to ensure the toughness and strength equipment unit.



a) Reflux Column with a Counter flow



b) reflux column with a Counter & Circular Flow

Figure 2. Projection Drawn for Making Distillation Reflux Column

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Parts unit and the components as shown in Figure 2, is connected to the welding work perfectly with each other to avoid leaks that cause losses steam flow. Boiler tank (boiler) is first made /worked in the manufacturing process before setting up and connecting pipes reflux column.

For more details look distillation machines complete manufacturing yields shown in Figure 3 with two models: (a) the principle of counter flow, (b) the principle of counter flow and a circular (/multipass flow)

(a) Reflux with Counter flow System (b) Reflux with Counter & Circular Flow System

Figure 3. Distillation Plant with Reflux Column System -As a Result of Design and Contruction for Small Scale Industries

3. Materials and Distillation Methods

The materials used for bioethanol distillation procedure includes the fermentation of raw material/substrate tibarau cane plants, either processed from pulp stem and drops/water sugar cane. For the fermentation of waste materials/residual stems (baggase), first used as flour after cracker and milled by machine (disk-mill). Then on the base material can be made acidic or alkaline hydrolysis process, with the addition of 0.1 m H_2SO_4 or liquid NaOH according pretreatemen process/hydrolysis desirable to adjust the solution to pH levels, warm water to inject pure yeast. Yeast function is as a catalyst to improve the fermentation process, while for the other equipment is used, such as pH meters, alkoholmeters, as well as brix sugar measuring instrument (hand refractometers).

If using drops/brix from sugar cane tibarau material for fermentation, the base material must first be squeezed to take water from tibarau steem broking squeezer machine/ milling (mill press). Subsequently, the juice is heated with a flame that was to manufacture brix/solution contains a certain percentage of glucose levels.

After fermentation of the basic ingredients of the sugar cane tibarau (saccarum spontaneum L.) were conducted during the interval of 5-20 days, then followed by a distillation process to obtain sugarcane bioethanol tibarau. Figure 4, is a fermentation process of cane powder tibarau process alkaline hydrolysis and fermentation of sugarcane brix tibarau.

(a) Powder of Tibarau Baggase Fermentation (b) Brix of Tibarau Sugarcane Fermentation

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Figure 4. Basic Materials Processed of Cane Tibarau for Fermentation Process

For example, the basic material distilled from the fermentation of molasses/cane juice tibarau with a brix level of 30 % was obtained alcohol content of the ethanol through alcoholmeters test equipment by 40% as in Figure 5. The operation of the distillation system design results is to work with a relatively good speed which is the production levels of 0.3 liters per hour for a tankage capacity of approximately 5 liters of distillation of fermented sugarcane tibarau with a brix level of 30 %.

Figure 5. Level Alcohol Distillation Results of Tibarau Brix

The Sugarcane bioethanol distillation Tibarau results will be processed further, to obtain the levels of ethanol/alcohol representative used as transport fuel mix. With the improvement of pretreatment / hydrolysis process and the provision of lime shells in order to be able to eliminate the water content is still stored in ethanol and also as effort to improve quality (pure ethanol is obtained and an increase in heat energy).

4. CONCLUSIONS

This paper concludes the research results with some consideration for the interests of engineering and distillate fuel bioethanol, is as follows:

a. Sugarcane Tibarau (Saccarum spontaneus L.) has potential as an energy plant that can be processed and conversion into fuel bioethanol
b. One model for the needs of bioethanol is a simple distillation with reflux column unit, in addition to the traditional model (feedstock system), namely the improvement of the system portion condenser with heat exchanger concept (counter flow system and a combination of counter and circular flow system).
c. To design Reflux distillation column models should be analysis of the calculation, the amount of ethanol vapor mass and volume, the amount of circulating water needs heat energy balance, as well as setting some assumptions and corresponding material choices.
d. The simplicity of the system and process as well as the affordability levels in terms of knowledge and financing for the implementation of bioethanol distillation system unit on a smaller scale have to be the main rationale for the future.
e. Tibarau cane plant is a kind of energy that has been forgotten, saw its potential needs to be lifted to the surface into cultivated plants / industry so that economic value for society

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ISBN 978-602-19877-3-5

ANALYSIS OF BEHAVIOR DEFLECTION COMPOSITE PARTICLE BOARD CANE BAGGASE USING ADHESIVES TAPIOCA

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ABSTRACT

Engineering materials such as composites are a blend of a variety of materials that can be made into a product. Particle board as composite an engineering material made from bagasse raw material after the extraction process. Innovation utilization of waste bagasse potentially be used as a composite particle board for furniture interior and furniture . Improved quality internal bonding particleboard made by looking at the effect of the adhesive. Deflection behavior which affects the ability to bending loads owned composite particle board that has broken resistance which can be measured as modulus broken. Ability broken modulus composite particle board as a quality parameter in its application as a furniture material. This method of manufacture of composite particle boards made by the process of emphasis and heated at 120 ^{0}C temperature. Models manufactured composite board with a variety of particle volume fraction ratio of bagasse 80%, 70%, and 60%. Binders used are starch adhesive. Bagasse as a filler particle board made of composite granules (mesh) measuring an average of 1.2 mm. Manufacture of composite board made with the same printing pressure that is equal to 100 kgf / cm2. The test method modulus of composite particle boards broken according to JIS A 5908 (2003) and SNI03-2015-2006. From these results obtained composite model of particle board on a mixture ratio of 60%: 40% have a fracture modulus (MoR) of 3.67 kg/cm^2. Whereas another mixture ratio has a value lower than the mixture ratio of 60%: 40%. The use of tapioca starch adhesives can be applied as an adhesive in the manufacture of composite particle board with a range of lower production values. From this condition can be stated that the ability of the composite particle board had a good deflection behavior as parameter endurance and strength. So the quality of the composite particle board bagasse can be applied as a furniture interior.

Index Terms : *perticle composite board, bagasse, deflection, furniture*

1. INTRODUCTION

The development of engineered material led to its use is increasing. Engineered materials called composites is the combination of various materials that can be made into a product. Among the types of composite products are composite particle board (particle board) berlignoselulosa of materials derived from plants and gummed then pressed so has the nature of wood (Maloney 1997) . The application of composites technology is widely used as an application in the manufacturing process as new material . According to SNI (2006), the composite particle board is the result of a mixture of hot compression wood particles or other berlignoselulosa material with an organic adhesive and other materials

Natural fiber which has the advantage, among others: non-abrasive, low density, cheaper, environmentally friendly and non-toxic, and received widespread attention to continue to be developed. The concept of returning to nature began promulgated to address the environmental damage that is increasingly out of control. One way around that is to use it for something useful. For example, the use of such natural fibers as a reinforcing material composites. Ketermanfaatan bagasse was conducted resulting in the development of process technology diversification agricultural waste into engineering materials composite particle board. Through technological improvements in the manufacturing process of composite board products using a clamp (compacting), optimization of the composition of the content of the heavy fraction of bagasse chopped into particles is an effort to improve the quality of the resulting repairs. Before the particle-based composite boards waste bagasse produced sustainable Further research is needed to stage a more specific form of the quality characteristics of composite particle boards according to the standard JIS A 5908 (2003) and SNI03-2015-2006 as furniture material development model. One of the quality parameters of composite particle boards produced by the standards of a value of deflection or fracture modulus (MoR). Of course this is related to the use of adhesives in the manufacturing process. Under the conditions of this study will prove the behavior of deflection or fracture modulus (MoR) composite particle board using adhesive tapioca.

2. RESEARCH METHODS

In this research, experimental study on the characteristics of composite boards such as the quality of the resulting composite board quality . Comparison of the volume fraction is used as a variation of the manufacture of composite particle boards wherein bagasse powder ranging from 80 %, 70 % and 60 % . The main ingredient in the form of particle board composite fibers of bagasse first chopped up into granular particles (powder) as required ie mesh size of

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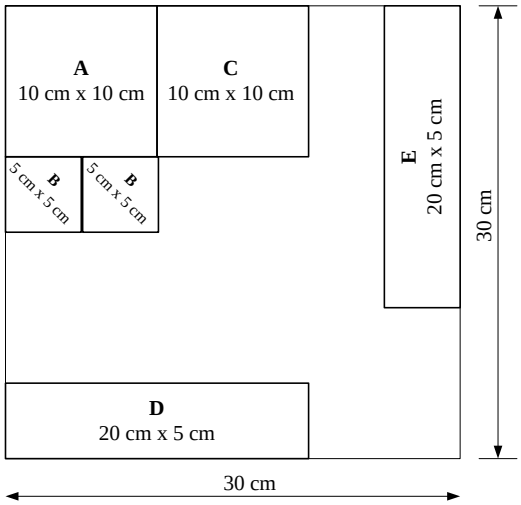
1.2 mm. Board composite particles produced according the method of manufacture and optimization of mix variations subsequent test performance. Manufacture of composite particle boards made using pressure (compression) of 100 kgf/cm^2 . It is expected to be produced quality composite board approaches the quality standard JIS A 5908 (2003), about modulus of rupture (MoR). Figure 1 shows the schematic capture and board cutting test material composite particle according to SNI 03-2015-2006



Gambar 1. Skema pemotongan bahan uji

Caption:

A : Testing of adhesiveness
B : Internal Testing Bonding
C : Testing the water absorption after 24 hours immersed
D : Testing the modulus of elasticity (MoE)
E : Pengujia fracture modulus (MoR)

The manufacture of composite particle boards using starch as an adhesive variation. Comparison of heavy fractions into determining the needs of raw materials and adhesive powder bagasse tapioca. Particle composite board developed in this study in the production of various types so that in the manufacturing process treated (treatment) by setting the ratio of the main raw material, namely bagasse and tapioca with a strong adhesive printing the same pressure. Manufacture of composite particle boards made with the same printing pressure that is equal to 100 kgf/cm^2. In this case there are three (3) alternative treatment carried out for the manufacture of composite board based on the composition ratio of bagasse with adhesive powder, the Type IA (80: 20), IIA (70: 30) and Type IIIA (60: 40). Prototype manufacture various types of composite board using bagasse with granules (mesh) of 1.2 mm further treated by heating at a temperature of 120 ^{0}C in holding time for 1 hour. Furthermore, the composite particles produced board is dried in the sun ± 7 days, and then the weighing is done in order to obtain the dry mass of the particle composite board. Thus there will be obtained a composite model of particle board as materials for furniture (furniture) and made possible as a replacement furniture and other wood raw material. Figure 2 shows the type of production of composite particle boards.

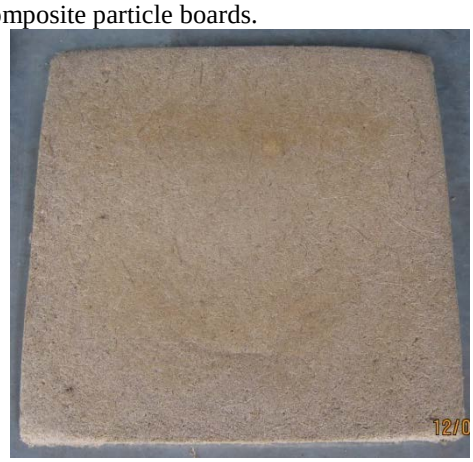


Figure 2. The resulting composite board

Testing deflection in getting a fracture modulus (MoR) conducted on the specimen dimensions 20 cm x 5 cm in thickness according thick particle board composite is formed. Test specimen glued between two steel beams and the central part loaded to break up . Bending or fracture modulus (MoR) board of composite particles can be calculated by the following formula :

$$MoR = \frac{3 . P . L}{2 . b . h^2}$$

dengan:

MoR = Modulus of Rupture (kg/cm^2)
P = maximum load (kg)
L = distance (cm)
b = width (cm)
h = thickness (cm)

3. RESULTS AND DISCUSSION

In this study, prepared raw materials as much as possible for the creation and printing of composite particle boards . Raw material requirement calculations performed by predicting the number of variations of the mixture between the adhesive powder bagasse and tapioca . This condition is intended to obtain the optimum variation that is produced as a prototype model that can later be developed as substitutes furniture . From the manufacture and printing of composite particle boards obtained some physical prototype as product development . Results manufacture and treatment of composite particle boards , bending strength or modulus obtained fracture (MoR) as shown in the graph Figure 3.

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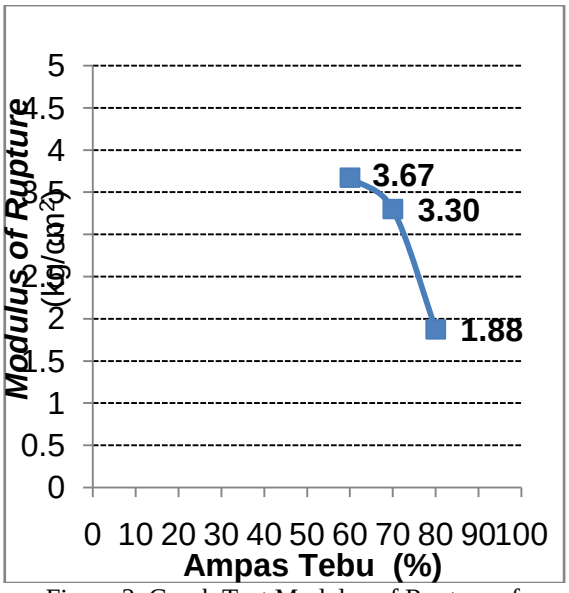

Figure 3. Graph Test Modulus of Rupture of composite particle boards

From the results shown in Figure 3 shows that the prototype board composite particles produced have a characteristic flexural strength or fracture modulus (MoR) high of 3.67 kg / cm2 on the composition of 60% bagasse and 40%. This shows that the use of tapioca adhesives can produce a composite board that has the ability to overcome the fracture adhesion. The greater the percentage of adhesive tapioca is used then the ability fracture modulus (MoR) composite particle board would have been better. This shows that the flexural behavior shown by a broken modulus parameter (MoR) The resulting composite particle board can be recommended as an adhesive in the manufacture of composite particle boards. Based on the use of different types of adhesives in the manufacture of composite board adhesive particles included in the category berkerekatan tapioca low (low density particleboard). This condition indicates an influence on the use of composite particle boards is that for the interior alone.

4. CONCLUSION

From this research can be summarized as follows :

a This study successfully using waste bagasse as raw material for the manufacture of materials that can be developed in the form of composite particle boards . Technical progress and development of this product are varied have discovered a physical prototype board composite particles that can be recommended to users as an alternative material furniture (furniture) interior .

b Prototype board composite particles produced have deflection behavior with broken modulus parameter (MoR) high of 3.67 kg / cm2 on the composition of 60 : 40 with adhesive tapioca . Manufacture of composite board made with the same printing pressure that is equal to 100 kgf / cm2 . From these results it can be stated that the effect of the use of adhesives in the manufacture of composite particle board can affect the quality of board broken modulus composite particles produced . It showed against its use is confined to the interior furniture .

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ISBN 978-602-19877-3-5

INTEGRATED FARMING, CREATING ZERO WASTE ENVIRONMENT

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ABSTRACT

Integrated Farming System is the combination of all components of agriculture, which includes agriculture, livestock and fishery in an integrated farming system. The concept of integrated farming system will produce F4, which consists of the Food, Feed, Fuel and Fertilizer. Applying zero waste system means the waste from the farm is used as fertilizer to enrich the soil plantations, while plantation crops is used as animal feed ingredients. Specifically, some of animal manures are processed into compost and some into biogas which can be used every day as gas stove fuel.

Index Term: integrated farming system, zero waste, environment

1. INTRODUCTION

1.1 The Background of the Problem

Land is a natural resource that has a variety of functions, such as medium to grow plants for supplying food, water, recreation, housing and other buildings. The functions for supplying food and housing are always contrast, which means that the farther the area used for residential or non-agricultural needs the lower the land area used for agriculture. The tendency of conversing (land use) of agricultural land into non-agricultural land increases from year to year. It clearly will threaten the sustainability of agricultural development in the future, especially in the supplying food and labor which will ultimately have an impact on the agricultural sector's contribution to the production of the Gross Domestic Product (GDP) will decline.

That conversion process must be controlled to avoid food, economic and social crisis which will ultimately lead to political instability and regional as well as national security. One of the alternatives that can be developed for this purpose is the development of Integrated Farming Systems (IFS). The Integrated Farming Systems (IFS), which is directed to rural areas (rural) and peri-urban (rurban) is expected to increase farmers' sustainable independence (economic and social as well as environmental sustainable increase). The success of IFS is expected to be able to control land conversion. The development of IFS models must be adapted to local resources in order to get effective and efficient result. [1]

Integrated Farming System is the combination of all components of agriculture, which includes agriculture, livestock and fishery in an integrated farming system. This system emphasizes on a friendly environment based economy and an optimization of all energy sources produced. The advantages of integrated farming systems are; energy efficiency, increasing the effectiveness of land, fund continuity and friendly environment.

The concept of integrated farming system applied will produce F4, which consists of the Food, Feed, Fuel and Fertilizer. The Food is a food source for humans that can be produced from agriculture, livestock and fisheries. The Feeds includes animal feed and fish feed which resulted from agriculture waste. The Fuel is a source of energy that can be produced from agriculture and livestock, such as biogas and coal from the chaff. The Fertilizer is a fertilizer for agriculture which is resulted from agriculture itself and from the livestock. [.2]

The Integrated farming integrates plantation, fishery and livestock. Applying zero waste system means the waste from the farm is used as fertilizer to enrich the soil plantations, while plantation crops is used as animal feed ingredients. Some of animal manures are processed into compost and some processed into biogas that can be used every day as gas stove fuel.

Rapidly, the Integrated Farming Systems have changed the conventional ways of farming, aquaculture, horticulture, agro-industry and all agriculture activities in several countries, especially in tropical and wet sub-tropical area (not-arid). Agriculture in the world will not have good result without the high input and usually it does not compromise with economic viability and ecology sustainability. This situation gets the IFS to become worse; everything must be paid with imported materials and energy in which some of pollutant materials are potentially used. [3]

The Integrated Farming can overcome all of these obstacles, not only from the economic and ecological problems, but also providing the necessary inputs such as fuel, fertilizer and food, in addition to productivity increase. It can transform risky farming systems (especially in poor countries) towards the economical agriculture systems and balanced ecological conditions.

The combinations of livestock and agricultural activity have helped many farmers around the world in the past through the use of animal manure as fertilizer for crops, and crops residues as animals' feed. Generally, most of the fertilizers lose half of its nitrogen content before it becomes nitrate for plants. Its amount is not enough if the plant population

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increases, so that chemical fertilizers and artificial food should be used and the farmers' small profit will become worse.

2. INTEGRATED FARMING

Integrated Farming is a management system (business), which combines agricultural components, such as plants, animals and fish in a unified whole. Another definition states that IFS is a system management of crops, livestock and fish with the environment to produce optimal products that tend to be closed to the external input.[4] This system will lead to positive impact and will meet the criteria for sustainable agricultural development because of its organic and local resources based system. The purpose of that system application is to reduce the minimum input from the outside (input / low input) so that the negative effects as mentioned above, can be avoided and sustainable.[5]

Patterns of integration between crops and livestock or often called integrated farming, is to integrate the activities of animal husbandry and agriculture. This pattern is very supportive in the provision of manure on agricultural land, so that this pattern is often called a pattern of livestock without waste because the livestock waste is used as fertilizer, and agricultural waste is used for animal feed. The integration of livestock and crops is intended to obtain optimal results of operations, and in order to improve soil fertility conditions. Interaction between livestock and crops must be complementary, supportive and mutual benefit, so it can increase production efficiency and improve profitability results of their farm.

Sustainable agriculture is the utilization of renewable resources and non-renewable resources for the agricultural production process by minimizing negative impacts on the environment. The sustainability includes: the use of resources, the quality and quantity of production, as well as the environment. The process of sustainable agricultural production will be directed to the use of biological products that are environmentally friendly.[6]

One of simple examples of integrated agriculture is when corns are planted in certain area and the corns are harvested, the results of crops waste must be disposed by the farmers. However, that will be different if the area is in ruminants animal husbandry, the crops waste would become food for the ruminants animal. Mutual relationship will occur when animals' manure is used as fertilizers for plants grown there.

3. ZERO WASTE

Indonesia as an agricultural country has large tropical agricultural resources and livestock. These resources are used not only for food but also potentially as sources of energy by creating livestock's manure into biogas. Crops-livestock integration system means to integrate all the components of farming both horizontally and vertically, so no waste is wasted. This system is very environmentally friendly and able to broaden sources of income and reduce the risk of failure.

Manure is animals' waste that can be utilized as sources of soil organic matter. All animals' waste and feed can be processed in-situ, to produce biogas as an alternative energy. The residues of biogas production which are in forms of liquid form (Slury) and solid (sludge) is a source of organic fertilizer needed by plants, and as well as becoming a soil Amendment.

The utilization of agricultural waste becoming feed or compost until no liquid waste thrown, means preserving the complete cycle of nutrients from the soil - plants - animals - back to the ground. This environmental wisdom needs to be developed and promoted widely to be able to preserve natural resources.

To face the challenges of environmental pollution and limited resource, this zero waste system can be done. It means "omitting the production waste process by integrating production process management with the minimization, segregation and waste management".

In other words, the people should minimize the waste and if the waste is still generated, it should be processed to become safe and economically useful products. Related to the production process, there is a need to prevent pollution which covers the whole production process such as selections of pure raw materials, uses of efficient and effective process in the use of water energy, equipment preservation for the optimization of processes, and capable human resources in conserving the environment.

Omitting the waste can be done in two ways:

First, it needs to obtain an efficient and effective production process with the support of the supporting factors of production. Theoretically and practically abolish 100% of waste from production processes is impossible. Even if it's with the most optimum effectiveness, the waste will still be produced, but the amount is very small. This small waste is then must be managed properly so it doesn't pollute the environment.

Second, it needs to process the waste produced when there are limitations in achieving efficient-effective production process. By processing the actual waste, it will reduce the waste. The better perception is when the waste has been regarded as raw materials for producing certain goods which have economic value.

Zero waste agricultural model is an agricultural model that does not allow products becomes waste with no benefit. In general, agricultural produces high organic waste which is easily decomposed. Besides, agriculture produces large waste because most of the plants are not used as raw materials for the process. [7]

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4. WHY INTEGRATED FARMING IS IMPORTANT

Long-term effects on the development of agriculture and industry in the modern agricultural system produce a large negative impact on natural ecosystems. Contaminated by toxic chemicals due to the high intensity of the use of fertilizers, pesticides and herbicides have been known. Similarly, the durability (resistance) of pesticides increases due to the higher spraying and ground water and river pollution by nitrate compounds due to excessive use of fertilizers. Modern agriculture has also reduced the diversity of plant species drastically due to the application of the large scale monoculture system. Which was originally composed of natural ecosystems are very complex, turning into a very simple ecosystem structure due to reduced species of plants. This is contrary to the concept of sustainable agriculture, which in addition to the fulfillment of human needs are always increasing and changing, while maintaining or improving the quality of the environment and conserve natural resources.

Modern agricultural technology (conventional) which is basically a monoculture system has changed drastically the balanced natural ecosystems becoming the unbalanced system. Because there is no balance, it's automatically forced to maintain the target ecosystem in order to progress. Finally, the intervention is done by providing a variety of chemical compounds in forms of bactericide, fungicide, algisida, herbicides, acaricides, pesticides, nematicides or other chemical fertilizers such as urea, NPK, KCL, TSP and so on. Without this intervention, monoculture farming system can not work and produce crops as expected. This creates a dilemma because the chemicals which are applied to nature often accumulates in soil, groundwater and parts of plants or animals and ultimately has an impact on humans.[8]

An accumulation of chemical compounds does not only occur in nature (land and water) but also on the living creature itself both animals and plants. For instance Johnstone et al. reported that the accumulation of organochlorine compounds and polychlorobiphenyl (PCB) is very evident in the birds 'Peregrines' and their preys' body tissues.[9] That accumulation of pesticide compounds evidently interfere the reproductive system of animals.[10] Even, the amount of species decreases drastically due to the pollution of sida compound. There is also an accumulation of chemical compounds on animals consumed by human such as Cd accumulation derived from nonorganic phosphate fertilizer in the liver and kidneys.[11]

In addition, an accumulation of chemicals in agricultural products, especially vegetables and fruits are the main issues for consumers who concerned about health. In an investigation conducted in Italy, it was found that there were some fruits at least 25 samples which were contaminated with thiabendazole (TBZ) and 27 contaminated with carbendazim (CBM) of 83 samples.[12] The same thing happened in Belgium where only 31.3% of vegetables were free of pesticide contamination, while 49.1% was contaminated with less hazardous substances residues and 19.6% with harmful residues. In China, at least 5 types of 4 organophosphate substances found in various food products by Chen and Gao.[13] This phenomenon has changed the views of many people in consuming products that use pesticides or chemical fertilizers. The demands of consumers, especially in developed countries toward hotilkultura products that are free chemical pesticides are increasing rapidly. Unfortunately, the intensive study of chemical residues in agricultural products has not been done yet. The fact of rejection of export commodities i.e. vegetables including mushrooms from our country is often given by the importing countries due to chemical contamination problems .[3]

4. 1 Integration with livestock

Large or small livestock that produces milk, eggs or meat requires the provision of a balanced diet every day. That livestock does not only need something valuable such as a comfortable and clean place but they also should have a good balance rations to produce qualified food products. Livestock also produces manure / waste every day, which is a valuable renewable resource that will support the sustainability of agricultural activity in that place, even if it's without external inputs such as fossil fuels, chemical fertilizers and artificial food. In some part of the world, it has been believed that they can increase the yield and quality but with even greater cost. However, most of farmers from middle and lower strata can not work at it, while the integrated agricultural farmers become rich with their agricultural products.

4.2 Integration with Embankment (Fish Pond)

Fish produces their own waste which will naturally give function in the second nutrient cycling, which is then used by the plants growing in the pond. This kind of high productivity is not found in other agricultural systems. Some organic material residue from the cattle manure will be oxidized in the pond; with adverse effects on larger fish populations. Moreover, the nutrients are readily available to produce lush growth of a variety of different plankton as a food source for 5-6 species of fish. There is no need for artificial food, except for the grass that grows there as food for herbivorous fish. For more details, it can be seen in the following figure:

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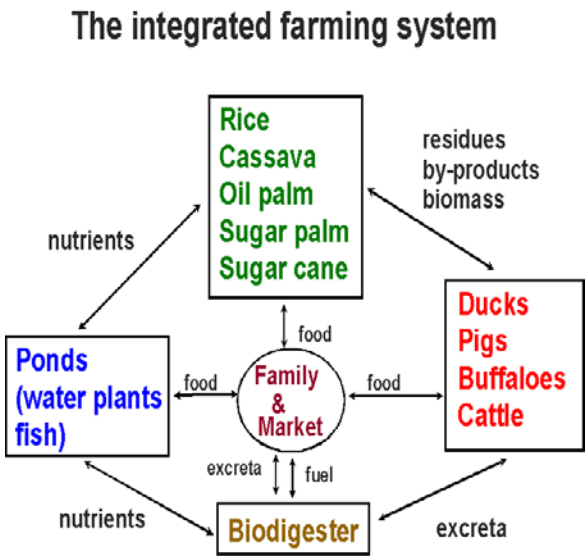

With an integrated farming, the environmental problems as a result of the chemicals can be solved as a solution to create an environment that has zero waste and produces organic food products that utilize either waste from farms, plantations, fisheries that are integrated with each other. In addition it will be able to improve the welfare of farmers due to the increase in income from various products.

5. CONCLUSION

Through the integrated farming which is the integration among fisheries, plantation, livestock and agriculture, a mutual cycle can be created. The waste resulted can be processed into energy sources for others and the production, economy, health can be improved so that our environment is free from waste.

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ISBN 978-602-19877-3-5

GEOGRAPHIC INFORMATION SYSTEM WEB-BASED ON CREATIVE INDUSTRY IN WEST SUMATERA

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ABSTRACT

Creative economic sector have a major impact on earnings, employment, value of exports, the welfare and sustainable development. Acceleration of the growth of information and communication technology to promote the creative industry is a major problem in the creative industry development plan. The aim of this research is to design a geographic information system (GIS) web-based about the attributes of creative industries in West Sumatera. Linear Sequential Model / Waterfall Model is used in system development. This model consists of the stages of requirements definition, system and software design, implementation and unit testing, integration and system testing, operation and maintenance.

Index Terms— *GIS, creative industries, Waterfall Model*

1. INTRODUCTION

Creative economic sector have a major impact on earnings, employment, value of exports, the welfare and sustainable development. Significant growth from the creative industries sector , an incentive for the Government to provide support. This sector achievement in 2013 ., growth reached 5.76 % and the Creative Economy GDP value reached Rp 642 trillion.

Creative industry is an industry that is based on the arts that are believed to attract the attention of creative people in the economy and a knowledge-based business , then through synergy with entrepreneurial potential can create new ideas and new things [7]

Sub sectors of creative economic that contributed the largest is the culinary and fashion with each value of Rp 209 trillion, or 32.5 % and Rp 182 trillion, or 28.3 % . Various sub sectors in the creative industries has the potential to be developed , because the Indonesian people have a creative human resources and rich cultural heritage

Acceleration of the growth of information and communication technology to promote the creative industry is a major problem in the creative industry development plan. The aim of this research is to design a geographic information system (GIS) web-based about the attributes of creative industries in West Sumatera.

Linear Sequential Model / Waterfall Model is used in system development. This model consists of the stages of requirements definition, system and software design, implementation and unit testing, integration and system testing, operation and maintenance

2. METHOD AND DESIGN

2.1. Waterfall

Linear Sequential Model / Waterfall Model is a model that is widely used in Software Engineering (SE) . This model is a systematic approach and sequence ranging from the level of the system needs , to the stage of the analysis , design , coding , testing / verification , and maintenance .
The term of waterfall shows step by step through which have to wait for the completion of the previous stage and run sequentially .

For example the design stage have to wait the completion of the previous phase, the stage requirements . In general stages in the waterfall model can be seen in the following figure :

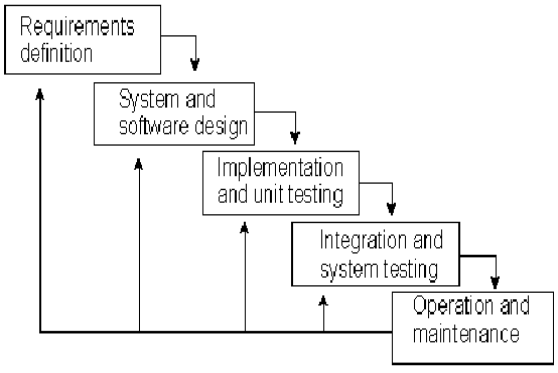

Figure 1. Waterfall Model

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2.2 Navigation Structure

Navigation structure is the structure of the storyline of a program . There are four kinds of navigational structures commonly used [2]

2.2.1 Linear

Linear is a structure that has only one series of sequential story . This structure displays one after the display screen sequentially according to the order . On this structure is not allowed any branching .

Figure 2. Linear Navigation Structure

2.2.2 Non Linear

Non Linear is the development of a linear structure , allowed to create branching . Branching made in this non-linear structure has the same position , no Master Page and Slave Page .

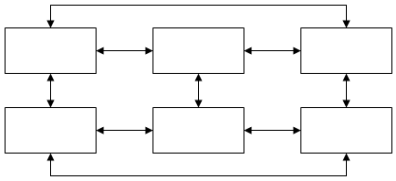

Figure 3. Non Linear Navigation Structure

2.2.3 Hierarchy

Hierarchy is a structure that relies branching to display data based on specific criteria . Views on the first menu will be called the Master Page (main page). The main page has a page branching said Slave Page (supporter page) .

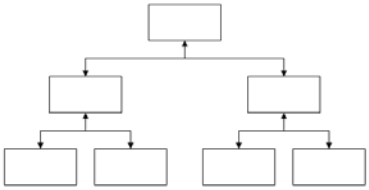

Figure 4. Hierarchy Navigation Structure

2.2.4 Composite

Composite is a combination of the three previous structure linear , non- linear , and the Hierarchy . This structure is also commonly called the free structure . This structure is widely used in creating applications because these structures can provide a higher interactivity .

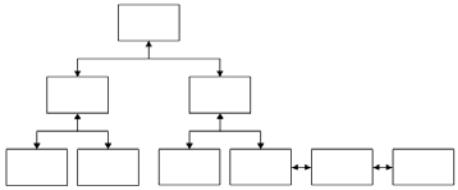

Figure 5. Composite Navigation Structure

2.3 Database

The database is used to store information or data that is integrated in the computer To manage the database required Database Management System DBMS) , a software system that allows the user to create , maintain , control , and access the database in a practical and efficient [1]

Database function is user will be easier to control and manipulate the data. One type of DBMS that supports the existence of a relationship between tables is Relationship Database Management System (RDBMS)

Database design is intended to store the data required in creating geographic information system website-based on cerative industry in West Sumatera. Designing a database associated with the user admin and the main data.

The design of the web page as a whole is reflected in the navigation structure and the details of each page imaged to complete the design .

3. WEBSITE SYSTEM

3.1 Geographic Information System

Geographic Information Systems (GIS) are a powerful set of computer-based tools used to collect, store, manipulate, analyze and display spatially referenced information. Another definition of GIS:“An information technology which stores, analyses, and displays both spatial and non-spatial data” [6]. They transform data into knowledge and present this knowledge in various formats for the purpose of supporting decisions [4].

In designing a Geographic Information System (GIS), ,the first stages is to analyze the needs of the system ,

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by analyzing the data that will be needed to help the process of creating geographic information systems and mapping the spread of enterprises in the field of culinary, fashion and creative industries in West Sumatera.

Data necessary to assist the process design the WEB GIS, contains the number of entrepreneur in the field of culinary, fashion and creative industries in West Sumatera, included a description and the location of the Entrepreneurs involved .

3.2 Designing

Analysis and design of the web -based software used Object Oriented Method UML (Unified Modeling Language) approach . To describe the typical interactions between the user of the system with its own system through a story used Use Case Diagram.

Use Case Creative Industry consists of two (2) users that is:

1. Admin as a user can Log in and manage Sentra Profile, Sentra Photo, SentraVideo and Sentra Location.

2. Visitor as a user that access Creative Industry Web, can get the Information about Creative Industry and give suggestion.

Figure 6. Use Case Diagram of Creative Industry Web

The next step is to describe procedural logic and workflow of Creative Industry Web that is contained in Activity Diagram.

3.3 Activity Diagram

Activity Diagram in the Creative Industry Web consists of two (2) Diagram, that is:

1. *Administrator Activity Diagram*

An Admin can access Admin pages and Log in, then enter to Creative Industry Web to process data and then entered into the database for data validation. If the data is not valid, repeat to login. A valid login will display the Admin page and Admin will choose the menu in Admin of the Creative Industry Web.

Admin will update data such as Adding, Editing, Deleting data in Creative Industry Web pages. If Admin can not update data, it will be back to menu Admin pages on Creative Industry Web. If it is Yes, Creative Industry Web will send the request and database will process the request and save the request result in database that next the result will be shown on Creative Industry Web.

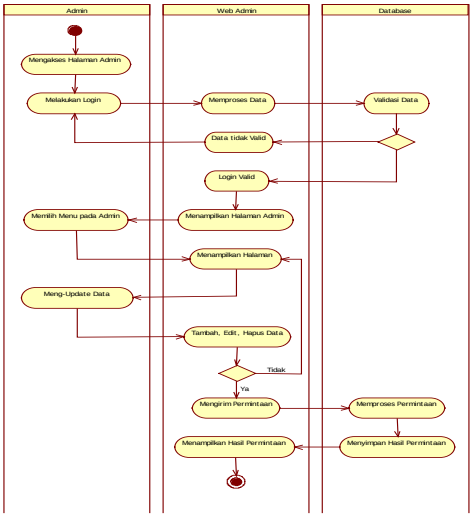

Figure 7. Administrator Activity Diagram

2. *Visitor Activity Diagram*

Visitor will access Web with entering main pages on Creative Industry Web then choose the menu on Creative Industry Web. Creative Industry Web will take data and data base will process it then Web shows Web pages.

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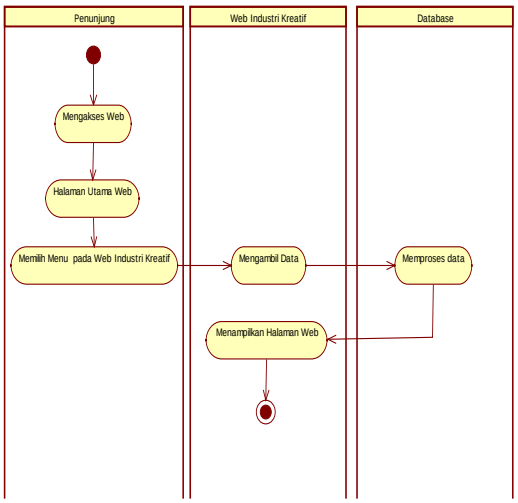

Figure 8. VisitorActivity Diagram

Next is to create Class, Features and Relationships of database that is used by Creative Industry Web.

3.4 Database Structure File

Create Class , features and relationships of database that is used by Creative Industry site can be seen in the following image

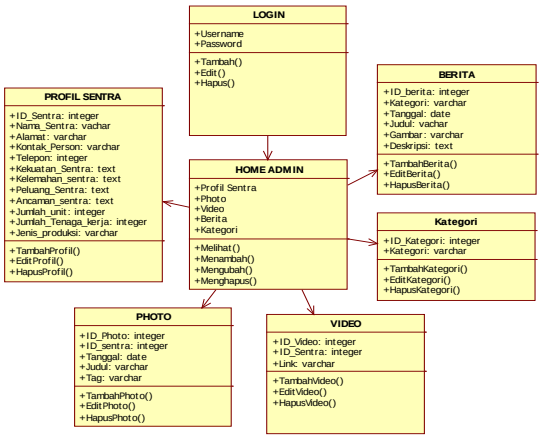

Figure 9. Class Diagram Database

The identity of entrepreneur is maintained in entrepreneur database file. The primary key is stated with ID_Pengusaha which length is eight digits. The first two digits indicate of cities that are Padang (01), Medan (02) and Palembang (03).

The next two digits indicate of creative industry categories that are Kuliner (01), Kerajinan (02) and Fashion (03). The next two digits indicate of business category of creative industries are stated with 01, 02, etc.

For examples Nasi Kapau (01), Sate (02) for Kuliner Mukena for Kerajinan, and Baju Bordir for Fashion. The last two digits indicate the numbers of entrepreneur.

For example: 01 01 01 01. The identity describe about the first entrepreneur that is located in Padang who have Nasi Kapau business as Kuliner category.
Database structure file of Pengusaha is presented in figure

Table 1. Entrepreneur Database Structure File

No	Nama Field	Tipe Data	Field Size	Keterangan
1	ID_Pengusaha	Integer	8	Primary key
2	Kota	Varchar	30	
3	Nama Sentra	Varchar	30	
4	Jenis Sentra	Varchar	30	
5	Jenis Produksi	Varchar	30	
6	Alamat	Varchar	30	
7	Kontak Person	Varchar	20	
8	Telepon	Integer	15	

Database file that consist about news of entrepreneur is Berita. The length of primary key is eleven. Description of the primary key similar with Pengusaha database. The first digit is B that describe about news.

For example : B 01 01 01 01 01. The identity describes the first news of first entrepreneur that is located in Padang who have Nasi Kapau business as Kuliner category.

The database structure file of Berita is presented in Table 2.

Table 2 . Database Structure File Of News

No	Nama Field	Tipe Data	Field Size	Keterangan
1	ID_Berita	Integer	11	Primary key
2	Kategori	Varchar	15	
3	Tanggal	Date	10	
4	Gambar	Varchar	20	
5	Deskripsi	Text	400	

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Database file that consist about photos of entrepreneur activities is Photo. The length of primary key is eleven. Description of the primary key similar with News database. The first digit is F that describe about photo.

For example : F 01 01 01 01 01. The identity describes the first photo of first entrepreneur that is located in Padang who have Nasi Kapau business as Kuliner category.

The database structure file of Photo is presented in Table 3.

Table 3. Database structure file of Photo

No	Nama Field	Tipe Data	Field Size	Keterangan
1	ID_Photo	Integer	11	Primary key
2	Tanggal	Date	10	
3	Judul	Varchar	20	
4	Tag	Varchar	20	

Database file that consist about videos of entrepreneur activities is Video. The length of primary key is eleven. Description of the primary key similar with News database. The first digit is V that describe about video.

For example : V 01 01 01 01 01. The identity describes the first video of first entrepreneur that is located in Padang who have Nasi Kapau business as Kuliner category.

The database structure file of Video is presented in Table 4.

Table 4. Database Structure File of Video

No	Nama Field	Tipe Data	Field Size	Keterangan
1	ID_Video	Integer	10	Primary key
2	Tanggal	Date	10	
3	Link	Varchar	50	

3.5 Navigation Structure of Creative Industry

The flow of the program application is described by navigation structure. In this application, composite navigation structure is mixture structure between non linear and hierarchical. Non linear structure is on the link of Home →Profil dan Produk→Kontak Kami→Admin, Kuliner →Kerajinan →Fashion. Hierarchical structure is on the link of Kuliner →Lokasi Sentra, and Galeri; Kerajinan →Lokasi Sentra, and Galeri; Fashion → Lokasi Sentra, and Galeri; Galeri →Video, and Photo.

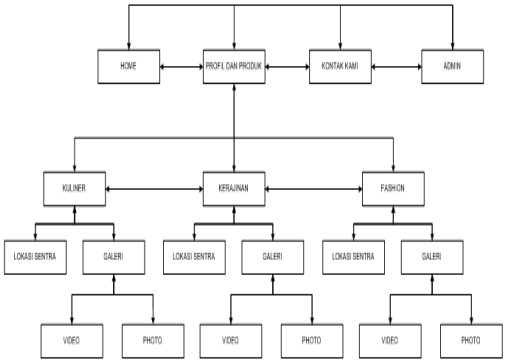

Figure 10. Navigation Structure of Creative Industry

3.6 Page Design

The Home page design is presented in Figure 11. Users can link to Profil dan Produk, and Kontak Kami from Home page. Administrator can link to Admin page in addition link to Profil dan Produk, and Kontak Kami.

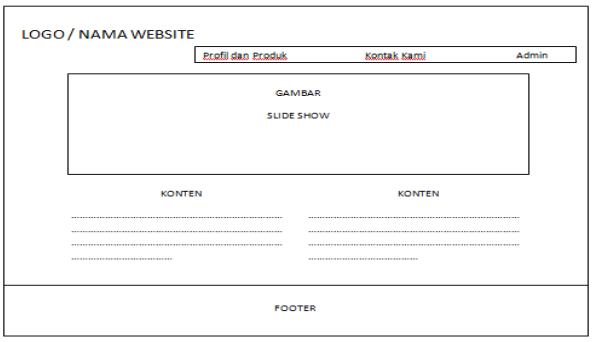

Figure 11. Home Page Design

In Profil dan Produk page users can link to Kuliner, Kerajinan and Fashion pages. The page design is presented in figure 12.

Figure 12 . Profil dan Produk Page Design

Users can link to Lokasi and Galeri (Photo and Video) pages from Kuliner, Kerajinan and Fashion pages. The Kuliner Page design is presented in figure 13. The Kerajinan and Fashion pages design similar with Kuiner design.

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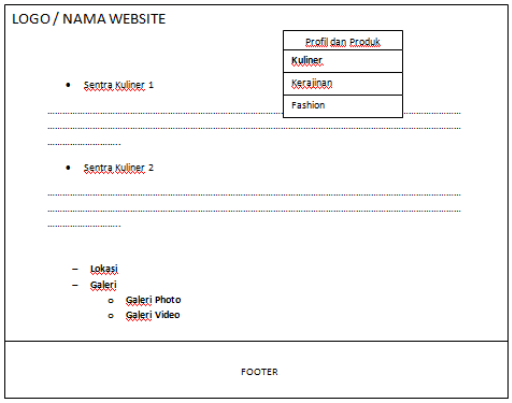

Figure 13 . Kuliner Page Design

In Lokasi page, users can find the map of every location of the entrepreneurs. From every location page users can link back to the master page of every page through the 'Kembali' button. The Lokasi page design is presented in figure.

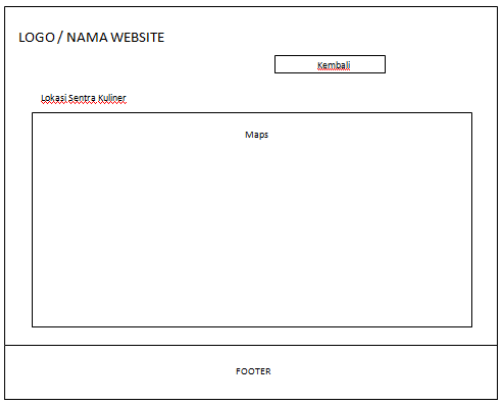

Figure 14 . Lokasi Page Design

Photos about entrepreneurs' products and activities are displayed in Photo page. Users can link to the master page of every page through the 'Kembali' button. The page design is presented in figure.

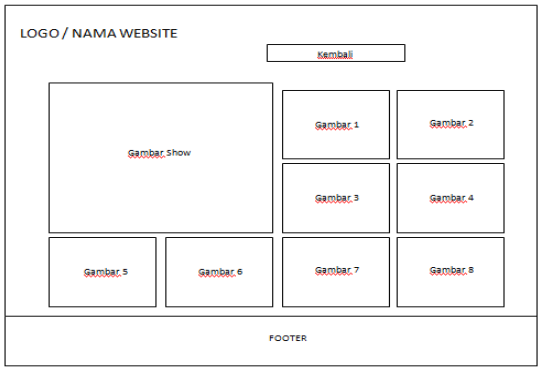

Figure 15 . Photo Page Design

In the Galeri (Video) page users can find the videos about entrepreneurs' activities and products. Users can link back to the previous page (master page) through 'Kembali' button. The page design is presented in figure 16.

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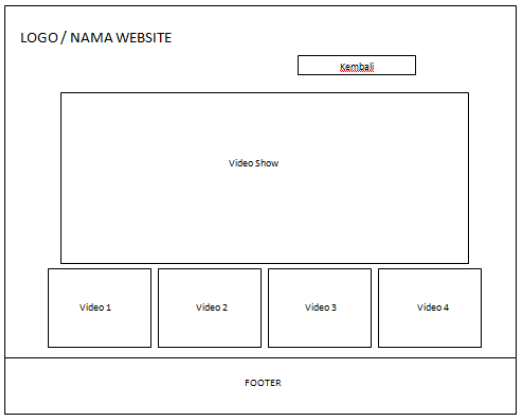

Figure 16. Video Page Design

Kontak page consist of contact (Kontak) info and picture (Gambar Kontak). In Kontak page users can link to Profil dan Produk and Home pages. The page design is presented in figure 17.

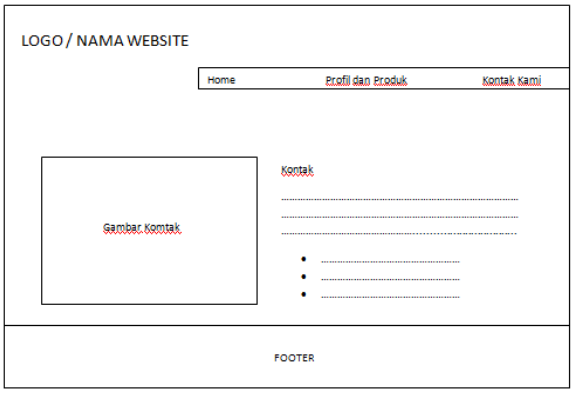

Figure 17 . Kontak Page Design

Admin page design is presented in figure 18. In this page administrator can link to maintain the Home, Profil, Galeri (Photo) and Galeri (Video) pages.

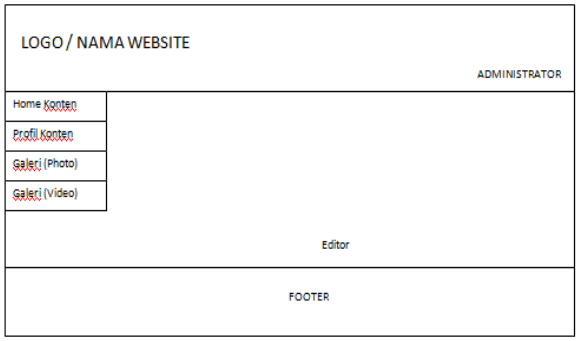

Figure 18 . Admin Page Design

ISBN 978-602-19877-3-5

4. CONCLUSION

Design a geographic information system (GIS) web-based about the attributes of creative industries in West Sumatera is very important to promote the creative industry, especially for creative industry development plan.

Ggeographic information system that referred to information technology which stores, analyses, and displays both spatial and non-spatial data is needed to help the process of mapping the spread of enterprises in the field of culinary, fashion and creative industries in West Sumatera.

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ISBN 978-602-19877-3-5

DEVELOPMENT OF MATHEMATICS INSTRUCTIONAL MODEL -BASED ASSISTED CONTEXTUAL ICT IN HIGH SCHOOL

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ABSTRACT

This article aims to explain the procedure of the development of research-based math learning assisted contextual model of ICT in the subject matter Function Exponent and logarithm functions in class X Science High School. The method used is the research and development with the model development procedure Plomp (2013) which consists of the preliminary stage, prototyping stage; and the assessment stage. Learning approach used Contexstual Teaching and Learning (CTL) in accordance with the seven components Described by Johnson (2010), which consists of constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment. Learning with ICT using Maple software and E-mail. Described Also in this paper the research products in the form of books students use mathematical models based contextual learning with ICT-assisted learning models using elements characteristic of the preparation Joyce & Weil (2011). Additionally Described the effectiveness of the models seen from the aspect of affective, cognitive and psychomotor. In the affective aspect Analyzed motivation to learn mathematics, cognitive aspects in terms of mathematical metacognition ability in solving mathematical problems, and psychomotor aspects seen in mathematics learning activities.

Index Terms— Research Development, Learning Mathematics, Contextual, ICT

1. INTRODUCTION

The more advanced and rapidly developing science and technology have made the educational process of the students who want to learn able to apply theory to technology. The use of technology in education in addition to explain the theory also has strived to lead the students to understand the daily life contextually.

On the other hand the development also occurred at the curriculum in Indonesia. On 2013 learning curriculum whose purpose is to process all aspects of the competency of the students in the cognitive, affective, and psychomotor. That is why the Curriculum 2013 prefers to use ICT in learning as set forth in RI Permendikbud number 31 2014 Article 9, paragraph 3, which reads: "All educators must be able to facilitate ICT-based learning". This fact is emphasized that the development of learning has had to use ICT in addition to using a contextual approach.

The need for the development of mathematical models of ICT assisted learning is very closely related to the problem behind it. Here is described data indicates problems in mathematics education that can be seen at the level of primary and secondary education and higher education. First, the academic quality among nations through the Programme for International Students Assessment (PISA) in 2009. It shows from 72 countries for mathematics Indonesia took 68th place , and in 2012, Indonesia took 64th place (PISA 2012). Second, specialized in the field of mathematics in the city of Padang and West Sumatra province, the results of pre UN year 2011/2012 for the high school level, the percentage of student mastery of the subject matter of mathematics is still low. Based on the average percentage of student mastery of the material of mathematics at the level of cities, and provinces, it turns mastery of mathematics is still below fifty percent. Details of the data can be viewed from Table 1 below.

Table 1. Average Percentage of Material Mastery Math Problem Pre-UN 2011/2012

No	Science Program Package Number	The average of mathematic mastery percentage of Pre UN from Rayon 01 High School of Padang	Average Percentage of Pre-UN Math Mastery Math West Sumatra Province
1	12	32,56	31,39
2	25	34,42	33,57
3	39	37,31	35,56
4	46	32,31	30,47
5	54	35,49	34,31

Third, the problem of learning mathematics is also related to the fact that are common in schools in Indonesia. Learning has not been implemented in the context of learning in Contexstual elements Teaching and Learning (CTL) such as the ability to construct their own understanding of the material being studied

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mathematics, the ability to find (inquiry) answers given mathematical problem. Students also have not had a lot of initiative to ask (questioning), and have not led to the creation of a learning society and not maximal authentic assessment procedures.

Moreover, the problems of learning mathematics in Indonesia disclosed Fauzan (2002) that the problems of mathematics education in Indonesia is: (1) The approach in the learning of mathematics is very mechanistic and conventional; (2) The learning process is only focused on learning objectives and learning outcomes, while the process to arrive at the learning outcomes are ignored. Most of the learning objectives only focused on remembering facts, concepts and other aspects of computing; (3) The changes and the innovations in the learning of mathematics does not solve the problems mentioned above, due to the change and innovation is far from an implementation strategy.

Associated with the purpose of learning mathematics high school level, the results of initial studies conducted by the author in May 2013 to the students of class XI IPA working contextual questions in mathematics. After the student's answers are analyzed, it is known that from the 30 students who participated answering practice questions, only 7 students who meet the minimum completeness criteria (KKM = 80), while the 23 other students not yet complete. As for the difficulties faced by students is the lack of skills of metacognition students in the form of the thinking of students in interpreting the information they read into the language of mathematics, as well as integrate and seek appropriate solutions to problems are given, they seldom do such as contextual quastion above.

The preliminary study of author is in the form of interviews with the teachers of mathematics and high school students, they stated that the teacher in the classroom in general only provide few of contextual questions that can construct students' thinking in solving problems done. The ability of students to make problem solving did not show metacognition steps that should be owned by the students. In accordance Permendikbud No. 64 of 2013 on the Content Standards Primary and Secondary Education stated that the level of competence for class X and XI in SMA on core competencies (KI) three, the aspect of knowledge competencies that must be possessed is to understand, to implement, and to analyze factual knowledge, conceptual, procedures, and metacognition based on curiosity about science, technology with the concept of nationalism, according to their talents and interests to solve problems.

The ability of metacognition in problem solving by Schraw and Dennison (1994) can be divided into two metacognition, into two broad categories, namely: 1). Knowledge of cognition with declarative indicators, procedural and conditional, 2). The cognition arrangements as regard the activity of self-regulatory mechanisms for ongoing effort to learn or troubleshooting indicators: planning, information management strategies, comprehension monitoring, debugging strategies and evaluation.

From the preliminary study in the form of observations and interviews well known that teachers who teach mathematics also not used the medium of ICT such as program Maple as a teaching aid, as well as students never collect assignments via e-mail, when in fact the students generally already have a smartphone in their pockets, that can access e-mail that could help them in the learning process of mathematics in the classroom.

Based on an analysis of specialization in high school math textbooks used in class X, it turns learning materials not designed contextually yet and not using ICT interactive assistance, making it less attractive and not induce the motivation to learn mathematics. From the description mathematical problems of study can be argued that this study is trying to create an effective mathematical learning and optimize an interesting ICT-assisted learning contextual-based that can induce motivation of students with student book program.

From numbers of problems that can be the focus of research related to teaching mathematics contextually based assisted ICT can be identified that the effectiveness of mathematics instruction in the subject matter exponential function and a logarithmic function in terms of the cognitive aspects, especially the ability of metacognition in problem solving, affective aspects related with student motivation toward mathematics the exponential function and a logarithmic function, and psychomotor aspects of students' skills in learning activities exponential functions and logarithmic functions.

1.1 How to develop a mathematical model of learning based on effective ICT-assisted contextual?

The expected product of this development research is students' books on the subject matter of the exponential function and a logarithmic function based ICT-assisted contextual (BSKICT). Book products containing the subject matter of the exponential function and a logarithmic function, in class X, which includes aspects related to learning model mathematics that uses prinsp principles of contextual learning and the implementation of the model assisted learning of ICT in the form of software Maple, video recording of the results of group discussion learning, and sending task via e-mail.

The Characteristics of the model developed, there are five components that function as constituent elements, namely syntax, the social system, the principles of reaction, and the effects of instructional support system and escort system. Effectiveness of the product, determined from observations and the results of students' mathematics learning for cognitive, affective, psychomotor which will be determined from student learning activities, and interviews with practitioners.

ISBN 978-602-19877-3-5

2. THEORIES RELATED

2.1 Mathematics and Model

According to the original word, math means the knowledge gained by reasoning (Depdiknas: 2004). The nature of mathematics is a mental activity to understand the meaning and relationships as well as symbols, then applied in real situations (Uno, 2008). Furthermore, Joyce and Weil (2011) explains that the teaching models actually learning models when students are helped to obtain information, ideas, skills, values, ways of thinking, and the purpose of expressing themselves with the instructions of the long term so that students can improve their capabilities to be able to learn more easily and more effectively in the future will come. It occurs either because the knowledge and skills they gain or because of their mastery of the learning process better.

Furthermore, Joyce and Weil found learning model is a plan or pattern that can be used to shape the curriculum (long-term learning plan), designing learning materials, and guide learning in the classroom or the other. A teaching model is the description of a learning environment, which also includes a teacher's behavior when the model is applied.

To streamline the learning of mathematics we need a model that can be implemented by teachers and students. The model is a learning model that allows students easily learn math. Related to the learning model, there are characteristics that need to be considered, they are (1) has a scientific procedure to change the behavior of students; (2) refers to the ability of the students; (3) identify a learning environment in which changes in behavior occur; (4) there are criteria for success; (5) the specification in its implementation or clear mechanism. (source http://pusdiklat-teknis-depag.go.id). With the five characteristics above, allows teachers and students to use a model so that the learning objectives achieved well.

2.2 Contexstual Based Learning Mathematics Teaching and Learning (CTL)

Contexstual Teaching and Learning (CTL) is a system that stimulates the brain to compose patterns that embody meaning, and is a teaching system that matches the brain that produce meaning by linking academic content to the context of everyday life of students. CTL is a learning system that is based on the philosophy that students are able to absorb the lessons if they capture the meaning of the subject matter they receive, and they capture the meaning in school assignments if they can relate new information with knowledge and experience they already have before, this is according to Johnson (2010).

According to Johnson (2002) CTL allows students to connect learning with everyday life to find meaning. CTL also expand students' personal contexts in order to further provide a better experience to stimulate the brain to establish new relationships and gain a new meaning. So on contextual learning, the learning program is more of a plan designed classroom activities by teachers, which contains scenario step by step on what will be done together with the students in connection with the topics to be studied.

2.3 Assisted Learning Mathematics ICT (Information and Communication Technology)

Many education experts argue that ICT has a huge potential in helping the educational process. In education, the computer can act as an additional aide in learning, utilization include the presentation of the contents of the subject matter information, exercise or both. This is consistent with those described Sutrisno (2012) that ICT aims to facilitate the understanding of the subject matter in accordance with the actual problems and contextual. Arnawa (2012) states that the ICT-assisted learning mathematics will accelerate the learning process, helping and supporting the learning process.

Sutrisno (2012) explains that the students in the study should be equipped with ICT to motivate, inspire to all students in the learning process without discrimination. Hopson (in Sutrisno, 2012) states the role of ICT in learning as motivation in learning for high school students and ICT are integrated into lessons can improve higher-order thinking such as: critical thinking, logical, reflection, metacognition, and creative.

Darmansyah (2012) explains that ICT based learning is a learning utilizing information technology as the main medium messenger learning, critical success factors of learning, and ICT as a factor supporting the implementation of learning. Thus, it can be concluded from expert opinion above that assisted learning ICT can raise students' motivation, can help students to remember in problem solving, and assisted learning of ICT can save files learning, can process data at high speed, can also display diagrams and chart to students.

2.4 Metacognition and Problem Solving in Mathematics Learning

Flavell in (Weiner and Kluwe, 1987) states that metacognition is a second-order cognition that means thinking about thinking, knowledge of knowledge, or a reflection of the actions. Schraw and Dennison (1994) divides the two metacognition, into two broad categories, namely: 1). Knowledge of cognition with indicators Declarative, Procedural and Conditional, 2). Regulation of cognition, namely as regard the activity of self-regulatory mechanisms for ongoing effort to learn or troubleshooting indicators: planning, information management strategies, comprehension monitoring, debugging and evaluation strategies.

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2.5 Learning Motivation

Winkel (2007) stated that the motivation to learn is the overall driving force of psychic within the students that lead to learning activities and provide direction on the learning activities in order to achieve a goal. Motivation to learn plays an important role in delivering the passion or enthusiasm in learning, so that students have the energy much stronger motivation for learning activities.

Winkel (2007) also explains that the motivation to learn is the motor that enable students to engage in learning. Motivation theory is also supported by Uno (2008) which suggests some indicators in the motivation to learn are: (1) the desire and passion succeed; (2) lack of motivation and learning needs; (3) the hopes and ideals of the future; (4) the award in learning; (5) the activities are interesting in learning; (6) the existence of a conducive learning environment, enabling students can learn well.

3. RESEARCH METHODS

The method is research and development (R & D) with a draft design Plomp (2013). This research resulted in the development of products to test effectiveness. Plomp models have three stages of development, the preliminary research, prototyping and assessment phase, where this sequencing provides an opportunity to researchers more freedom to develop according to the needs of research.

Based on the research objectives that have been established, this study was designed with design Plomp (2013). Declared design research is a systematic review of designing, developing, and evaluating educational interventions (interventions such as programs, strategies, teaching materials, products, and systems) as a solution to solve complex problems in the practice of education, which also aims to advance our knowledge of the characteristics of the interventions as well as the design and development process.

According to Plomp (2010), there are three results that can be obtained from research design, namely: design principle or theory of intervention; intervention models, and professional development. To get the best quality of a model of development then Nieveen; 1993 in Plomp (2013) describes the effectiveness of the products designed consistent between expectations and actual usage. Expectations defined by the use of the product is expected to successfully meet the wishes of outcomes. Actual interpreted with the use of products successfully meet the wishes of outcomes.

The development of models Plomp (2013) there are three stages (phases), the phase of preliminary research is the analysis of the needs and context, literature, developing the conceptual framework and theoretical framework for the study, the phase prototyping phase is the process of designing a cyclic manner and sequence in the form of the research process more micro as well as the use of formative evaluation to improve and refine models of intervention and assessment phases are semi summative evaluation to conclude whether the intervention is in conformity with the desired and propose recommendations intervention model development.

4. PROCEDURES AND PLAN DEVELOPMENT RESULTS

4.1 Development Procedure

4.1.1 Preliminary Research

Preliminary research stage (preliminary study). In this case the characteristics of students analyzed with the readiness of contextual-based learning and see the facilities owned by the students, as well as the utilization of ICT tools such as smartphone, gadgets, notebook or laptop owned by the students. In addition, to prepare a conceptual framework that is used as a reference for future studies.

4.1.2 Prototyping Stage

This stage aims to produce a valid prototype. There are three stages in this prototype: prototype design, formative evaluation, and revision.
Forms and levels of formative evaluation techniques using Tesmer shown in Figure 1 below.

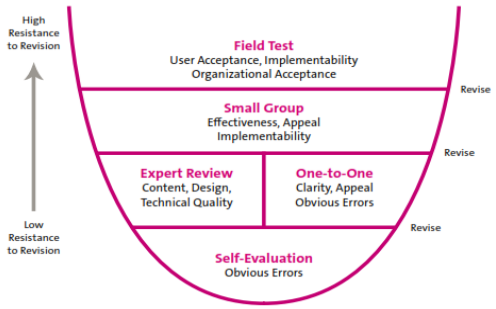

Figure 1. Phase Formative Evaluation by Tessmer (1993, in Plomp 2013)

Experts who became validator is an expert in mathematics education, education experts and development model of learning, language experts, and practitioners are in high school math teacher. For this formative evaluation activities using the instrument validation.

4.1.3 Assessment Stage

This stage is to conduct a more thorough examination of the prototype which has been revised. Assessment used is summative evaluation, the test of effectiveness. The type of data in this study is qualitative data and quantitative data from the learning stages of development of ICT-assisted contextual-based mathematics starting from stages of analysis, design, and evaluation. The necessary data

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in this study is the data from interviews, observation (qualitative data), and questionnaires, observation, evaluation of student learning outcomes (quantitative data).

4.2 Data for Viewing Effectiveness

Mathematics instructional design contextual based and ICT-assisted, as well as to see the students' metacognition ability in solving mathematical problems, which are given students based contextual learning mathematics with ICT-assisted compared to students who were not given contextual-based mathematics instruction assisted ICT.

The instrument used for this study was a questionnaire, validation sheet, guidelines for observation, interview, and sheet evaluation of learning outcomes. Data collection through questionnaire, sheets assessment of mathematics learning model based on ICT-assisted contextual designed as a sheet of observation, and interview and test student learning outcomes.

Data analysis of the effectiveness of the learning model mathematics contextual based assisted ICT, will be performed analyzes on: learning outcomes viability metacognition mathematical students, motivation and learning activities of students, student response to teaching mathematics contextually based assisted ICT, and analysis of the ability of teachers to manage teaching mathematics contextually based assisted ICT.

4.2.1 Analysis of Aspects of Metacognition Ability Of Mathematical Problem Solving Students.

The question tests made in the form of test description consists of two categories: the first is a matter of the subject matter of mathematics and the second question in the context of everyday life. Test data in the form of scores and pretest posttest results are used to determine the level of metacognition ability in solving mathematical problems students individually and classically according to type of metacognition ability in solving mathematical problems. Data processing techniques.
using the formula:

$$TKMS = \frac{SPS}{SMS} \text{ X } 100$$

TKMS: The level of ability of students' metacognition
SPS: Score of students
SMS: maximum score of students

Table 2. Criteria Score And Metacognition Ability Of Mathematical Problem Solving Students Against Effectiveness Model

Conversion Ability metacognition		Quality	Levels of Effectivess
Scala100	Scala 4		
81 -100	3.66 – 4.00	A	very effective
66 – 80	2.66 – 3.33	B	Effective
56 – 65	2.00 – 2.33	C	Less Effective
51 – 55	1.99 - 1.66	D	Ineffective
0 – 50	1.00 – 1.33	E	

4.2.2 Analysis of Motivation to See Student Activity

Motivation questionnaire data was obtained by counting the scores of students who answered each item on the questionnaire motivation. The questionnaire was made in the 1-4 Likert scale. Then the data is analyzed by a formula that scales the effectiveness of which has been modified according to the needs of the research, as follows:

$$Motivation\ \ Value = \frac{score\ of\ acquisition}{\max imum\ \ score} X 100\%$$

By criterion of motivation in learning activities of students on the effectiveness of the model such as the following table:

Table 3. Criteria for Effectiveness Against Student Motivation Model

Criteria	Motivation Value	Levels of Effectivess
81 – 100	Very high	very effective
71 - 80	high	Effective
51 – 70	moderate	quite effective
30 – 50	low	less effective
< 30	Very low	Ineffective

4.2.3 Response Analysis of Students Against Assisted Learning Math-Based Contextual ICT.

Activities undertaken to analyze the data in response to the students' learning of ICT-aided contextual-based model is to calculate the many students who gave a positive response in accordance with aspects asked about the model. Then the results obtained and the percentage calculated using the formula defined criteria as follows:

Table 4. Response Criteria Students Against Effectiveness Model

Criteria	Response Value	Level efectiveness
81 – 100	Very high	very effective
71 - 80	high	Effective
51 – 70	moderate	quite effective
30 – 50	low	less effective
< 30	Very low	Ineffective

If the analysis shows that the student has not been a positive response, then the revision of the device or provide guidance to teachers who try to model related to aspects of the value is less. This revision will be carried out several times until the effective criteria of the model is obtained.

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Criteria of effective models, if the students had a positive response to a model more than 50% and at least 75% of the questioned aspects of positive response.

4.2.4 Analysis Capabilities-Based Math Teacher Managing Contextual Assisted Learning ICT.

Analysis conducted on the assessment results of two observers who observe the teacher's ability to manage learning mathematics contextually based assisted ICT in the classroom. Results of each observer shall be calculated as the following formula:

Final score =

$$\frac{score\ of\ acquisition}{\max imum\ score\ item} \times many\ assessment\ scales$$

With defined criteria:

3.33 <the final score ≤ 4,00 = very high

2.33 <the final score ≤ 3,33 = high

1.33 <the final score ≤ 2.33 = moderate

≤ 1.33 = low

4.3 Expected Results

The conclusion to be drawn to the effectiveness of contextual learning model based on ICT-assisted minimally at the high category. If the observations have not reached the minimum height categories will be revised to provide advice and input. Further observations will be done again, and so on to meet the minimum criteria which have been set.

Of the development model of learning mathematics contextual based assisted ICT is expected that the students in the study have the motivation to learn mathematics is high, education outcomes are high mathematics, has the ability metacognition mathematical problem solving, and learning models and product student book produced is a model of learning mathematics effective.

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ISBN 978-602-19877-3-5

PHYSICS EDUCATION STUDENTS' CONCEPTIONS ON ACTIVE FORCES AND ACTION-REACTION PAIRS

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ABSTRACT

The purpose of this research was to investigate student-teachers' conceptions on active forces and action-reaction pairs. The instrument used was made up of 13 multiple choice questions with 5 options selected from the FCI (ver. 1995). It was administered to physics education department students of faculty of teacher training and education of a state university in Indonesia. The qualitative data were also collected through interviews and observations performed during the learning process. The research findings revealed percentages of seven common misconceptions on active forces based on taxonomy of misconceptions probe by FCI, i.e. 1) only active objects exert forces (17,81%), 2) the motion of an object representatives of active forces acting on the object (63,01%), 3) no motion means no force (50,68%), 4) velocity is proportional to applied force (40,41%), 5) acceleration of an object implies increasing force acting on the object (35,62%), 6) force causes acceleration to reach terminal velocity (15,53%), and 7) active force wears out (28,77%); and two misconceptions on action-reaction pairs, i.e. 1) greater mass exerts greater force (33,22%), and 2) most active object produces greater force (47,49%). The results of the research showed that the Indonesian physics education students held strong misconceptions on active forces and action-reaction pairs. The results of this research are similar with the findings of related studies in other countries.

Index Terms— Misconceptions, Active Forces, Action-Reaction Pairs

1. INTRODUCTION

The purposes of science education in Indonesia among them are to develop students' understanding of natural phenomena, concepts, and principles of science that are useful and can be applied in everyday life; and to increase their knowledge of concepts, and science skills as a basis for continuing education to the next level. This great goal has not been accompanied by satisfactory results yet. Indonesia has been struggling to face a variety of education issues, including the issue of the quality of science education.

Based on research reports of the Organisation for Economic Co-operation and Development (OECD) through its PISA program (Programme for International Student Assessment) for years 2000, 2003, 2006, 2009, and 2012 the science literacy of Indonesian senior high school students were at ranking 38 out of 41, 38 of the 40, the last of the 57, 57 of the 65, and 64 of the 65 countries respectively. Similarly, according to a report of TIMSS (Trends in International Mathematics and Science Studies) for year 2011, Indonesia was at ranking 40 out of 42 countries. This finding was not better than the previous TIMSS findings, for example in 2003, Indonesia was at ranking 36 out of 45 countries both for science and mathematics. Survey by the IEA (International Educational Achievement) on the ability of science and mathematics of senior high students, Indonesia was at ranking 38 out of 39 countries. Generally, based on the record of the UNDP, the quality of Indonesia human resources a.k.a. the Human Development Index (HDI) for year 2000 was ranked 105 out of 108 countries, and Indonesia was far below ranking of regional countries such as Singapore, South Korea, Brunei Darussalam, Malaysia, Thailand, and the Philippines [1].

Among the causes of the lack quality of science education in Indonesia are the tendency of science education to tests/exams-oriented, and teachers conveyed science as a product to be memorized by students [1]. Sciences or physics questions at various examination dominated by quantitative computational questions have been encouraging teachers to drill students to solve the questions by using formulas instead of increasing students' conceptual understanding. Kim and [2] found a little impact of doing computational problem toward increasing of conceptual understanding. Lack of conceptual understandings continues until they are in the university even after returning to schools as physics/science teachers. Misconceptions occur generation to generation and are taught by teachers in the classroom. Syuhendri, Jaafar, and Yahya [3] who studied about physics education student-teachers' conceptions of a public university in Indonesia reported that average students' conceptual understanding in mechanics was 18.18%. This finding was worrying. Hestenes and Halloun [4] stated that only by mastering mechanics concepts of 85% a

ISBN 978-602-19877-3-5

learner can apply them well and only by mastering 65% of the concepts he/she is ready to learn mechanics.

Mechanics is important material in physics. Almost all parts of physics depends on mastery of mechanics concepts. Zukoski [5] argued that students enrolling in a college physics course do have misconceptions concerning force. Therefore, the basic conditions of students in mastery of concepts in mechanics need to be known. Two of the key concepts in mechanics are active forces and action-reaction pairs. The purposes of this study are to see 1) how the conditions of students' conceptions on active forces and action-reaction pairs, and 2) what kinds and what levels of the misconception experienced by the students at that field.

2. METHOD

The instrument used in this descriptive research was the Indonesian translation version of the FCI. The FCI is a set of diagnostic test in mechanics domain developed by Hestenes, Wells and Swackhamer [6]. The revision version of the FCI consists of 30 multiple choice items [7]. Each item has five options, one is a correct concept and the four others are misconceptions often experienced by students in the mechanics field. The Indonesian translation version of the FCI and other language versions can be downloaded in http://modeling.asu.edu/R&E/Research.html. As many as 13 items of the FCI corresponding to active forces and action-reaction pairs were selected for this study.

The subject of the study was all first semester Physics Education Department students of a pubic univeristy in South Sumatera comprised of 73 students who enrolled in Basic Physic 1 course. The FCI test was administrated to them in the beginning of the Semester 1.

Descriptive statistical data analysis by using frequency, means, and percentages of students' answer for each of five options for one or several items was calculated to probe students' misconception. The misconceptions were revealed based on all students' wrong answers consulted to the table of Taxonomy of Misconception probed by the FCI [6]. The qualitative data were also collected through semi-structure interviews and observations during the learning process. The sample for the interviews based on opportunistic sampling [8] was consisted of 9 students who were indicated hold dominant, middle, and low misconceptions.

3. RESULTS

Based on the data analysing, it was obtained the student-teachers' misconception and their levels in active forces and action-reaction pairs as displayed in the following table.

Table 1. Misconceptions Experienced by Respondents and Their Percentages on Active Forces and Action-Reaction Pairs

No	Misconceptions	Items and Options	N	%
	Active Force			
1	Only active agents exert forces	15D;16D; 17E; 18A; 28B; 30A	78	17,81
2	Motion implies active force	5C,D,E; 27A	92	63,01
3	No motion implies no force	29E	37	50,68
4	Velocity proportional to applied force	22A; 26A	59	40,41
5	Acceleration implies increasing force	3B	26	35,62
6	Force causes acceleration to terminal velocity	3A; 22D; 26D	34	15,53
7	Active force wears out	22C,E	21	28,77
	Action/Reaction Pairs			
8	Greater mass implies greater force	4A,D; 5B; 16B; 28D	97	33,22
9	Most active agent produces greatest force	15C; 16C; 28D	104	47,49

Based on Table of Taxonomy of Misconceptions Probed by FCI [7].

Table above showed 7 and 2 types of misconceptions held by respondents on active forces and action-reaction pairs respectively. The most common misconception was *"motion implies active force"*, while the lest common one was *"force causes acceleration to terminal velocity"*. Next, it is described in detail each of these misconceptions.

3.1. Only active agents exert forces

There were 17.81% of respondents held the misconception that *only active agents exert forces*. Question number 15 showed *a car is pushing a broken truck*. Respondents who had this conception would think that *only the car exerts a force on the truck, and the truck cannot push the car because the truck's engine is not on*. The same thing was also revealed by the option **D** of question 16. In question 28, it was illustrated *there are two children sitting in a wheelchair; child A heavier than the child B. Then child **A** suddenly pushes child **B** outward with his feet so that they move away each other*. Students thought that *only child **A** exerts a force on **B**, while **B** does not.* It can be concluded that students held perception that only active objects can exert forces.

ISBN 978-602-19877-3-5

3.2. Motion implies active force

As many as 63,01% of respondents held the conception that motion represents active force. This misconception is contrary to the first Newton's law that an object either remains at rest or continues moving at a constant velocity if the resultant of forces acting on it is zero. There were two questions revealed this misconception, i.e. number 5 and number 27. In question 5, about *a ball moves in a circular channel*, the students chose option **C**, **D**, and **E**, that described there is a force in the direction of the ball motion. Meanwhile on the question 27, option **A**, it was described *a box will immediately stop moving if the push is stopped*. So the students thought that the box moves because of being pushed constantly and it will stop moving if it is not pushed anymore, instead of it stop moving due to the frictional force that works in the opposite direction of its motion.

3.3. No motion implies no force

There were 50.60% of respondents experienced misconception that *there is no force acting on a rest object*. Similar to the previous statement, it is argued that if the object does not move then it means that there is no force acting on it. Question 29 depicted a stationary chair on the floor. Respondents who held this kind of conception chose the option that *there is no any force working on the chair*. Because the chair is in a rest condition, it means that there is no force acting on it. Lack understanding of the action-reaction force, the third Newton's law, was also revealed besides lack of understanding of the first Newton's law.

3.4. Velocity proportional to applied force

This kind of misconception means that *the greater the force applied on an object the greater the velocity of the object is*. It was again disclosure that a force needs to keep an object moving. It is clearly contrary to the first Newton's law. There were 40.41% of respondents held this misconception. This was revealed by their answer for question 22 option **A**, *the rocket are going to move in space without the influence of external forces with a constant speed when the rockets' machine is turned on to get the thrust*. While on the question 26, students chose the answer that *the box will move with a constant speed that is double the original speed if a person doubles the constant horizontal force that he or she exerts to push the box*.

3.5. Acceleration implies increasing force

There were 32.65% of respondents held misconception that acceleration implies increasing force. It was described by option **B** of question number 3. If an object's speed is increase it means that the forces acting on the object are also increase. The implications of understanding that velocity is directly proportional to the force is *the greater the velocity (accelerated), the stronger the force acting on the object*.

3.6. Force causes acceleration to terminal velocity

In question number 3 it is stated that *a stone was dropped from the top of a building to the earth's surface*. Students who held misconception that force causes acceleration to terminal velocity thought that *the stone will reach its maximum speed shortly after it is released and then moves with constant speed*. In this case, the existency of a constant gravitational force acting on an object was not understood as something that is steadily accelerating the stone. So the respondents assumed that the stone will be accelerated from the rest to move and then will continue moving at the same velocity. The number of respondents who experienced such misconception was 35.62%.

3.7. Active force wears out

As many as 28.77% of respondents believed that the forces acting on an object were used up by the objects to move. Question 22 option **C** and **E** revealed this misconception. Respondents chose option to *a rocket moving in outer space freely from external force* that *the rocket will move with a constantly decreasing speed or maintain constantly its original speed for a moment and then decreased, despite rockets' engines was continuously providing thrust on the rocket*. This kind of misconception arise because students assume that the rocket fuel continues to be reduced so that its force continues to decrease as well.

3.8. Greater mass implies greater force

It has been stated in several sections above, the understanding of action-reaction pairs was becoming a serious problem. Many students hold this misconceptions. Although students know that forces on the action-reaction pairs are equal and work in opposite directions, but on implementation they can not apply that understanding well to analyze given cases.

There are four questions in the FCI proved that students are difficult to apply the concept of action-reaction pairs. In question 4 it was given a case, *"a large truck collides head-on with a small car. At the time of collision ..."*. Students' misconception was disclosed by their answer for option **A, "***the truck exerts a greater amount of force on the car than the car exerts force on the truck"*, and option **D** *"the truck exerts a force on the car but the car does not exert a force on the truck"*. Both options **A** and **D**

ISBN 978-602-19877-3-5

confirmed that respondents thought that the larger object exerts the greater force. Furthermore, in question 15 *"a small car pushes a large truck"*, the same conditions are shown by the answer for option **B**, *"the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the car"*. Although the idea of action-reaction pairs on this option has appeared, but the action-reaction is just determined by the ratio of the mass of interacting objects. The same choice also happened for question 16. Finally, such kind of understanding was again revealed by the question 28 for option **D**, that is *the bigger child or the greater-mass child will give the greater force.*

3.9. The most active agent produces the greatest force

This misconception is similar to the previous one, *"only active agents exert forces"*. Questions that revealed this conception were questions (along with their options) 5**C**, 16**C**, and 28**D**. There were 47.49% of respondents classified into this misconception. The main cause of this misconception was lack in understanding of the action-reaction concept.

4. DISCUSSION

The serious problem of Indonesia student-teachers' misconceptions found in this research is similar to findings of other studies. For example, Kim and Pak [2] reported that students had many of well-known conceptual difficulties in basic mechanics area. Rahman, et.al [9] in a study of student teachers' conceptions on force and motion found that respondents strongly adheres to Aristotelian understanding that was not accepted in scientific belief. In addition, Bayraktar [10] also got an average score of pre-service physics teachers from an education faculties in Turkey about force and motion was below the threshold, i.e. 40.89%.

This condition of misconceptions requires specific learning strategies. It refers to the theory of conceptual change learning [11]. Techers need special learning strategies to overcome misconception because it is resistant and difficult to change. Hasan, Bagayoko, & Kelley [12] suggested that misconceptions need a modified instruction that is intended just to eliminate the misconceptions. Only by conceptual change learning that misconceptions which have long been in students' mind can be changed to the true one. Similarly, Bayraktar [10] suggested that to overcome misconceptions requires effective teaching and learning strategies. Traditional teaching and learning process was reported in many studies failed to do that. So, it is recommended that for Basic Physics 1 course, lectures should apply conceptual change learning strategies in order to improve students' conceptual understandings.

5. CONCLUSION

Based on description above, it can be concluded 9 types of common misconception held by respondents on active forces and action-reaction pairs. The order of the misconceptions from the dominant one are: 1) an object moves due to an active force works on the object, 2) one of the possible condition of an object if no force acting on the object is at rest, 3) the most active agent influencing an object gives the greatest force on the object, 4) the bigger the force acting on an object the faster the velocity of the object is, 5) if a speed of an object is increase from time to time it means that the force working on the object is increase as well, 6) object has greater mass will exert the greater force, 7) active force acting on an object will wear out, 8) only active agents exert forces on an object, and 9) force will accelerate an object till it gets its terminal velocity.

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