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EXPLORATION THE STUDENTS REASONING IN SOLVING TRIGONOMETRY PROBLEMS IN TERMS OF THE ABILITY OF LOGICAL THINKING

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Abstract

Reasoning has been researched by many experts. However, the research of students in reasoning in solving Trigonometry is not sufficient. This research is a qualitative research used to explore students' reasoning in Trigonometry based on logical ability and comparison between subjects with high-logic ability and subjects with medium-logic ability. The instruments in this research are the researchers themselves as the main instrument guided by math-problems solving task and valid and reliable interview manual. The data collection is done by task-based interview. The subjects of the research is the XII-IPA students which consists of 2 people. The research process follows these stages : (a) formulate the reasoning indicators in solving math problems based on relevant theory and research, (b) formulate valid and reliable supporting instruments (math problems solving task and interview manual), (c) collecting the research subject by giving logical ability test, (d) data collecting to reveal students' reasoning in solving math problems, (e) conclude the research result.

The result shows: (1) the similar method between the high-logic subject and the medium-logic subject is in solving each Trigonometry question, they always start with inductive reasoning and then continue with deductive reasoning, (2) the difference between the subjects reasoning of high-logic ability and medium-logic ability was on the process of reasoning between two those two subjects on each of problem solving according to Polya's steps. Based on the result, the students' reasoning can be a reference in developing math learning model to improve students reasoning abilty base on logical thinking.
Keyword : Mathematics Reasoning, Logical Thinking

A. Background

Researchers and educators have given a lot of attention not only focused on students' understanding of the concept, but also the skills to think, to reason, solve their problems by using mathematics. Mathematics is seen as an active process of dynamic, generative, explorative. Based Education Unit Level Curriculum (SBC) to the Minister of National Education number 22 of 2006 on content standards, the purpose of studying mathematics is that learners have the following capabilities: 1) understand math concepts, explains the relationship between concepts and apply the concept of the algorithm, are flexible, accurate, efficient, and precise in solving the problem, 2) using the reasoning in the pattern and nature of mathematical manipulation in making generalizations, menyususn evidence, explain ideas, and math questions, 3) to solve the problem which includes the ability to understand the problem, devised a mathematical model, completing the model and interpret the obtained solution, 4) communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or

problem, 5) have respect for the usefulness of mathematics in life is to have curiosity, attention and interest in studying mathematics, and tenacious attitude and confidence in solving problems

Based on some of the above description, the researchers conclude that the reasoning aspects as the students need to have a standard that must be developed. But reality shows that the reasoning of students still felt very weak. Referring to the previous description, the reasoning is one of the important standards developed by the NCTM students. Thus arises the question "How reasoning students in mathematical problem". Reasoning associated with the formal goals of students in a structured arrangement of reason to be applied in solving a problem through mental activity .. The factors that make it difficult to learn math students, which are (1) the initial perceptions of students and the community during that think math is a lesson difficult. Furthermore, if the initial perception is already difficult, then they will be reluctant to learn and tend to complicate the simple; (2) difficulty communicating ideas into mathematical language when given a problem that has to do with everyday life. Thus, the problem associated with the number of students is not difficult, but the problems are very difficult for students to use the phrase.

Reasoning be one occurrence of the thinking process. Limitation of thinking (thinking) is a series of mental activities are legion, such as recalling a thing, imagining, memorizing, calculating, linking some sense, create something concepts or estimate the range of possibilities. So in this case it can be said that the reasoning and thinking is very different, the reasoning may occur one thought, but not all think the reasoning. Mental process starts from the observation of the senses or empirical observation. The process in the mind produces a number of sense and at the same proposition. Based on observations similar sense anyway. The process is called reasoning as based on a number of propositions that are known or assumed to be true then used to infer a new proposition that were previously unknown. The results of previous studies showing lack of mathematical reasoning of some students in the school. If you look at the substance of the matter, it is one of the materials that are considered difficult is trigonometry. Trigonometry serve as the focus of the problem because it is based on observations made by interviewing some of the students of class XII-Science in Makassar and alumni say that Trig is a material that is very difficult to understand because when they learn in class X, the concept of trigonometry is not embedded well as material The newly introduced to the students. Thus, when the material learned in class XI trigonometry-IPA has become a problem for students because the concept in class X is not embedded properly and when students get the question of trigonometry then students will feel that the matter in connection with trigonometry difficult, for in class XII -IPA more use trigonometry material relationship with the materials that have been studied.

Researchers concluded, based on the problems identified earlier. material about trigonometry given in schools, especially high school students in Makassar is less meaningful due to immateriality material. The underlying problem besides keabstrakannya student is long-term memory is not embedded in their minds to solve trigonometry problems, is caused because of the many formulas that must be understood and less meaningful student Trigonometry material, so the material that they can slip by. A further problem is obtained in school students can not mengaitakan Trigonometry material with other materials in mathematics for example the quadratic equation material, limit, derivative, Three Dimensional, Matrix and others, so that students increasingly feel that the subjects of mathematics that deals with Trigonometry is very difficult. Thus, the researchers conclude that the reasoning of students who are still lacking, affecting students in solving trigonometry problems.

The expression above is strengthened by the observation of the early writers on trigonometry material. The author gives about trigonometry to some high school students of class XII who will prepare for the National Examination as follows: if the $\triangle$ ABC, if $\sin C = \tan B(1 - \cos C)$, whether $\triangle$ ABC is an isosceles triangle or right-angled ?. When given a few minutes to menyelesaiakn about it, the thing seen when students will solve problems that are: students can not understand how to solve a given problem, the students were busy looking for what is the appropriate formula for accomplishing this matter, students look for examples of

problems previously in accordance with the model given problem. After given time to solve these, most are not able to solve problems and ask "how to solve this problem?". Once identified, the researchers concluded that students who asked not able to understand the meaning of a given problem and not able menalarkan given problem, and some of them are not interested to resolve the matter. This indicates that students' reasoning in solving trigonometry problems still low and almost every matter of trigonometry is short

Based on the description above, by looking at previous studies as well as studies and facts that occurred in schools, the researchers intend to explore or dig detailed information about how the student reasoning in problem solving trigonometry in terms of the ability to think logically.

B. Research Questions

Based on the background and identification of problems set forth above, then the question of this study is:

1. How does the student reasoning in problem solving trigonometry in terms of the ability to think logically?
2. How comparison logical reasoning ability of students of high and students are capable of logical being in problem solving trigonometry?

C. Types of Research

This research is a qualitative exploratory study aimed to collect information on students' reasoning in problem solving trigonometry based on the ability to think logically. Reasoning students in problem solving trigonometry can be seen from the behavior of students in solving a mathematical problem-solving task (TPMM) which reflects the mental activity and through in-depth interviews.

D. Subject Research

This study will be conducted in high school in Makassar. Measures making other research subjects are:

1. Determine which class research-science class XII students who have studied the matter Trigonometry. XII class chosen with consideration:
   a. Students of class XII-Science has followed a series of materials in class X trigonometry previously given teacher at school
   b. Character class XII student-IPA relatively well known by teachers and not interfere with the preparation of the UN
   c. Activity class XII student-IPA is not too dense, making it easier to conduct interviews
2. Provide initial test in the form of multiple choice questions relating to the logic of what they have learned. The number given problem are 15 questions in the form of multiple choice. This measure, intended to select students who have the ability to logical high, medium, and low
3. The result of the test is the ability to think logically analyzed to determine the subject to be chosen in the study. Banyanknya research subjects to be selected is 3 (1 high logical abilities, 1 logical abilities are, 1 low logical abilities).
4. Prospective subjects are grouped based on the level of logical thinking ability of students, which is capable of logical high, medium and low
5. If there is more than one candidate subjects who meet the criteria, then the chosen subject can:
   a. express his thoughts. In this case the researchers asked the teacher considerations for selecting students who are considered quite able to express his thoughts based on observations of the teacher during the learning process going on in class.
   b. Subject willingness to participate in the data collection for the study.
6. Candidates selected subject used as subjects in this study.

E. Focus Research

Implemented research focus function directs the researcher to be able to devote attention to what should be clearly observed that the research questions can be answered with the best. To answer

the research question well then that is the focus of this research are: Reasoning students in problem solving trigonometry with the indicator are: 1) Presenting the mathematical statement, either orally, in writing or images; 2) Asking allegations; 3) Perform mathematical manipulation; 4) Develop the evidence and reasoning to truth solution; 5) Draw conclusions from statements; 6) Checking the validity of an argument.

F. Instrument Research

The research instrument was a researcher himself. In this case the researchers are planning, implementing data collectors, analysts, data interpretation, and become the reporting of research results. Researcher as instrument will facilitate collecting information of interest include other information than the other (findings are interesting), which was not planned in advance, which is not unexpected in advance or which is not uncommon. In this study also used other supporting instruments, namely: (1) Logical Thinking Ability Test (2) Interview Guide; (3) The task of Mathematical Problem Solving (TPMM). Test the ability to think logically contains questions that can draw logical conclusions. The interview guide instrument includes questions trigonometry and the central questions to be posed to the subject of research. Given to the subject matter in an interview to explore how students' reasoning in problem solving trigonometry in terms of the level of logical thinking ability.

G. Data Collection Techniques and Validation Data

The process of collecting data in this study are:

1. Students are given the task of solving the problem, each step is indicated completion students, researchers asked questions relating to the conclusion of the student. Alternative question is "tell me what you think so that conclusion like that?" The data collected in the form of the results of student work, and interviews. The interviews are recorded by using a camcorder and made a transcript of the interview is equipped code, the data set that comes included in the bundle and called data-1.
2. Two weeks later, subjects were given back the next problem-solving tasks that are similar to the first problem-solving task. Furthermore, the task-based interviews. Data collected in the form of the work of the students, and the results of interviews and recorded using a camcorder and made a transcript of the interview is equipped code, data collection comes included in the bundle and called data-2.
3. Reduction, abstraction, transformation and categorizing the data 1 and data 2
4. Triangulation of data, ie comparing the first problem-solving tasks with the task of solving the problem through interviews. Problem-solving tasks that are consistent and valid as a reference in the interpretation of the conclusion of the study. Meanwhile, the task of solving the problem of inconsistent called invalid data and collected separately for verification of data

H. Data Analysis Techniques

Results transcripts and results of mathematical problem solving tasks were analyzed with the following steps:

1. Review all available data from various sources, from interviews, observations that have been written, in the field notes, and the results of mathematical problem solving tasks.
2. ata reduction is an activity which refers to the process of selecting, focusing, abstracting, and transforming raw data. In this study conducted with a summary that consists of: core, processes, statements in accordance with the purpose of research. Words subject that does not comply with the purpose of research omitted. Validation of data is done at the time of data collection took place, namely by way of verification. In this study used data verification is a triangulation is done by examining the data subject with different time comparing and examining data from two or more problem-solving tasks that appear to be different, but are substantially similar.
3. Presentation of data that includes the classification and identification of data, which writes the data collection organized and categorized making it possible to draw conclusions from the data. In this study, data from interviews of student reasoning in problem solving trigonometry based on the reduced ability to think logically

categorized based indicators in every aspect to be observed. This meant that the information obtained can easily be concluded

4. Make Coding which aims to facilitate the presentation of data reasoning students in problem solving trigonometry based on the ability to think logically, then do the coding on a quote from the research subjects answer the interview

5. To examine the validity of the data reasoning students in problem solving trigonometry based on a logical ability. To assess the validity of the qualitative data

6. Interpret the data / Draw conclusions from the research data that has been collected and verified this conclusion. The interpretation of the data can be directed to build a formal theory of reasoning students in problem solving trigonometry. The conclusion of this study seen by digging detailed information about students' reasoning in problem solving trigonometry based on the ability to think logically

7. Analysis of interesting things, namely behavioral analysis indicated that the research subjects are not planned and not related to the purpose of research.

I. Result and Discussion

Reasoning and problem solving are the two things are interrelated, based on the results of this research through the stages of problem solving Polya disclosed in each of these stages can be revealed students' reasoning in solving problems, especially trigonometry. Mathematical reasoning in the literature referred to mathematical reasoning. Brodie (2010: 7) states that "Mathematical reasoning is reasoning about and with the object of mathematics" the statement can be interpreted that mathematical reasoning is reasoning about objects related to mathematics. Mathematical objects in this case are branches of mathematics are studied as statistics, algebra, geometry and others If associated with this study, the mathematical objects that will dinalarkan the objects associated with Trigonometry. In this case, Trigonometry is the focus of the problems faced by each student, the problem is the inability of students to associate information about related to trigonometry. This is consistent with previous studies that research Milda (2012) and Rashid (2011) about the mistakes and the inability of students to solve problems in trigonometry, of these things, it can be one of the causes of the errors and the inability of students to solve trigonometry problems one of which is a factor in managing the teacher in the classroom or student factors that less attention or inability to solve any given problem. The inability of the student to solve a math problem, especially trigonometry very much, but one of the factors is the lack of student reasoning in solving a problem. In Education Unit Level Curriculum (SBC) revealed that "Mathematics Learning Focus is Problem Solving". So that students are stuck with the meaning of solving the problem itself, so as if mathematics is the questions that always sought solutions to solve these problems, the condition when the problem has been solved / unsolved problem then there is the matter of the students will mimic a similar return if given problems that conforms to the shape of the matter. Krulik and Rudnik (1995) in Alimuddin (2013) defines as a problem-solving: "it [solving] is the mean by the which an individual uses previously acquired knowledge, skills, and understanding to satisfy the demand of an unfamiliar situation. "The quote above shows that solving the problem is an individual effort to use the knowledge, skills, and understanding to find a solution to a problem. Thus, mathematical problem solving is an individual effort using the concepts, properties, principles, theorems, and postulates of mathematics to find the solution of a mathematical problem. This means that each student construct their own knowledge in solving a problem. So a solution to a problem that is constructed solely by the students, there is a process of scientific thinking, scientific thinking process refers to a basic frameworks consisting of reasoning, logical, analytical, conceptual, and critical (Jalaluddin, 2013).

The scientific thinking processes can occur when following the basic framework, one of which is used in this study is the reasoning and logical. If related to the learning of mathematics, reasoning is a mental process in the form of knowledge to draw conclusions based on logical and analytical. Material understand through reasoning, while the reasoning is understood and practiced through the learning of mathematics. This is in line with the results of this study which examines students' reasoning in problem solving trigonometry, any steps to resolve (to

understand the problem, plan completion, conduct settlement plan) constructs implied an abstract problem or an issue through mental activity or shadowing in accomplishing problem the. This is in line with the opinion of Russell (in Asrawati, 2012) namely Mathematics is the discipline with regard to abstract terms, and with a means to abstract reasoning or understanding of abstraction.

If the review of a given problem trigonometry, trigonometry presented the problem is 1) a matter of graphs, 2) about the use of the properties of mathematics, 3) a matter of proof. Problem graphs are used to express how the student reasoning in describing the graph of the function and what strategies are primarily used in describing the graph of the function, while a matter of using the properties of trigonometry is used to determine students' reasoning in linking information and concepts are linked in looking for relationships of each concept in solving these problems and propose some examples of denial and ask students to investigate whether the examples provided in accordance with the definition given or problems. As for the proof is in line with the opinions Hayes (Lyn, 1997) through verification occurs reasoned activity, which is a process of mental activity which link the facts or evidensi-evidensi are known to lead to a conclusion. through proof students are required to be more careful and meticulous in choosing the concept of what used to prove. Another opinion supporting that reasoning can be developed through the evidence is from Rota (Lyn, 1997) who argues that "the only thing that can guarantee the truth of a mathematical statement is deductive reasoning. Evidence obtained through deductive reasoning is intended to establish the certainty of mathematics pengatahuan, but it is not absolute certainty '. So the truth it can be obtained through the evidence, while the proof requires reasoning. Opinions Hayes (Lyn, 1997) The studies were carried out in line with Nizar (2007) who developed a number of characteristics about which included questions reasoning. To improve students' reasoning power one way is to strengthen the student as early as possible at the school level, with the view that mathematics as a contributor terbesardalam forming logical thinking provides a large share of students in sharpening the reasoning power. So there is no harm if the math gives a very significant contribution in building students' reasoning power. research conducted Usodo (2012) which explains that each student has different characteristics in solving mathematical problems, is seen different reasoning ability students who have creative ideas in solving mathematical problems. Many students are highly capable in solving math problems often use creative ways so that their answers brief and accurate is because students are able to reason well. While the students are capable of medium and low, the means used to solve a problem that is less likely to give accurate answers, even students capable of medium and low difficulty finding a way to solve mathematical problems.

Suriasumantri (in Jalaluddin, 2013) reveals more Reasoning refers to the process and flow of thinking, then the logic is the product of thought itself. Logic examines the criteria to determine the truth of the statement or argument, thus, logically connected with the process of drawing conclusions in a certain way, in order to obtain a valid conclusion. In logic, thinking means compile-syllogism syllogism to obtain appropriate conclusions. So based on these opinions, then to see the reasoning of students in solving a particular problem trigonometry, it can be seen from the logical abilities of each student. n this study in subjects drawn is logical high ability students (ST) and students are capable of logical medium (SS). This is in accordance with the opinion Asrawati (2012) regarding the reasoning abilities of each student is different, and is associated with the ability to find solutions or problem-solving; related to the conclusion, as a syllogism, and that relates to the ability to assess the implications of an argument; and look at the relationships, not only the relationship between the objects but also the relationship between ideas, and then use that connection to obtain objects or other ideas. While subjects were capable of logical low (SR) in this study was not examined in detail, it is because each selected subject showed no mental activity in menalarkan any given problem, especially when given the problems associated with trigonometry. Thing that happens is the subject capable of logical low (SR) does not provide information about the mental activity that is expressed in problem solving, in analysis, subjects capable of logical low (SR) can not determine the first step in solving the problem, which is visible is a subject capable of logical

low (SR) are not able to understand the problem and start solving the problem. If it is associated in theory, a subject capable of logical low (SR) have difficulty in learning mathematics. This is in line with the opinions Larner (in Abdulrahman, 2012) which revealed that the characteristics of mathematics learning difficulties, namely (1) the presence of interference in spatial relations, (2) Abnormalization visual perception, (3) visual-motor associations, (4) persevarasi, (5) the difficulty to know and understand the symbols, (6) disruption of the body appreciation, (7) difficulties in language and reading. In this study, each subject capable of logical low (SR) taken have difficulty in recognizing and understanding the symbols, as well as the mistakes committed in solving any problem given the lack of understanding of the symbol, place value, calculation, and the use of the wrong . These things happen in every subject that is enabled with a logical low (SR) were elected, less understanding of the symbols shown in the inability of the subject that is enabled with a logical low (SR), especially in trigonometry: (1) do not understand the meaning of the symbol π in describing the graph of the function, (2) do not understand the meaning of the symbols $\leq$ and $\geq$. interval $0 \leq x \leq 2\pi$ in question describe the graph of a function. Then less understanding of the subject's inability pehitungan shown in the lower logical ability (SR) in performing simple arithmetic operations especially when menjumlahan two fractions. Thus, the researchers conclude that the subject is capable of logical low (SR) did not answer the purpose of the study, in the sense that every subject that is enabled with a logical low (SR) did not show his reasoning in solving problems because of the difficulty of learning in mathematics. This is in line with the results Milda (2012) found that in solving trigonometry students there are many errors in the interpretation of which is one of the things that are known and are asked of matter to form sketches, one of the rules of trigonometry concepts, one in determining the results of the calculation.

Based on the research results obtained thorough, logical reasoning subject capable of high (ST) and subjects that are capable of logical (SS) in solving trigonometry problems could theoretically be explained that in understanding a trigonometry problem by providing the type of questions that different, either about graphs of functions, using the properties of trigonometry, or proof, start by using inductive reasoning. However, in mathematics, understanding the concept is often preceded by inductively through the experience of real events or intuition. That is a subject that is capable of logical high (ST) and a subject capable of logical medium (SS) in understanding the problem and the planned completion of trigonometry using the allegations (make mathematical conjecture) to initiate or begin to solve a problem in this case solve the problems of trigonometry and find patterns planned settlement through mental activity and observation of the subject. If it is associated with the early stages in solving the problem, the logical subject capable of high (ST) and a subject capable of logical medium (SS) initial observations in solving the problem, then the results of these observations arises a conclusion that is associated with knowledge and experience of each each of which is stored in memory long term. This is in accordance with the opinion Soekadijo (in Wulandari, 2011) regarding the chronology of reasoning that mental activity starts from the observation of the senses or empirical observation. The process in the mind produces a number of sense and at the same proposition. Based on observations similar sense anyway. The process is called reasoning as based on a number of propositions that are known or assumed to be true then used to infer a

new proposition that were previously unknown. While the subject capable of deductive reasoning logical high (ST) and a subject capable of logical medium (SS) seen on stage doing the settlement plan by conducting calculations based on specific rules or formulas, draw logical conclusions with silogisma rule-based, and compile evidence.

So, based on the analysis , so inclined the students right now in solving the problem specially for trigonometry always started with do the reasoning of inductive and then using the reasoning od deducvtive in solving thats problem. This is in line with the result of research by Rohmad (2008) expressed that the student to construct the mathematic knowladgde with using inductive mindset. For example the learned activity can start with presents some example or fact that observed, make a list that appear, estimate a maybe result, and then student can directed for conctruct the generalization in the deductive. Next, if the possibility the students can requested to prove the generalization that obtained the gemeralization who received by deductive. In general, in solving the problem the students using a inductive-deductive mindset. In solving the problem, to solving the problem usually just using one of the inductive or deductive mindset, however many problem in solving the problem using by them, the inductive and deductive maindset in alternately

J.   Conclusion

Capable of logical reasoning equation subject height (ST) and the subject are capable of logical (SS) in a matter of problem solving trigonometric graphs are as follows: (1) the stage of understanding the subject matter capable trigonometry logical high (ST) and a subject capable of logical medium (SS) using inductive reasoning types of analogy, (2) the stage of planning a trigonometry problem solving, logical capable Subject high (ST) and a subject capable of logical medium (SS) using inductive reasoning, but the type of inductive reasoning between subject capable of logical high (ST) and capable of logical subjects were (SS) is different. Subject capable of logical high (ST) using inductive reasoning kind of generalization, while the subjects are capable of logical (SS) using reasoning kind of analogy and generalization, (3) phase commit settlement plan, subject capable of logical high (ST) and a subject capable of logical being (SS) using inductive reasoning and deductive reasoning type generalization silogisma type, (4) re-examine phase, subjects capable of logical high (ST) and a subject capable of logical medium (SS) does not have the same reasoning in regard to re-examine what has been done previously. For the relevant research, in order to re-examine the reasoning process more complete, needs to be verified by: 1) connect some trigonometry materials associated with materials such as quadratic equations, quadratic functions, sequences and derat, three-dimensional and others , 2) the indicators are complete reasoning associated with the

words expressed logical subject of research, 3) revise the guidelines that direct interviews reveal students' reasoning in solving the problem in detail and structured, 4) revising the test's ability to think logically are directly categorize prospective research subjects that subject logical capable of high, medium, and low. Other findings in this study were 1) the subject of research sometimes inconsistent in revealing what dinalarkan when solving problems, especially trigonometry so recommended to use exploratory study with a qualitative approach to uncover the reason students are not consistent in solving the problem, 2) subject-capable logical low in solving problems, especially trigonometry not found how bernalarnya capability despite repeated interviews conducted repeated, so it is recommended to use exploratory study with a qualitative approach to reveal the causes and alternative solutions are capable of logical subject Low (SR) in a certain material menalarkan, 3) subjects are capable of logical (SS) in this study is more creative and have lots of ways to solve trigonometry problems than subjects capable of logical high (ST) is due to the possibility of testing the ability to think logically for high subjects easier than subjects low, so it is recommended to use exploratory study with a qualitative approach to see how the test instrument with the ability to think logically reasoning students in solving a problem in a particular matter.

Bibliography

Alimuddin. 2012. *Process of Creative Thinking Creative Teacher Candidate Students In Math Problem Solving by Gender*. Dissertation. Not Published. New York: State University of Surabaya

Arends, Richard. 2008. *Learning To Teach "Learning To Teach"*. Library Student: Yogyakarta

Asrawati, Nur. 2012. *Exploration Reasoning Ability and Communication Strategy Applied Mathematics After Think-Talk-Write Settings Cooperative by Gender In Class X SMK Kartika XX-1 Wirabuana Makassar*. Unpublished thesis. Makassar: UNM Graduate Program

Brodie, Karin. 2010. *Teaching Mathematical Reasoning in Secondary School Clasroom*. New York: Springer.

Clerkin, Ben and Fiona Macrae. 2006. *Men Are More Intelligent Than Women, Claims New Study*. Situs http://www. Dailymail.co.uk/news/article-405056/Men-Intelligent-women-claims-new-study.html. Download

Jalahuddin. 2013. *Philosophy of Science*. Rajawali Release: Jakarta

Krulik, S & Rudnick, J. A. 1995. *The New Sourcebook of Teaching Reasoning and Problem Solving in Elemntary School*. Needham Heights: Allyn & Bacon

Livne and Milgram. 2006. *Academic Versus Creative Abilities in Mathematics: TwoComponents of the Same Construct*? Creativity Research Journal 2006, Vol.18, No. 2, 199–212. Download

Lyn, D. 1997. *Analogies, Methapora, and Images: Vihicles for Mathematical Reasoning.* Lawrence Erlbaum, Inc

Milda, Afni. 2012. *Error Description Students In Solving Trig In Class XA SMAN 12 Cenrana-Maros*. Unpublished Thesis. Makassar: UNM Graduate Program

National Council of Teachers of Matematics. 1989. *Curriculum and Evaluation Standars For School Mathematics*. Reston, VA: NCTM

_____. 2000. *Principle and standars for School Mathematics*. Reston, VA: NCTM

Polya, George. 1973. *How To Solve It (2nd Ed)*. Priceton: Priceton Univercity Press.

Rohmat. 2008. *Using Inductive-Deductive Thinking In Mathematics Learning beracuan Constructivism*. Download: Accessed on July 5, 2013

Sumarmo, Utari. 2010. *Mathematical Thinking and Disposition: What, Why, and How Developed on Students*. On Line.Tersedia:http://math.sps.upi.edu/wp-content/upload/2010/02/BERPIKIR-DAN-DISPOSISI-MATEMATIK-SPS-2010.Pdf [January 3, 2013].

Usodo, Budi. 2012. *Characteristics Intuition High school students in Mathematics Problem Solving In terms of gender differences and the ability of Mathematics*. Download: Accessed on December 4, 2012

Woolfolk, Anita. 2009. *Educational Psychology Active Learning Edition "Edition Ten"*. Yogyakarta: Student Library