PROFILE OF HIGH SCHOOL STUDENT MATHEMATICAL REASONING TO SOLVE THE PROBLEM MATHEMATICAL VIEWED FROM COGNITIVE STYLE

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Abstract: The purpose of this study was to (1) reveal the mathematical reasoning profiles of high school students who impulsive cognitive style in solving mathematical problems; (2) reveals the mathematical reasoning profiles of high school students who reflective cognitive style in solving mathematical problems. This study is exploratory research that uses qualitative descriptive approach. This study drawing this subject there are two people, the one student who impulsive cognitive style and one student reflective cognitive style. Analysis of the data in this study through the process: reduction, data presentation and conclusion. The results of this study are: (1) on each phasing Polya, subject impulsive present oral statements and written, create an image as a representation of the problem, it can not determine the validity of the arguments expressed or written, and could not fathom the truth of what is understood or written; , (2) at the stage of understanding the problem, reflective subjects presenting oral and written statements about what is understood the problem, set the picture as a representation of the problem, stating the validity of the arguments expressed or written and can infer the truth of what is understood or written.

Keywords: *Mathematical Reasoning, Mathematical Problem Solving and Cognitive Style*

1. INTRODUCTION

In the 2004 curriculum formulated four mathematical ability is expected to be achieved by students ranging from primary level to secondary level, ie the ability of reasoning, problem solving skills, ability to connect mathematics and mathematical communication skills (MONE, 2004). It also mentioned the purpose of learning mathematics in Curriculum 2004 is as follows: (a) train the way of thinking and reasoning in drawing conclusions, for example through the activities of investigation, exploration and experimentation; (B) develop a creative activity that involves imagination, intuition and invention to develop divergent thinking, original, curiosity, make predictions and conjecture and try; (C) develop problem-solving abilities; (D) develop the ability to convey information or communicate ideas, among others through verbal discussions, notes, charts, diagrams map in explaining the idea.

Of the function and purpose of learning mathematics mentioned above show that mathematics as one means of scientific thinking is needed to develop reasoning skills and problem solving skills in mathematics. Two general purpose mathematics presented above is a mathematical problem solving and mathematical reasoning. This shows that the mathematical problem solving and mathematical reasoning are the two things that can not be separated, because the math problem solving understood through mathematical reasoning and mathematical reasoning can be drilled through solving math problems. The same thing also expressed by Sadiq (2004) that the mathematical problem solving can train and develop students' mathematical reasoning abilities.

Reasoning is derived from the word "reason" which means consideration of the good and bad, the power of thought or activity that allows a person to think logically (Sumarmo, 2008). Furthermore it is said that the reasoning is a way of using reason or mental process in developing the minds of some fact or principle. According to Kusuma (1986) reasoning is defined as a conclusion in an argument, and a way of thinking that was the explanation in an effort to show the relationship between two or more based on the properties or certain laws that recognized the truth, using certain steps ending with a conclusion.

Reasoning is the process of using evidence to draw conclusions, using prior knowledge to develop a new concept of understanding (NCTM, 2000). As a broad definition, the reasoning is the process of drawing conclusions based on evidence or specific assumptions. Reasoning can be done in the form of formal proof, but it usually starts with mathematical ideas explored and created the allegations. Gunhan (2014) defines reasoning as an ability to think coherently and logically by drawing conclusions through facts. Mathematical reasoning refers to the ability to formulate and assess a given math problems and to explain the solution or argument (Kilpatrick, Swafford & Findell, 2001). Suriasumantri (2010) stated that the reasoning is a thought process in drawing conclusions in the form of knowledge and have certain characteristics, namely logical and analytical thinking patterns in the search for truth.

Mathematical reasoning ability is the ability to draw conclusions based on the facts and the relevant sources. Sadiq (2004) stated that the ability of mathematical reasoning is an important part in solving math problems. Mathematical reasoning is a thought process that is done by drawing conclusions. General conclusions can be drawn from the cases of the individual. But it can also be the opposite, of things that are common to be the case that individual (Suherman and Winataputra, 1993). Reasoning skills is an important component in the education and skills needed to understand mathematical reasoning, and reasoning skills are an important tool in developing ideas (NCTM, 2000).

From the above it can be concluded that the mathematical reasoning is the ability of students to be able to draw logical conclusions through a process of thinking is done either from the general to the particular, or vice versa.

Broadly speaking there are two types of reasoning, inductive reasoning and deductive reasoning. Inductive reasoning is a process of thinking in the form of a common conclusion (applicable to all / many) on the basis of knowledge about the specific case (Sumarmo, 2008) This means that for the conclusion of an inductive argument starts from a set of facts that exist. While deductive reasoning works in reverse, from the general to the specific.

NCTM (2000) states that the 5-8 grade students, the mathematics curriculum should include lots of diverse experience to strengthen and expand the skills of logical reasoning so that students can: (1) recognize and apply deductive and inductive reasoning; (2) understand and apply the reasoning process with special attention to spatial reasoning and reasoning with proportions and graphics; (3) develop and evaluate the conjectures-conjectures and arguments logically; (4) assess the absorptive capacity and strength as part of mathematical reasoning.

Suryadi (2005) stated that there are several characteristics of mathematical reasoning, among others: (a) the existence of a pattern of thinking called logic, in which case it can be said that the activities of reasoning is a process of logical thinking and think logically interpreted as thinking in a certain pattern or by certain logic; (B) the thinking is analytical; reasoning is an activity that relies on an analysis, in the framework used for the analysis are logical reasoning is concerned.

Sumarmo (2008), provide an indicator of the ability of mathematical reasoning, namely; (1) make analogies and generalizations, (2) provide an explanation using the model, (3) use patterns and relationships to analyze the situation of mathematics, (4) develop and test the conjecture, (5) checks the validity of the argument, (6) develop direct evidence , (7) develop indirect evidence, (8) provides an example of denial, and (9) to follow the rules of inference.

Regulation of the Directorate General of Primary and secondary No. 506 / C / PP / 2004 Ministry of Education (Sadiq, 2004), stated about the reasoning indicators to be achieved by the students. Indicators show the reasoning, among others: (1) the ability to present mathematical statements, either orally, in writing or images; (2) the ability to perform mathematical manipulations; (3) ability to check the validity of an argument; (4) the ability to draw conclusions from a statement.

From the second opinion on the indicators of mathematical reasoning, in this study used indicators put forth in the regulations of the Directorate General of Primary and Secondary Education No. 506/C/PP/2004, namely: (1) the ability to present mathematical statements, either orally, in writing or images; (2) the ability to perform mathematical manipulations; (3) ability to check the validity of an argument and (4) the ability to draw conclusions from a statement.

Low mathematical reasoning skills students will affect the quality of student learning and will impact low mathematics achievement of students in the school. This is evident from the results of student learning implicit in the results of research conducted Sumarmo (2008) which states that the scores students' skills in understanding and reasoning still low. Low ability students' mathematical reasoning is expressed also in research and Siswono Istiqomah (2010) that the students were divided into groups of high and was not able to meet all the indicators of reasoning in drawing graphs trigonometric functions, while the low group did not meet all of the indicators reasoning.

Conditions lack of mathematical reasoning students described above was seen also on a preliminary study done by the students Graduate Program Mathematics Education haluoleo university (Anonymous, 2015) in some schools in Southeast Sulawesi, namely at Senior High School 1 Wundulako Kolaka, Senior High School Muna and Kabangka Madrasah Aliah Laburunci Buton. The results showed that students generally have not been able to solve the problems of mathematical reasoning.

Basically the problem solving is the process by which a person to solve his problems until the problem was no longer a problem for the man (Sudia, et. Al., 2014). It means that something is a problem for someone, other times no longer a problem for the person concerned.

Problem solving is the embodiment of a mental activity that consists of a variety of cognitive skills and actions that are intended to get the correct solution (Kirkley, 2003; Sudia, et al, 2014). This will result in the ability of each person to solve the problem would be different. A problem that is difficult and challenging for a person, may be a simple matter for others .. While Solso, Maclin &

Maclin (2008) suggests the same about problem solving is a thought that targeted directly to find a solution / way out of a specific problem.

Rodney et al. (2001) defines as a problem-solving process by individuals in combining knowledge prior knowledge to new situations. This means solving the problem is the process carried out by someone in combining knowledge prior knowledge to complete the task is not yet known procedure completion.

Based on some understanding of solving problems mentioned above, it can be concluded that solving the problem is an activity to find a way out of a problem to be solved, but not immediately able to find a way to resolve.

There are three important characteristics of any problems, namely: (1) known, that all the elements, his relations and requirements form the state of affairs; (2) objectives, which settlement or desired outcomes of the problem; (3) barrier, which is characteristic of the problem and make it difficult for people to solve the problem (Gama, 2004; Sudia, 2013). Thus, to solve a problem, one must understand the characteristics of a given problem.

Krulik and Rudnik (Sudia, et. Al, 2014) defines problem solving as an individual effort in using the knowledge, skills and understanding to find a solution to a problem. Thus, the mathematical problem solving is an individual effort using the concepts, properties, theorems or postulates in mathematics to find the solution of a mathematical problem. Mathematical problem solving can not be separated from one's knowledge will be the substance of the matter. For example how an understanding of the core of the problem, procedures / steps used and what rules / formulas appropriate what is used in solving the problem.

Math problems in this study is related to the derivative material algebraic function, the application of the derivative function algebra in everyday life. The reason is because the material algebraic function just finished a lot of material taught and its application in everyday life.

Mathematical problem solving is very important in the learning of mathematics. Therefore, in the curriculum of 2006 stipulated that in learning mathematics used approach to problem solving. Problem-solving approach was implemented to provide adequate provisions for students to have the ability to solve various forms of math problems. They will also be useful to acquire the knowledge and the formation of a way of thinking and being in solving problems.

To obtain optimal results and benefits in solving mathematical problems, should be done through solving steps are organized well. One form of organizing mathematical problem solving is as proposed Polya (1973), which includes four steps, namely: (1) understand the problem; (2) determine the plan of solving the problem; (3) working according to plan; (4 look back on the results obtained. Through these steps to solve the problem raised above Polya enable even a systematic problem-solving and the results do not reflect a true solution, but also a mindset that is structured in a person when facing problems that must be solved.

Solving problems is a high-level mental activity, so the development of problem solving skills in mathematics learning is not easy. Suherman (2001) states that solving the problem is still considered to be the most difficult thing for students to learn and for teachers to teach. Such as the problems are not related to the presentation routine real situations or everyday life.

Each student has a cognitive style of each. Differences in cognitive style attracted the attention of researchers because researchers want to know the profile of students' mathematical reasoning in solving mathematical problems of different cognitive styles.

Many experts have defined the notion of cognitive style, for example: Heineman (1995) and Sudia, et. al (2014) suggested some understanding of cognitive styles as follows: (1) cognitive style refers to the preferred way people organize and process information; (2) cognitive style is usually described as a dimension of personality that influence the attitudes, values and social interaction; (3) cognitive styles include behavior consistent in terms of the way people think, remember and solve problems. The same thing also expressed Riding, et. al (1993) and Sudia, et. al, (2014) that cognitive style and consistency refers to the tendency of individuals in understanding, remembering, organizing, thinking and problem solving.

From some of the cognitive styles mentioned above, basically focused on the characteristics of individual consistency in terms of how to think, remember, process information and solve problems (Dornyei, 2005; Mall-Amiri and Adham, 2013). From the definition of cognitive style is also seen that between cognitive style and reasoning have relevance for cognitive style associated with the way people think and it is none other than one's reasoning. Likewise between cognitive style and problem solving has relevance, because a person's success in solving the problem will be determined how that person thinks, remembering previous concepts related to the given problem and how to process the information to get the right solution (Sudia, et . al, 2014). So we can say that between the cognitive styles, mathematical reasoning and problem solving interconnected. Therefore, in learning problem solving and reasoning need to pay attention to students' cognitive styles.

Some cognitive styles have been identified in the literature, for example, Abdurrahman (1999) says that one of the dimensions of cognitive style that gained most attention in the assessment of children's learning disabilities are impulsive cognitive style and cognitive style reflective. Impulsive cognitive style and cognitive style reflective first put forward Jerome Kagan in 1965. Kagan cognitive style grouping children into two groups, namely: children are impulsive cognitive style and cognitive style reflective child. Children who have the characteristic quick in answering the problem, but not carefully / not careful to answer the problem tends to go wrong, is called impulsive cognitive style. Children who have a characteristic slow in responding to the problem but carefully / thoroughly, so the answer to the problem tends to correct, is called cognitive style reflective (Kagan, 1965 Sudia, et. Al, 2o14).

The above description mentions that the impulsive-reflective cognitive style would be linked closely / meticulously or inaccurate / not accurate in solving the problem. To solve the problem of much-needed high precision and accuracy in choosing the concepts, principles and the proper way in order to obtain the right solution anyway. Precision and accuracy to train students in mathematical problem solving learning implementation is very important that skilled students solve mathematical problems. Similarly to obtain good mathematical reasoning ability is definitely required a high precision and accuracy. This description is also strong enough according to researchers saving as one reason for choosing impulsive cognitive style and cognitive style reflective for further investigation related to mathematical reasoning profiles of students in solving mathematical problems.

The purpose of this study was to (1) reveal the mathematical reasoning profiles of high school students who impulsive cognitive style in solving mathematical problems; (2) reveals the mathematical reasoning profiles of high school students who reflective cognitive style in solving mathematical problems.

2. METHOD

This study is exploratory research that uses qualitative descriptive approach. This study was conducted in August to November 2016 in Senior High School 4 Kendari.

Subjects in this study there are two (2) people who were taken from students who impulsive cognitive style and cognitive style reflective. How to determine the subject of research is for students impulsive students who have taken the fastest time and highest error when answering test cognitive style, while for students reflective taken students who have tended long time and fewer errors when answering test cognitive style.

Instruments in this study are of two kinds, namely: (1) the main instrument, and (2) auxiliary instruments. The main instrument is the researchers themselves, while the auxiliary instruments there are three (3) types, namely: (1) tests of cognitive style; (2) the task of solving the problem, and (3) guidelines for the interview. For the purposes of triangulation, given the two problems are identical.

Problem 1.

Manila-shaped piece of cardboard square with sides of size 20 cm, without lid box will be made by cutting a small square in every corner. What is the size of the box so that the maximum volume?

Problem 2.

Manila-shaped piece of cardboard square with sides of size 40 cm, without lid box will be made by cutting a small square in every corner. What is the size of the box so that the maximum volume?

To collect data in this study used techniques of tests and interviews. Test delivery techniques used to collect data on students' cognitive style and profile data about students' mathematical reasoning to solve problems, while the interview techniques used to explore in depth profile of students' mathematical reasoning. To check the validity of the data in this study used triangulation of time.

Data analysis techniques in this study followed the following steps: (1 (1) data reduction, which is a process of choosing the necessary data and disaggregate data by categorizing (2) data and (3) conclusion and verification of data (Miles and Huberman in Sudia, et. al, 2014).

3. RESULTS AND DISCUSSION

3.1. Research result

Analysis of the data in this study is given to each student who impulsive cognitive style and cognitive style to any phasing reflective and problem solving by Polya, namely: (1) the stage of understanding the problem; (2) the stage of making plans troubleshooting; (3) the stage of implementing plans and problem solving (4) stage to re-examine the results of troubleshooting.

Siswa yang bergaya kognitif impulsif

a. Tahap memahami masalah

At this stage of understanding the problems result: impulsive subjects did not understand the problem because the problem is given only read one, eventually impulsive subjects were told to return to read the problem until the problem is well understood. Subject impulsive create an image as a representation of the problem, but the subject impulsive one make the picture and finally directed to create a correct image. Furthermore, impulsive subjects perform mathematical manipulations at the time to understand the problem, namely when determining what is known and who asked the question. Subject impulsive can not check the validity of what is understood the problem, a result of impulsive subjects can not infer the truth of what is understood.

b. Stage make plans troubleshooting

At the stage of making plans troubleshooting result: impulsive subjects revealed that the formula box volume is obtained by multiplying the length, width and height of the box, making the image as a representation of the problem, express condition that the maximum volume of the box. Subject impulsive perform mathematical manipulations in determining the length and height of the box. Impulsive subjects are unable to determine the validity of the statement expressed and could not fathom the truth of the statement expressed.

c. Stages of implementing the plan troubleshooting

At this stage of the plan to implement problem-solving, the result of analysis as follows: impulsive subjects to write down what has been thought or what he had planned, determine the volume of the box match what has been planned. Students impulsive perform mathematical manipulations, namely reducing the volume equation box, but wrong in the equation multiplies the volume of the box and then the subject is directed to rewrite the equation with the right volume. Subject impulsive stated requirements for maximum box volume, ie V '(x) = 0. x = 10 or x = 10/3. For x = 10 obtained Volume box = 0 and for x = 10/3 is obtained V = 16,000 / 27 cm3 (maximum volume). In order to obtain the maximum volume, then the length = 40/3 cm; cm width = 40/3 and 10/3 cm high. Impulsive subjects are unable to determine the validity of the answers that have been written and can not deduce the truth about the completion of a given problem.

d. Phase check the troubleshooting results

At this stage re-examine the results of solving the problem, the result of analysis as follows: reveal how to re-examine the results of solving the problem, namely by tracing back from the beginning of what has been accomplished, manipulation of mathematical time to re-examine the results of solving the problem, it can not assert the validity of the breakdown problem, do not conclude that their results are correct.

Students who reflective cognitive style

a. Stage understand the problem

At this stage of understanding the problem, the results are as follows: reading reflective subject matter several times until really the problem is well understood, presents a mathematical statement orally and in writing, that reveals the unknown and to people's questions on the issue. Subject reflective create an image as a representation of the problem. Subject reflective writing down things that are known, the length of the box = 20 - 2x; box width = 20 - 2x and high box = x. It is asked is how the length, width and height of the box so that the box becomes the maximum volume. Subject reflective said that what is disclosed is already valid by looking back problems, deduce what is understood that cardboard boxes provided will be made without the lid through the procedures specified in the problem.

b. Stage make plan problem solving

At the stage of making plan problem solving, the result that is currently making plans troubleshooting reflective subjects do the following things: presenting oral statements about the formula volume box, perform mathematical manipulation verbally by saying that the conditions for obtaining the maximum volume of the box. Subject to think that what he thinks is already valid, conclude what people think that in order to obtain the maximum volume of the box, the box size should be determined in advance.

c. Stages of implementing the plan problem solving

At the stage of implementing the plan problem solving, result: presents a mathematical statement in writing, ie write the formula volume of the box, then manipulation of mathematical, which was to determine the volume of a box as multiplying the length, width and height of the box, specify the condition that the volume of the box maximum, ie the first derivative of the equation box volume is equal to zero, then lower the volume equation box, and written as V '(x) = 0. Furthermore derivative equation factoring volume of the box and the obtained value x = 10 or x = 10/3. For x = 10 obtained Volume = 0 and for x = 10/3 is obtained V = 16,000 / 27 cm3 (maximum volume). So in order to obtain maximum volume, then the length = 40/3, cm; cm width = 40/3 and 10/3 cm high. Furthermore, the subject of reflective claiming validity of what is written, and concluded that the maximum volume of the box if x = 10/3 cm and for x = 10 volume zero.

d. Phase check the troubleshooting results

At this stage re-examine the results of solving the problem, the result of analysis as follows: presenting oral statement that the results obtained are correct, because after returning mathematical manipulation, ie recalculate the answer of the given problem are in accordance with the answers obtained. Subject reflective believe that the answers given are valid. Lastly, the subject of reflective conclude that the answers obtained are correct.

3.2. Discussion

The discussion in this article is done for every phasing Polya, namely: (1) the stage of understanding the problem; (2) the stage of making plans troubleshooting; (3) the stage of implementing plans and problem solving (4) stage to re-examine the results of troubleshooting.

At the time to understand the problem, the subject impulsive reading problems is only done once, while reading reflective subject matter several times. Consequently impulsive subjects not directly understand the problem because the problem only read one, while reflective subjects can instantly understand the problem well as issues read carefully several times. Impulsive subjects were told to re-read several times until the problem is really a problem is well understood. At the time to understand the problem, the research subjects were equally present oral and written statements about what was understood at the problem. Both subjects make the picture as a representation of the problem. Subject impulsive can not check the validity of the arguments presented orally and in writing, while reflective subjects can instantly check the validity of the arguments presented. Subject impulsive can not infer the truth of a thing that is understood on the issue, while the reflective subjects can infer the truth of what is understood the problem. Reasoning skills a person at the time to understand the problem will depend on how one process and analyze information (Dornyei, 2005; Mall-Amiri and Adham, 2013). Therefore, the subject can not check the validity of the impulsive and can not conclude a what is understood. This is because the subject impulsive not careful in processing and analyzing the information obtained, being the subject of reflective otherwise.

While making plans solving the problem, both the study subjects revealed a verbal formula volume box, perform mathematical manipulation orally on condition that the maximum volume of the box. Subject impulsive can not affirm the validity of the arguments expressed, and can not conclude what has been disclosed. Instead reflective subjects can assert the validity of the arguments expressed and can be concluded from the arguments expressed. This is due to the impulsive subjects do not have a deep understanding that it can not declare the legitimacy and can not deduce an argument disclosed. Instead reflective subject has a deep understanding so as to declare the validity and conclude the arguments that have been disclosed.

When implementing troubleshooting plans, both of research subjects presenting a written statement about what people think; perform mathematical manipulation when determining the length, width, height and volume of the box; impulsive subjects can not explain every step of the solution adopted, whereas reflective subjects can be explained in a detailed breakdown of each step taken. To develop mathematical reasoning skills required mathematical communication skills. This is in accordance with the opinion of Lithner (2000), Briscoe & Stout (2001) that the communication skills is essential for the development of mathematical reasoning abilities of students. At the stage of implementing a plan troubleshooting, impulsive subjects can not assert the validity of what is written and not be able to conclude what has been written, while the reflective subject stating the validity of what is written and concluded what was written when implementing a plan troubleshooting.

At the time of re-examine the results of solving the problem, both the subject of research reveals a way to re-examine the results of troubleshooting. Subject impulsive did mathematical manipulation time to re-examine the results of solving the problem, but only trace back what has been accomplished. Subject reflective pull through mathematical manipulation of time to re-examine the results of solving the problem, namely by calculating back what has been accomplished. Subject impulsive can not affirm the validity of the results of troubleshooting. Reflective subjects can declare the validity of the results of troubleshooting. Subject impulsive can not infer the truth of problem-solving, while reflective subjects can deduce the truth of troubleshooting.

From the above discussion it is seen that way of thinking impulsive subjects are not careful, think not promote rational thinking. This is in accordance with the opinion of Goleman (2007) found that impulsive individuals tend to think not systematic, not promote rational thinking that lead to many errors in solving the problem.

In mathematical problem solving situations, require various forms of reasoning, but it really depends on the conceptual understanding and reasoning skills of the person concerned (Malloi, 1999; Lithner, 2000; Briscoe & Stout, 2001 and Gerald, 2002). This means that in problem solving situations much-needed conceptual understanding of the person concerned. Based on the characteristics of impulsive child who quickly resolve the problem, but not carefully / not careful and lead them into a low level of understanding. In contrast, children reflective of their understanding of a problem is higher because when solving problems is done very carefully and thoroughly.

4. CONCLUSION

Based on the analysis and discussion, it can be concluded:. (1) on each phasing Polya, impulsive subjects presenting oral and written statements, make the picture as a representation of the problem, it can not determine the validity of the arguments expressed or written, and could not fathom the truth of what is understood or written;. (2) at the stage of understanding the problem, reflective subjects presenting oral and written statements about what is understood the problem, set the picture as a representation of the problem, stating the validity of the arguments expressed or written and can conclude.

REFERENCES

Abdurrahman, Mulyono. (1999). *Pendidikan Bagi Anak Berkesulitan Belajar*. Jakarta, Rineka Cipta.

Anonim. (2012). Studi Pendahuluan Mahasiswa Program Pascasarjana Universitas Halu Oleo, PPS Universitas Halu Oleo, Kendari.

Briscoe, C & Stout, D. (2001). Prospective Elementary Teachers' Use of Mathematical Reasoning in Solving a Lever Mechanics Problem. School Science and Mathematics, 101(5):228-235. doi: 10.1111/j.1949-8594.2001.tb18025.x

Depdiknas. (2004). *Kurikulum Tahun 2004,* Depdiknas, Jakarta.

Dornyei, Z. (2005). *The psychology of language learner: Individual differences in second language acquisition.* NJ: Lawrence Erlbaum Associates.

Gama, Claudia, Amado. 2004. *Integrating Metacognition Instruction in Interactive Learning Environment*, D. Phil Dissertation, University of Sussex.

Gerald LM Jr 2002. *An evolutionary theory of knowledge and conceptual evolution in science.* Global Bioethics, 15(3):73-80.

Goleman, Daniel. 2007. *Emotional Intelligence: Mengapa EQ Lebih Penting daripada IQ* (Terjemahan oleh: Hermaya), Jakarta, Gramedia Pustaka Utama.

Gunhan, Berna Canturk. (2014). *A Case Study on the Investigation of Reasoning Skill in Geometry*, South African Journal of Education; 2014; 34(2) , http://www.sajournalofeducation.co.za, Diakses tanggal 12 Agustus 2016.

Heineman, Peter L. 1995. *Cognitive and Learning Style,* Boston, Allyn & Bacon.

Istiqomqh,Nurul dan Siswono, Tatag Yli Eko. (2010). *Penalaran Siswa dalam Menggambar Grafik Fungsi Trigonometri Ditinjau dari Perbedaan Kemampuan Siswa,* Jurnal Unesa, Surabaya.

Kagan, Jerome. (1965). *Impulsive and Reflektive Children Significance of Conceptual Tempo.* Dalam Krumboltz, J.D (Edt) Learning and the Educational Process. Chicago, Mc Nally & Company.

Kilpatrick J, Swafford J & Findell B (eds.). (2001). *Adding It Up: Helping Children Learn Mathematics*. National Academy Press, Washington, DC.

Kirkley, J. (2003). *Principle for Teaching Problem Solving*, Technical Paper, Plato Learning Inc.

Kusumah, Y.S. (1986). *Logika Matematika Elementer*. Tarsito, Bandung.

Lithner J. (2000). *Mathematical reasoning in task solving. Educational Studies in Mathematics,* 41(2):165-190.

Mall-Amiri, Behdokht and Adham, Leila Navid. (2013). *The Comparative Effect Cooperative and Competitive Learning on Impulsive and Reflective EFL Leaners' Writing Achievement,* International Journal of Language Learning and Applied Linguistics World (IJLLALW), Volume 4 (4), December 2013; 429-449 & ISSN (print): 2289-3245, Tehran.

Malloy CE. (1999). *Developing mathematical reasoning in the middle grades: recognizing diversity. In LV Stiff & FR Curcio (eds). Developing mathematical reasoning in Grades K-12.* Reston, VA: National Council of Teachers of Mathematics.

NCTM, (2000). *Executive summary: Principles and standards for school mathematics. Reston, VA: NCTM*. Available at http://www.nctm.org-/uploadedFiles/Math_Standards/12752_exec_pssm.pdf. Accessed 12 Agustus 2016.

Polya, G. (1973). *How To Solve It, Second Edition*, New Yersey, Princeton University Press.

Riding, RJ., Glass, A.,& Douglas, G. (1993). *Individual Differences in Thinking: Cognitive and Neurophysiological Perspectves, Special Issue: Thinking,* Educational Psychology, 13 (3 & 4), 267-279.

Rodney, L. C., Brigitte, G. V., & Barry, N. B. (2001). *An Assessment Model for a Design Approach to Technological Problem SAolving*, Journal Technology an Education, Vol 12, No. 12.

Shadiq, Fadjar. (2004). *Penalaran, Pemecahan Masalah dan Komunikasi dalam Pembelajaran Matematika,* Depdikbud. Jakarta.

Sudia, Muhammad. (2013). Profil Metakognisi Siswa Sekolah Menengah Pertama yang Bergaya Kognitif Impulsif-Reflektif dalam Memecahkan Masalah Terbuka Ditinjau dari Perbedaan Gender (Disertasi), PPS-Unesa. Surabaya.

Sudia, Muhammad, Budayasa, I Ketut, Lukito, Agung, (2014). *Profil Metakognisi Siswa yang Bergaya Kognitif Impulsisif-Reflektif dalam Memecahkan Masalah Terbuka,* Jurnal Ilmu Pendidikan, Malang

Suherman, Erman dan Winataputra (1993). *Strategi Belajar Mengajar Matematika*. Jakarta: Depdikbud.

Suherman, Erman, (2001). *Strategi Pembelajaran Matematika Kontemporer*, Bandung, Jurusan Pendidikan Matematika FMIPA UPI, Bandung

Sumarmo, Utari. (2008). *Berpikir Matematik, Apa, Mengapa, dan Bagaimana Cara Mempelajarinya.* Makalah pada Kuliah Analisis Hasil Penelitian Internasional, UPI, Bandung.

Suriasumantri, Jujun S,. (2010). *Filsafat Ilmu Sebuah Populer*. Jakarta: Sinar Harapan

Suryadi, D. (2005). *Penggunaan Pendekatan Pembelajaran Tidak Langsung serta Pendekatan Gabungan Langsung dan Tidak Langsung dalam Rangka Meningkatkan Kemampuan Berpikir Matematik Tingkat Tinggi Siswa SLTP*. PPS UPI, Bandung.