Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.8, No.34, 2017

Analysis of Problem Solving Ability in Applying *Problem Based Learning* Reviewed From the Learning Style

Supriadi Banjarnahor[1] Bornok Sinaga[2] Elvis Napitupulu[3]

1.State University of Medan (UNIMED), Jl. Willem Iskandar Psr. V, Medan 20221, Indonesia

2. Lecturer at Mathematics Department FMIPA State University of Medan, Jl. Willem Iskandar Psr. V, Medan 20221, Indonesia

3. Lecturer at Mathematics Department FMIPA State University of Medan (UNIMED), Jl. Willem Iskandar Psr. V, Medan 20221, Indonesia

* E-mail of the corresponding author: supriadibanjar21@gmail.com

Abstract
This research was a qualitative descriptive study. The Methods of data analysis used Miles and Huberman Method. The result of the research showed that: 1) students in Converger learning style could solve the problem by using Polya steps which also were able to take the right decision in solving the given problem and could use the impliat formula in question; 2) Students in Diverger learning style can solve the problem according to Polya steps because students with Diverger learning style able to connect information by themselves so it was easy in re-checking; 3) in understanding the problem of Accommodator students used the ongoing experience and trying to involve themselves in making this decision. It was caused Accommodator students were impatient in taking action without considering the logical in making a decision. Students of Accommodator were more likely to act based on their intuition / impulse; 4) students in Assimmilator learning styles solve problems by way of processing information and placing it into the logical and definite information, and in implementing the student plan with Assimilator learning style by understanding the plan that which had prepared before carrying out further action and thinking about various things in question more detail.
Keywords: *Problem solving ability, Klobs learning style, problem-based learning model*

1. 1. Introduction

Mathematics is one of the important science as a mode of logical thinking, critical, systematic, objective, critical and trained since primary education. Student math learning is prepared to cope development the increasingly sophisticated are by exercising the ability to think logically, critically, carefully, honestly, discipline and effectively. Besides, students are required to use mathematics in daily life to solve their happening problems. From the opinion it can be concluded that the importance of mathematics is taught to students because mathematics is always used in daily life, logical and critical means of thinking, a means to develop the level of creativity of students, can draw conclusions from a problem experienced and as a problem-solving tool. According to Fitri et al (2014), learning mathematics is a mental activity to understand the meaning and relationships and symbols are then applied to real situations. The purpose of studying mathematics according to BSNP (2006), so the students have the following capabilities. 1) Understanding the concepts of mathematics, explaining the interconnection of concepts and applying concepts or algorithms flexibly, accurately, efficiently, and appropriately, in problem solving; 2) Using reasoning in patterns and traits, performing mathematical manipulations in generalizing, compiling evidence, or explaining mathematical ideas and statements; 3) Solve problems that include the ability to understand problems, design mathematical models, solve models and interpret the solutions obtained; 4) Communicate ideas with symbols, tables, diagrams, or other media to clarify circumstances or problems; 5) Have an appreciation of the usefulness of mathematics in life, which has a curiosity, attention, and interest in learning mathematics, as well as a preserving and confidence in problem solving.

2. Literature

2.1. Problem Solving and Problem-Based Learning

In learning mathematics there are some thing that must be owned by students who, as revealed by Trend in International Mathematics and Science Study (NTCM) that the cognitive domain consists of four aspects, namely: 1) knowing (knowing) which includes facts, concepts and procedures that must be known by learners; 2) applying focused on the ability of learners to apply the knowledge and conceptual understanding to solve problems or answer questions; and 3) reasoning on non-routine issues, but reasoning in unfamiliar situations,

complex contexts, and multi-stage problems. Problem solving is so important so it becomes major goal of mathematics and problem solving is at the heart of mathematics, because it prioritizes the process rather than results and as the focus of school math and helps develop students' creative thinking. There are several indicators that can indicate whether a student has mathematical problem-solving skills, according to NCTM (Widjajanti, 2009: 408) are: (1) applying and adapting various approaches and strategies to solve problems; (2) solving problems that arise in the upper mathematics in other contexts mathematics; (3) building new mathematical knowledge through problem solving; and (4) monitor and reflect on the process of solving mathematical problems.

According Polya (2002: 27) there are 4 steps problem solving; (1) understand the problem, (2) plan the problem solving, (3) solve the problem according to plan, (4) re-examine the procedure and result of completion, Furthermore, the MKPBM Team (2001: 84) provided an explanation of the problem solving by Polya. The first phase is to understand the problem. Without an understanding of the given problem, students may not be able to solve the problem correctly. After students are able to understand the problem correctly, students should then be able to prepare a problem-solving plan. The ability to do the second phase is highly depend on the student's experience in solving the problem. vary their experience, there is a tendency of students to be more creative in preparing a problem solving plan. if a problem-solving plan has been established, whether in writing or not, the problem is solved based on the most appropriate plan. And the final step of the problem-solving process is checking what has been done from the first phase to the third completion phase. In this way unnecessary errors can be corrected so that the student can achieve at the correct answer according to the given problem.

To develop students problem-solving skills, teachers try the teaching learning process learning by using learning models that can provide opportunities and encourage students to learn independently. Ruseffendi (1991: 51) stated that from a group of randomly selected students will always be found students who have high, medium, and low. Differences of ability possessed by students are not merely innate, but can also be influenced by the environment. Therefore, the selection of learning environments, especially the learning model becomes very important to be considered, the choice of learning model must be able to accommodate students' heterogeneous math skills so as to maximize student learning outcomes. There are many models of learning that can be used in the effort to develop the mathematical creative thinking abilities, one model of learning that allegedly would be in line with the characteristics of mathematics and curriculum expectations prevailing at this time is a problem-based learning model This model is an approach to teaching students on authentic problems (real) so that learners can construct their own knowledge, develop high skills and inquiry, to independent the learners, and increase self confidence (Trianto, 2011: 92).

Learning by PBL model is one of student centered learning while teacher as facilitator. Savery (2006) stated that: "PBL is an instructional (and curricular) learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem". In this PBL model the students also developed their ability in high thinking level required in learning mathematics. This is corresponding with Arends (in Trianto, 2011: 92) that PBL is a learning approach where students work on problems that authentic with the intention to construct their own knowledge, develop inquiry and a higher thinking level skills, develop independence and confidence. In the PBL model proposed the main steps of learning proposed by Trianto (2011: 98) in table 1.

Table 1. Main Steps of Problem Based Learning Model

PHASE	STEP	TEACHER ACTIVITIES
1.	Orienting students to problems	• Teacher explains the purpose of learning • Describes the required logistics • Motivate students involved in selected troubleshooting activities
2.	Organize students to learn	• Teachers help students define and organize learning tasks related to the problem
3.	Guiding individual and group investigations	• Teachers encourage students to gather appropriate information, to carry out experiments, to gain clarity and problem solving
4.	Develop and present the work	• Teachers assist students in planning and preparing suitable works such as reports, videos, and models and helping them to share the task with their friends
5.	Analyze and evaluate the problem-solving process	• Teachers help students to reflect on their investigations and the processes they use

2.2. Klobs Learning Style

One that affects the success rate of students in solving problems that are about problem solving and mathematical reasoning is the learning style of the students (Learning Style). Learning styles of each student of course vary each student of course. Therefore, the teacher must also analyze the learning styles of each student

so that the information obtained by teachers can help teachers in understanding the differences of each student so that there is meaningful learning in the school environment (class). Learning style is one of the important variables and related to the way students understand lessons in school especially math lessons. Each student's learning style is different from each other. Due to different learning styles, it is important for teachers to analyze their students' learning styles to gain information that can help teachers be more sensitive in understanding the differences in the classroom and meaningful learning can take place.

Student learning styles according to Klob is based on 4 stages of learning. Most people go through these steps in the order of Concrete Experiences, Reflective Observation, Abstract Conceptualization, and Active Experimentation. This means that students have real experience, then observe and reflect on them from different points of view, then form the abstract concepts and generalize them into theories and finally which are actively experience the theories actively and test what they have learned in complex situations. Learning styles based on four stages of style consist of *Converger, Diverger, Accommodator and Assimilator* learning styles. Here is a learning style chart according to Klob's

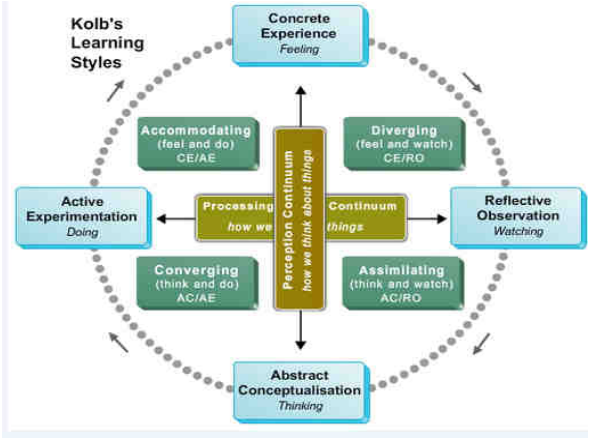

Figure 1 Learning Style Chart According to Klob's

3. Research Methods

This research was using descriptive qualitative approach. According to Moleong (2007: 6), qualitative research is a study that intends to understand what phenomena experienced by research of subjects such as behavior, perception, motivation, action, etc., holistically, and by way of description in the form of words, words and languages, to a specific, natural context and by utilizing various natural methods. Strauss & Corbin (2003: 4) suggested that qualitative research is a study whose findings are not obtained through statistical procedures or counts. To know the process of students' mathematical creative thinking, the guideline used is the creative process developed by Wallas covering four stages: 1) preparation, 2) incubation, 3) illumination, and 4) verification. In the first stage someone prepares to solve the problem by collecting relevant data, and looking for an approach to solve it. In the second stage, a person seems to break away temporarily from the problem. This stage is important as the beginning of the process of inspiration which is the starting point of a new invention or creation from the preconscious region. In the third stage, someone gets a problem solving followed by the emergence of inspiration and ideas that start and follow the emergence of new inspirations and ideas. In the last stage is the stage of someone testing and to examine the problem solving to reality. Here needed critical thinking (convergent). At this stage of verification, a person does a creative thinking followed by critical thinking.

This data collection process included the process of entering the location of the research as well as being in the location of research and collect research data. Methods of data collection was to implement learning, test students' creative thinking ability mathematically, interviews to students and teachers, observation, and documentation. The mechanism used in this research included three stages, namely (1) stages of preparation of learning tools and research instruments; (2) the stages of validation and testing of study tools and research instruments; (3) stages of the implementation of research and data analysis. Each stage is designed in such a way as to obtain valid data for the purpose of research. While the data analysis process used Miles and Huberman method includes data collection, data reduction, display data, and conclusion.

4. Research Results

4.1. Klobs Learning Style Questionnaire

Based on the results of filling questionnaires that have been done by 37 students of VII-3 the grade of SMP Brigjend Katamso Medan by using the instrument learning style questionnaire shown in Table 2

Table 2 Results of Question of Class VII-3 Learning Styles

Learning Styles	Number of Students	Percentage
Converger	6	16,21%
Diverger	14	37,83%
Accommodator	14	37,83%
Assimilator	3	8,11%

Based on table 2 above, it is found that there are students who occupy each Klob learning style. Many students were classified into 6 Converger learning styles (16.21%), the number of students classified into Diverger learning style as many as 14 students (37.83%), the number of students classified into Accommodator learning style as many as 14 students (37.83%), the number of students classified into the learning style Assimilator as many as 3 students (8.11%). This is also supported by the results of research Gohara and Sadeghib (2014) states that: *This research aimed to identify the preferred learning styles of Iranian EFL learners at an English language institute named Zaban Saraa in Sirjan, Iran. Further, the study sought to compare variance in students' final term grades with regard to the four learning style categories, namely divergers, convergers, assimilators, and accommodators. The findings show that converger learning style represent the highest proportion of the dominant 4-category learning styles preferences (62.60%), followed by assimilator learning style (17.89%), accommodator learning styles (11.38%), and diverger learning styles (8.13%). The students' inclination towards converging and assimilating learning styles implies that they prefer the practical application of opinions with little emotion,judgment and development of theories and abstract notions.*

4.2. Test Results Problem Solving

Quantitatively, the level of problem solving ability of students in class VII-3 can be seen in Table 3 below:

Table 3 Results of Student Problem-Solving Test

No	Interval Values	Number of Students	Percentage	Category Assessment
1.	$80 \leq SK \leq 100$	5	13,51%	Height
2.	$65 \leq SK < 80$	12	32,43%	Medium
3.	$0 \leq SK < 65$	20	54,06%	Low

Ket: SK = Conversion Score (Student Value)

Based on table 4.2 above can be seen that the level of problem-solving ability of students with problem-based learning model obtained that, the number of students which get the interval $80 \leq SK \leq 100$ or high rating category are as 5 people or 13.51%, which get the interval $65 \leq SK < 80$ medium rating category are as 12 people or 32.43% and who get the value interval $0 \leq SK < 65$ or low rating category are as 20 people or equal to 54.06%

4.3. Analysis of Problem Solving Ability reviewed from Converger Learning Style

Students with learning convergers style learned through *Abstract Conceptualization* and Active Experimentation. Learning through the Abstract Conceptualization stage makes the converger students having ability focus on logics, ideas, and concepts. This includes the concept of a given problem from what is known and asked to the problem and explains the problem with their own sentence. Students with a converger learning style will create a plan conceptually, sequentially and systematically in order to make them able to problem in the test item.

Learning through the Active Experimentation stage also makes students with a converger learning style having ability to perform actions and simulations related to problem solving. Students with converger learning styles learned through the abstract stage of conceptualization can and manipulate abstract symbols. In this case the meaning of the symbol is the operation that exists on the given problem and the mathematical sentence. Someone who has a converger learning style will give emphasis in terms of decision making. it can be seen from the way students learn convergers through the Abstract Conceptualization stage. Students will take other decisions in solving mathematical problems that are given to the students in learning style convergers category. Students convergers will tend to use alternative ways in solving mathematical problems when they can not use the previous methods.

It is similar to Orhun's research (2013) states that: *Convergers' dominant learning abilities are abstract conceptualization and active experimentation. They are active learners who prefer discovery type inquiry. Convergers make decisions and solve problems by using factual data particularly*. To facilitate converger students' learning, their instructors should make teaching approachiment from an objective viewpoint, which allows students to learn how to converge students to their work style so that the converger student will are check the work that has been done so they can implement the strategy chosing in solving the problem correctly. The converger student will consider everything he or she has decided in solving the problem. The converger student also re-reads the questions in the test to assure the answers he has obtained so that the answers that have been obtained are correct and right

4.4. Analysis of Problem Solving Ability reviewed from Diverger Learning Style

Students with diverger learning style learned through *Concrete Experience* and *Reflective Observation*. *Concrete Experience* is the stage where students learn through self-involvement in the learning experience of mathematics while the *Reflective Observation* is the stage where students learn through observation. Below will be explained the achievement of students with diverger learning style in solving problems. Students who learn through *Concrete Experience*, learned through what he had experienced during the learning process (Ramadan, 2011). In this research, it can be concluded that students with diverger learning styles are able to understand the problem by knowing what is known and asked on the problem and can interpret the problem given by explaining them with their own sentence.

Students with diverger learning style learned through the *Concrete Experience* stage in what they have experienced in learning process so that they can make plans by simplifying problems, creating experiments and simulations, searching for sub-objectives and sorting information. It is because in the process of learning mathematics students have been taught by teachers. Students with diverger learning style learned through the *Reflective Observation* stage so that students will focus on understanding the meaning of mathematical ideas. This allows students with diverger learning style capable to interpret the problems in mathematical sentence. If a student with a diverger learning style has been able to make the previous two stages of problem solving smoothly, then he will be able to execute the strategy during the calculation process. It is also similar to Orhun's research (2013) results that: *The diverger style was the third preferred style of our students. These are imaginative and emotional individuals. They perceive information concretely and process it reflectively. They prefer to watch rather than do, tending to gather information and use imagination to solve problems.*

In this research, students with diverger learning style only perform two indicators of the re-checking stage. The diverger students are able to reflect back on what has been done during the learning process but it is important to remember that diverger students also study with the *Concrete Experience* stage. Students in learning through the *Concrete Experience* stage, learned by involving feelings so if there are interesting things they find in learning process they will be interested in extracting information from what they observe, and vice versa. It will affect the diverger's students in re-reflecting what has been done during the learning process, thus causing diverger students to be unable to perform indicators of the re-checking stage optimally.

4.5. Analysis of Problem Solving Ability reviewed from Accommodator Learning Style

Students with *Accommodator* learning style learned through *Concrete Experience* and *Active Experimentation*. *Concrete Experience* is the stage where students learn through self-involvement in the learning experience of mathematics. *Active Experimentation* is the stage where students learn through experiments and actions in learning mathematics. Students who learn through the *Concrete Experience*, learned through experience that he experienced during the learning process. At the time in learning process the students were asked to be able to understand the problem given by knowing what is known and asked on the problem given. In this research, students who have been selected as subjects are able to understand the problem by knowing what is known and asked on the problem and can explain the problem with their own sentence.

Students with *accommodators* learning style learned through the *Active Experimentation* stage so allow them to make experiments and simulations related to problem solving. Indicators such as being able to simplify the problem, look for sub-objective, and sort information obtained through experience while following the learning of mathematics class. In this research, students *accommodators* were able to make plans in problem-solving plans by simplifying the problem, simulating, and sorting the information in the given problem.

Students with *Accommodators* learning style learned through the *Concrete Experience* stage it means that the students have already gained experience learning such as understanding the meaning of mathematical ideas so allow students able to interpret the problems in a mathematical sentence. In this reseach the chosen subject is able to create a plan by understanding the problem in the form of a mathematical sentence and do the calculation strategy.

Students with accommodators learning styles learned through the concrete experience stage, allow them to reflect back on what they have done during the lesson. This allows students in accommodator's learning style to check back all the informations and calculations in process, asked themselves that the questions have been answered. Students with an accommodator learning style are different from other learning styles for the re-checking stage not considering whether the solution were logic or not. Generally students with accommodator learning style tend to act on feelings rather than logical thinking. In general, students with accommodator learning styles are less logical and prefer feeling and intuition while learning or making decisions. It is equivalent on the research that students with accommodator learning style do not consider the solutions obtained logically so it can be concluded thay they were not maximal in the re-checking stage.

4.6. Analysis of Problem Solving Ability reviewed from Assimmilator Learning Style

Students with Assimmilator learning styles learned through *Abstract Conceptualization* and *Reflective Observation* stage. Students who learned through Abstract Conceptualization were able to focus on logics, ideas, and concepts. This allowed students with Assimilator learning styles were able to understand the concept of the

given problems from what is known and asked in the problems, as well as the concept of the problem. In this study, it is found that students with Assimilator learning styles able to understand the problem by knowing what is known and asked the problem and explain the problem with their own sentence.

Students with Assimilators learning styles usually have the ability to keep information become organized so allow students with an Assimilator learning style to sort existing information from a given problem. In this research, students with Assimilator learning styles were able to make plans by simplifying the problems, making experiments and sorting the information that exist on the given problem.

Students with an assimilator learning style were more interested in thinking than acting but students with an assimilator learning style were able to do the experiment and simulation when solving a given mathematical problem. As well as simplify the problem and find for sub-objective that need to be found first. Basically the students assimilator learned with *Abstract Conceptualization* that has an interest in things that are abstract concept. In this study, selected subjects representing the assimilator learning style able to perform the stage of making a plans with indicators simplifying the problems, creating experiments, searching for sub-objectives and sorting informations.

By learning through the *Abstract Conceptualization* stage, students with assimilator learning styles were able to manipulate abstract symbols (Richmond & Cummings, 2005). This allows students with an assimilator learning style to define the problem in the form of a mathematical sentence and analyze the ideas very carefully so they can do the strategy during the calculation process. In this research, students with assimilator learning styles were able to implement the plan by interpreting the problem in the form of a mathematical sentence and implement a strategies to solve the problems.

Learning through the Reflective Observation stage allows students with an assimilator learning style to reflect back on what has been done during the problem-solving process. Students with assimilator learning styles also learned with *Abstract Conceptualization* that allows students to be interested in the abstract concept described by the teacher during the learning process. This further maximizes the student's assimilator in re-reflecting what has been done. In this research, students with assimilator learning styles were able to perform a reexamination phase by checking all the information and calculations involved, considering the logical solution and asking themselves that the question had been answered.

5. Conclusions

Based on the results analysis of research during the learning process using problem-based learning model obtained some conclusions were the answers to the questions posed in the formulation of the problems, as follows.

a. Based on the research, from 37 students of class VII-3 obtained that 6 students had *Converger* learning style, 14 students had *Diverger* learning style, 14 students had *Accommodator* learning style, and 3 students had *Assimilator* learning style. The percentage of existence of *Converger*, *Diverger*, *Accommodator*, and *Assimilator* learning styles were 16.21%, 37.83%, 37.83%, and 8.11%, respectively. In this case students with diverger learning styles and Accommodator were more numerous than students with other learning styles.

b. Based on the research, from 37 students of grade VII-3 obtained the level of problem solving ability the number of students who obtained interval or high problem solving category were 5 students or 13.51%, which obtained interval of moderate problem solving category were 12 students or equal to 32,43 % and which get the value interval or low problem solving category were 20 students or equal to 54,06%.

c. For students with *Converger* learning styles can understand the problem by knowing what is and asked questions and can explain the problem with their own sentence. *Converger* students make plans by simplifying the problem, sorting the problem, executing the strateg's during the process and the calculation and can interpret the problem in the form of a mathematical sentence. *Converger* students are able to carry out a re-examination phase by checking all the information and calculations involved, considering the logical solution, reading the question again, and asked themselves that the question has been answered. *Converger* students are also able to take the right decision in solving the given problem and can use the formula implied in the matter.

d. For students with *Diverger* learning styles can understand the problem by knowing what is known and asked questions and explaining the problem with their own sentence. it is supported by real experience used as capital to solve the problem. Creating a plan by simplifying the problem, simulating, sorting the informations in the problem and working on the problem by observing the problem and then can determine the right plan to solve the problem. Students with Diverger learning styles implement the plan by interpreting the problems in mathematical sentences and do the calculation process with, this is obtained when students with learning styles Diverger trying to solve the problem even if the work is wrong or right. Student Diverger is able to carry out the re-examining phase by considering the logical obtained solution and read the question again because the student with the learning style of Diverger is able to relate the inside information in order to case the were re-checking process.

e. For students with *Accommodator* learning styles can understand the problem by knowing what is known and asked and explaining with their own sentence. In understanding the problems Accommodator students using the ongoing experience and trying to involve themselves in making decisions. In making the students plan with Accommodator learning style by simplifying the problem, simulating and sorting information and executing the plan by doing the calculation process but not yet correct. This is because Accommodator students less patient in doing the action without considering the logic in decision making. Students of Accommodator were more likely to act on intuition / impulse. Student Accommodator is able to do the re-examination phase by checking all the information and calculations involved by asking for help to others rather than his or her own ability.

f. For students with Assimmilator learning style understand the problems by writing down what is known and asked in the problem and can explain with their own language. it is caused because the students process the information and placing it into information that is accorater and logical. Create a plan by simplifying the problem and executing the strategy during the completion process properly and appropriately because the Assimmilator students always plan the settlement in an objective, systematic and analytical way. In implementing the student plan with the Assimilator learning style by understanding first about the plan that has been prepared before carrying out further action and thinking about the things that exist in the test. Be able to do a reexamination stage by checking all the information and counts, considering the solutions, reading back questions, and asking yourself that the question have been answered.

6. Suggestions

Research about qualitative analysis of problem solving and mathematical reasoning is an attempt to describe the quality of problem solving ability and students' mathematical reasoning in the lesson that applied with problem based learning model. Based on the results of this research, mathematics learning with problem-based learning model that is viewed from the learning style well applied to the learning activities of mathematics. The researchers suggest

a. It is expected that math teachers can create an atmosphere of problem-based learning so that students are actively involved in learning by giving the opportunity to express their ideas in their own language and manner.
b. Math teachers need to consider the learning style of students in the learning process because of learning styles one of the factors that affect problem-solving skills and mathematical reasoning
c. Teachers should provide greater opportunities for students to explore their own abilities so that at the time of discussion the group has the capital to discuss so that the discussion created more directed.
d. For related institutions, it is necessary to socialize in introducing problem-based learning model to teachers and students so the of students in particular problem solving ability and students' mathematical reasoning ability increases
e. For further researcher, this research may be used as a reference in conducting other similar research in order to obtain quality results.

References

Amri, S. (2013). *Pengembangan & Model Pembelajaran dalam Kurikulum 2013*. PT Prestasi Pustakarya. Jakarta.

Antonius. (2016) .*Peningkatan Kemampuan Pemecahan Masalah Dan Komunikasi Matematik Siswa Dengan Melalui Penerapan Pembelajaran Berbasis Masalah Di SMPNegeri 4 Medan* . Tesis. Medan : PPs Unimed. (tidak dipublikasikan)

Arends, R. (2008). *Learning to Teach Belajar untuk Mengajar Edisi Ketujuh/Buku Dua*. Terjemahan oleh Helly Prajitno Soetjipto dan SriMulyantini Soetjipto. Yogyakarta: Pustaka Belajar.

Barbara, P. (2008). *The Power of Learning Style* http://Binakreatif.blogspot.com/2008/06. Diunduh 10 September 2016

Boud, Felletti. (2000), *The Challenge of Problem Based Learning*, London :Kogan Page.

Brodie, K.(2010). *Teaching Mathematical Reasoning in Secondary School Classroom*. New York: Springer.

BSNP. (2006). *Penyusunan KTSP Kabupaten/ Kota; Panduan Penyusunan Kurikulum Tingkat Satuan Pendidikan Jenjang Pendidikan Dasar dan Menengah*. Jakarta : Departemen Pendidikan Nasional

Djamarah, S. (2012). *Psikologi Belajar*. Jakarta. PT Rineka Cipta.

Damavandi & dkk (2011).*Acedemic Achievement of Students With Different Learning Styles.* Internasional Journal of Psychological Studies. Vol 3 No.2 December 2011

Eivers. E & Clerkin, A. (2012). *PIRLS & TIMSS 2011*. Dublin: Educational Research Centre.

Hasanah. A. (2004). *Mengembangkan Kemampuan Pemahaman Dan Penalaran Matematika Siswa Sekolah Menengah Pertama Melalui Pembelajaran Berbasis Masalah Yang Menekankan Representasi*

Matematik.Tesis.Bandung : PPs UPI Bandung (tidak dipublikasikan)
Ibrahim , Nur. (2000).*Pengajaran Berdasarkan Masalah*, Surabaya: University Press
Ika dan Sufri (2014). *Analisis Penalaran Proporsional Siswa dengan Gaya Belajar Auditori dalam Menyelesaikan Soal Perbandingan pada Siswa SMP Kelas VII*. Edumatica volume 04 nomor 02, Oktober 2014
Katranci & Bozkus (2013). *Learning Style of Prospective Mathematics Teachers: Kocaeli University Case.* Procedia- Social and Behavioral Sciences 116 ,328-332
Kolb, A. Y., & Kolb, D. A. (2005b). *Learning Styles And Learning Spaces: Enhancing Experiential Learning In Higher Education*. Academy of Management Learning and Education, 4(2), 193-212.
Lither, Johan. (2012). *Learning Mathematics By Creative Or Imitative Reasoning*. Tersedia : Http:/www.icme12.org/upload/submission/1971 f.pdf.
M. Saekhan Muchith. (2008). *Pembelajaran Kontekstual*. Semarang: Rasail media Group.
Miles M.B. dan Huberman. (1984). *Complementary Methods for Research Education Change*. Washington: ARA
Mareesh K, R.D. Padmavathy. (2013). *Effectiviness of Problem based learning in mathematics Vol. II Issue-I Januari Page-45*, international Multidiscplinary e-Jurnal, www.sheeprakasahan.com
Moleong, L. (2002). *Metodologi Penelitian Kualitatif.* Bandung: PT. Remaja Rosdakarya.
Nasution, M.A. (1992). *Berbagai Pendekatan dalam Proses Belajar Mengajar*.Jakarta: Bumi Aksara.
NCTM. (2000). *Curriculum and Evaluation Standards for School Mathematics.* United States of America: The National Council of Teachers of Mathematics, Inc.
Orhum, N. (2013). *The Effects of Learning Styles on High School Students' Achievement on a Mathematics Course*. Academic Journal Vol. 8(14), pp. 1158-1165, 23 July, 2013
_____ (2012).*The Relationship Between Learning Styles And Achievement In Calculus Course For Engineering Students*. Procedia-Social and Behavioral Sciences, 47, 638 – 642.
Polya. (2002). *Metode Pembelajaran Problem Solving*
Rusman. (2009). *Model-model Pembelajaran*. Surabaya: PT.Raja Grafindo Persada
Sanjaya,W. (2011). *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana Prenada Media
Shadiq. F.(2004). *Pembelajaran Matematika cara meningkatkan kemampuan berpikir siswa*. Yogyakarta: Graha Ilmu
Sugiyono. (2011). *Metode Penelitian Kuantitatif, Kualitatif, Dan R&D*. Bandung: Penerbit Alfabeta.
Suherman, dkk. (1999). *Strategi Pembelajaran Matematika Kontemporer*. Bandung: Universitas Pendidikan Indonesia.
Sumantri, P. (1999). *Strategi Belajar Mengajar*. Jakarta:Depdikbud Dirjen Dikti.
Sumarno. U. (2014). *Penilaian Pembelajaran Matematika.* Bandung: Reflika Aditama.
Suprijono, A, (2011). *Cooperative Learning: Teori dan Aplikasi PAIKEM*,Yogyakarta: Pustaka Pelajar.
Soekadijo, R.G. (1985).*Logika Dasar. Tradisional, Simbolik, dan Induktif*. Jakarta: PT. Gramedia.
Tim MKPBM Jurusan Pendidikan Matematika. (2001). *Strategi Pembelajaran Kontemporer*. Bandung: JICA.
Tim Puspendik. (2012). *Kemampuan Matematika Siswa SMP Indonesia Menurut Benchmark Internasional TIMMS 2011*. Jakarta: Puspendik
Tulbure, C. (2012) *'Learning styles, teaching strategies and academic achievement in higher education: A cross-sectional investigation* ', Procedia - Social and Behavioral Sciences, 33, pp. 398-402
Trianto. (2010). *Mendesaian Model Pembelajaran Inovatif-Progresif*. Jakarta : Kencana
_____. (2011). *Pengantar Penelitian Pendidikan bagi Pengembangan Profesi Pendidikan dan Tenaga Pendidikan.*Jakarta : Kencana
Yamin. M. (2011). *Paradigma Baru Pembelajaran*, Jambi: Gaung Persada Press
Widjajanti, D.B. (2009) *Kemampuan Pemecahan Masalah Matematis Mahasisiwa Calon Guru Matematika: Apa dan Bagaimana Mengembangkannya.* Prosiding Seminar Nasional Matematika dan Pendidikan Matematika. 3 (2) Halaman. 402- 413.

First A. Author (Supriadi Banjarnahor, S.Pd)

Supriadi Banjarnahor was born in Sialabane, Parsingguran Village I, Pollung Sub-district, Humbang Hasundutan District, North Sumatera Province, January 21, 1991, Third Child of six brothers from Jatoman Banjarnahor and Fransiska Lumban gaol. Primary education in SD Negeri no. 173413 Pollung, Pollung Sub-district, Humbang Hasundutan District completed in 2003, continuing school to SMP Negeri 3 Pollung completed in 2006. After that continue the school in Balige East Balige High School completed in 2009.Higher education that has been taken is Mathematics Education at HKBP Nommensen University entered in 2009 and completed in 2013. In August 2015 went to the Graduate Program of Medan State University Department of Mathematics Education

and finished on December 12, 2017, with the title of thesis "Analysis of Problem Solving Abilities and Mathematical Reasoning of Students in the Application of Problem Based Learning Model in terms of Student Learning Styles in VII SMP Brigjend Katamso Medan ". Since 2015, he has taught at SMP Brigjend Katamso 1 Medan until now. On the way as a teacher the author also has several times to compete in terrain, provincial and national level, and one of them is Finalist of National Olympiad of Mathematics Learning Innovation (ONIP) 2017 which is organized by PPPPTK Matematika. The author is also active in developing mathematics tools and application of mathematics learning in the school environment. Year 2015 the author went on to study masters education mathematics State University of Medan

Second A. Author (Prof. Dr. Bornok Sinaga, M.Pd)

Prof. Dr. Bornok Sinaga, M.Pd., a professor in Mathematics Department FMIPA State University of Medan, started his education at IKIP Negeri Medan in 1984, and successfully completed his Mathematics Education study in 1989. Then, continuing S2 education at PPs IKIP Surabaya in year 1996-1999, and S3 in PPs Universitas Negeri Surabaya from 2004 to 2007, with the same department.

Third A. Author (Dr. Elvis Napitupulu, M.S)

Dr. Elvis Napitupulu, MS., Lecturer at Mathematics Department FMIPA State University of Medan