Advances in Social Sciences Research Journal – Vol.5, No.10
Publication Date: Oct. 25, 2018
DoI:10.14738/assrj.510.5264.
Saragih, D. I., Minarni, A., & Mukhtar. (2018). Differences Between Student's Mathematical Problem Solving Ability and Learning Motivation Taught By Using Geogebra-Assisted Cooperative and Contextual Learning Model. *Advances in Social Sciences Research Journal,* 5*(10)* 256-265.

Differences Between Student's Mathematical Problem Solving Ability and Learning Motivation Taught By Using Geogebra-Assisted Cooperative and Contextual Learning Model

Doni Irawan Saragih
Mathematics Education Program, Post Graduate Program.
Universitas Negeri Medan, Indonesia

Ani Minarni
Mathematics Education Program, Post Graduate Program.
Universitas Negeri Medan, Indonesia

Mukhtar
Mathematics Education Program, Post Graduate Program.
Universitas Negeri Medan, Indonesia

ABSTRACT

This research aimed to: (1) analyze the differences between student's mathematical problem solving ability taught by using GeoGebra-assisted cooperative and contextual learning model; (2) analyze the differences between student's learning motivation taught by using GeoGebra-assisted cooperative and contextual learning model; (3) analyze the process of student's answer mathematical problem solving test that taught by using Geogebra-assisted cooperative and contextual learning model. The instruments used in this research consisted of: (1) mathematical problem solving ability test, (2) learning motivation questionnaire. The data was analyzed by using Two Way Anova. This result research showed that: (1) there are differences between student's mathematical problem solving ability taught by using GeoGebra-assisted cooperative and contextual learning model, (2) there are differences between student's learning motivation taught by using GeoGebra-assisted cooperative and contextual learning model, (3) the process of student's answer taught by using contextual learning model is better than cooperative learning model.

Keywords: Mathematical problem solving ability, learning motivation

INTRODUCTION

Education is a series of communication activities, between people and students face-to-face or by using the media in order to provide assistance to the development of children as a whole, in the sense that it can develop all potentials they have, to become a responsible adult human being. This potential are physical, emotional, social, attitudes, morals, knowledge and skills.

Education is an effort carried out by family, society, and government through guidance, teaching and training activities, which takes place in school and outside school throughout life to prepare students to play a role in various types of environment constantly for the future. Of course education is the responsibility of parents towards their children and country towards its people (Saragih, 2017). And education is a series of action that encourages learning and through learning the physical and mental of students develope.

In teaching and learning activities at school, mathematics is an important lesson which is certainly required to be able to be applied in student's real life. the function of mathematics is as a media or tools for students in achieving competence. By studying mathematics material, students are expected to master a set of competencies that have been determined. Therefore, mastery of mathematical material is not the last goal of mathematics learning, but mastery of mathematical material is only a way of achieving mastery of competence, such as competence in solving mathematical problems.. On NCTM (2000), suggests that problem solving is the process of applying knowledge that has been obtained previously in new and different situations. Minarni (2017) states that when students are solving of mathematical problem, they are building other mathematical skills such as understanding ability, mathematical representation ability, etc.

The results of TIMSS 2015 for secondary schools showed that Indonesia scored 397 and was ranked 46 of 51 countries, it means that they were only be able to answer 4% of the questions correctly. And based on the PISA 2015, Indonesia scored 386 and was ranked 69 of 76 countries. The TIMSS and PISA results illustrate that Indonesian student's mathematical problem solving ability that involves knowledge, application and reasoning are still very low at the international level.

Based on the diagnostic tests given, it can be concluded that students still have low mathematical problem solving ability, especially in the second step, that is devising a plan to solve problems and in the fourth step, that is looking back for the proposed problem. This is in accordance with Minarni's study (2017), which stated that in determining the mathematical model, students can do it well, and students face difficulties in the aspect of planning a solution and explaining the solution to the problem posed. Eviyanti, Surya, & Syahputra (2017) said the same result that student's ability in looking back gotten is 40,22 % and include in less-good category. In addition, it is mentioned that constructivism based model such as problem-based learning can develop mathematical understanding ability and mathematical representation ability which is a component of mathematical problem solving ability of junior high school students (Minarni & Napitupulu, 2016). Cooperative learning and contextual learning models are also based on constructivism that can be expected to improve cognitive aspects such as problem solving ability (Arends, 2004).

Another important thing in learning is the affective aspect, for example the motivational aspect. Motivation is one of the factors that helps to determine the effectiveness and success of learning, because students will study seriously if they have high motivation (Nayazik, 2012). Based on observations and interviews with mathematics subject teachers at Budi Agung Medan Junior High School, student's learning motivation, especially in grade VIII, was still in the low category.

On the other hand, the use of Information and Communication Technology (ICT) in education since the technology existed, and used extensively since the early 1980s (Darmawijoyo, 2011). Meanwhile, the use of technology in learning process, including computer technology and software can improve student's ability in doing mathematics (Agyei & Voogt, J, 2010). However, the use of software that can help the learning activities of mathematics in SMP Budi Agung Medan also not maximal. Meanwhile, in other schools, Information and Communication Technology (ICT) has been used in education since the beginning of the technology discovered, and used heavily since the early 1980 (Becta, 2003). So, the use of Geogebra software is an important thing to be applied in teaching and learning activities. Thus, the use of GeoGebra software is important to be applied in teaching and learning activities. And the use of GeoGebra is effective for modeling learning strategies for improvement and change in teacher's pedagogy

(Escuder and Furner, 2012). Another opinion suggests that students have a positive perception of learning and have better learning achievements using Geogebra (Zengin, 2012). Then, we can expect that Geogebra-assisted learning model could improve student's mathematical problem solving ability.

THEORETICAL BACKGROUND

According to Bell (1978), the problem for someone is not necessarily a problem for others. Problems can be felt or realized by someone who cares about an interesting phenomenon Problem is something to be solved even though it is complex, has no procedures and requires some strategies to solve it. Meanwhile, NCTM (In Picus, 1983) said that problem solving is "the process of applying previously acquired knowledge to new and unfamiliar situations". Whenever someone is in a problem solving, he will follow some steps to attain the solution. Four steps in problem solving proposed by Polya (1987), as follow:

1. Understanding the problem
2. Devising a plan
3. Carrying out the plan
4. Looking back

As an analogy, mathematical problem solving is the process of applying previously acquired mathematical knowledge to new and unfamiliar problems. Through the process of solving math problems, intelligence of the student will become sharp as well as his tenacity. Geogebra-assisted cooperative learning and geogebra-assisted contextual learning are learning models that used Geogebra software as an aid in learning mathematics in order the students more understand the abstract concept of mathematics. Geogebra-assisted learning model has been successful in improving mathematical-concept understanding of junior high school students. Mathematical concept understanding is an important role in problem solving (Minarni, 2017). Related to contextual learning, Duff (2012) in his research entitled "Cooperative Learning vs. Direct Instruction: Using two Instructional Models to Determine their Impact on Student Learning in the Middle School Math Classroom", that the lessons taught by using cooperative learning model were more enjoyable and students could connect material with their own lives.

RESEARCH METHOD

This study was categorized in a quasi-experiment study. Population in this study are all students in grade VIII of Budi Agung Medan Junior High School Academic Year 2017/2018 and the samples are students in class $VIII^4$ (as experiment class I) and students in class $VIII^1$ (as experiment class II). In the experiment class I applied Geogebra assisted cooperative learning model, while in the experiment class II applied Geogebra assisted contextual learning model. The research design used in this study is the Pretest Posttest Control Group Design

Before cooperative learning model and contextual learning model are applied, the teacher first gave diagnostic tests to see student's mathematical prior ability (PMA). When the learning model was applied, students were given a Student Activity Sheet (SAS) to be discussed in groups according to the teacher's instructions. The existence of responsibility and recognition in cooperative learning model made students more enthusiastic and motivated in completing SAS and in discussion groups. The difference of the two models is cooperative learning confuses team work in a group along teaching learning activity, while contextual learning gives more attention to mathematical problems used in the classroom, problems are designed based on appropriate context, rich context and meaningful. Data processing started by test the necessary statistical prerequisites, namely normality test and homogeneity test. Next, used The Two Way Anova throuh computer program SPSS version 22.

RESULT AND DISCUSSION

Data analysis consisted of analysis of mathematical problem solving ability, and analysis of learning motivation.

Description of Student's Prior Mathematical Ability (PMA)

Prior mathematical ability (PMA) is knowledge that students have before learning takes place. PMA is the foundation as a basic capital to form of new concepts in learning. The provision of diagnostic tests is something that is conducted to find out student's PMA who are high, medium, and low, which then the data would be used in the distribution of student discussion groups, and to find out the similarity of the average PMA of the two experiment classes. The following are the results of the calculation of average and standard deviations PMA as shown in Diagram 1:

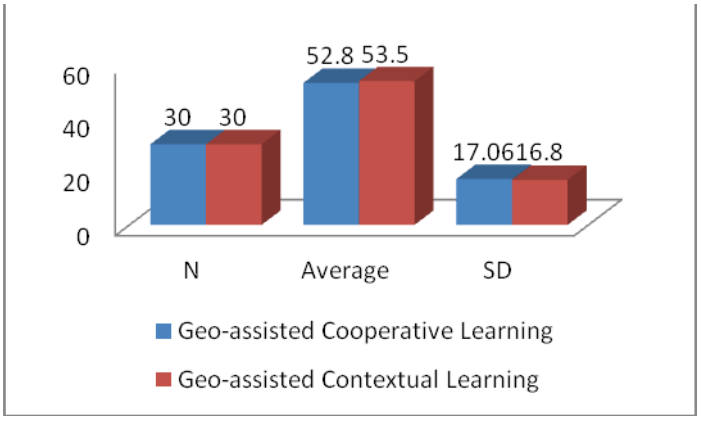

Diagram 1. Average and Standard Deviation of PMA

It appears in Diagram 1 that students MIA in both classes are the same. This shows that students in both experiment classes have a homogeneous mathematical initial ability. The average similarity test results for PMA shown in Tabel 1:

Table 1. Average Similarity Test Results for PMA Data

Class	N	Variance (s^2)	s^2_{gab}	t_{count}	Df	t_{table}
Experiment I	30	291,2	16,933	-0,620	58	2,002
Experiment II	30	282,259				

Based on the table above, it can be seen that the value of t_{count} is between -2,002 and 2,002, which is -2,002 ≤ - 0,620 ≤ 2,002. Thus, Ho is accepted, and it can be concluded that there is no difference between student's prior mathematical ability (PMA) in experiment class I and experiment class II. It means, Geogebra-assisted Learning approach can be implemented in the two homogeneous classroom. So, the students start at the same PMA position.

Description of Student's Mathematical Problem Solving Ability (MPSA)

Post test is given to determine student's mathematical problem solving ability after being given treatment. The description of the student's mathematical problem solving ability post test is shown in the following Diagram 2:

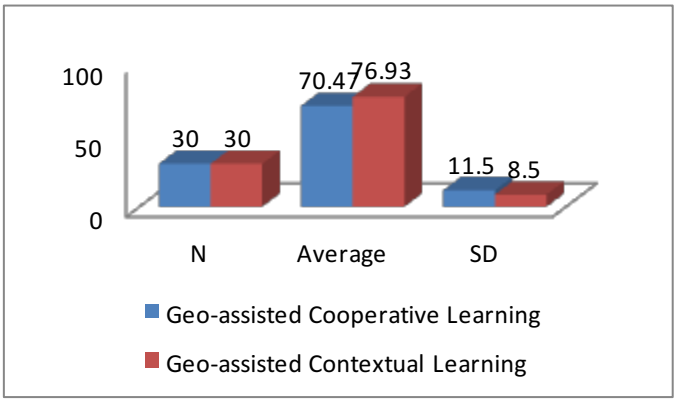

Diagram 2. Average and Standard Deviation of MPSA

Diagram 2 shows that student's mathematical problem-solving ability in both experiment classes after treatment were found to be homogeneous with each high score of 70.47 and 76.93.

The following diagram of average score of post test based on the steps of problem solving ability:

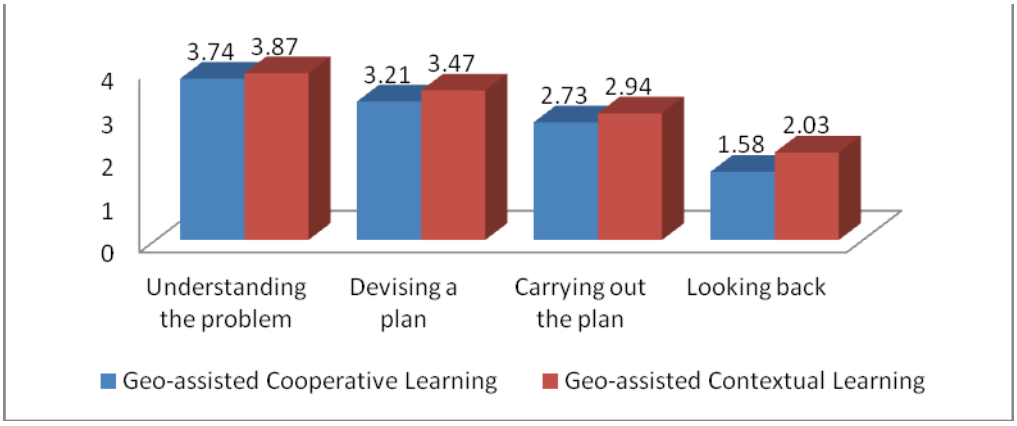

Diagram 3. Average Score of Post Test Based on The Steps of Problem Solving Ability

Description of Student's Learning Motivation

Student's questionnaire learning motivation was used to see student's motivation to learn after being given the treatment of the application of learning model. The description of the results of student's learning motivation after being given treatment is presented in the following Tabel 2:

Tabel 2. Average and Standard Deviation of Student's Learning Motivation

Class	Ideal Score	N	Mean	SD
Geo-assisted Cooperative Learning	100	30	82,37	2,684
Geo-assisted Contextual Learning			80,70	3,261

Tabel 2 shows that student's learning motivation in both of experiment classes after treatment were found to be homogeneous with each average score of 82,37 (Geo-assisted Cooperative Learning) and 80,70 (Geo-assisted Contextual Learning). The average score of student's motivation learning after being given treatment based on each indicator of learning motivation can be seen in the following Tabel 3:

Tabel 3. Student's Learning Motivation Based on Learning Motivation Indicators

No	Indicator	Average Score	
		Experiment I	Experiment II
1	Success and desire	75,8	83,1
2	Encouragement and need in learning	81,4	80,8
3	Student's attention in learning	83,8	83,8
4	Student's confidence in their own ability to finish tasks given	81,5	70,4
5	Doing interesting activities in learning	86,9	83,5
6	Student's satisfaction obout the learning process	81,8	80,3

RESULT OF ANALYSIS

The first hypothesis is that there is a difference of MPSA among students in experiment class I with students in experiment class II. The second hypothesis is that there is a difference of learning motivation among students in experimental class I with students in experiment class II. The testing criteria to test the hypothesis is if the significance value is < 0.05 (sig. < 0.05) then rejects Ho and if the significance value is > 0.05 (sig. > 0.05) then rejects Ha. The results of hypothesis testing by using Two Way Anova through SPSS are described in the following Table 4:

Table 4. Result of Hypothese 1

Tests of Between-Subjects Effects					
Dependent Variable:MPSA					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1206.401[a]	3	402.134	4.217	.009
Intercept	326446.608	1	326446.608	3.423E3	.000
Gender	178.171	1	178.171	1.868	.177
Learning Approach	571.401	1	571.401	5.992	.018
Gender * Learning Approach	402.153	1	402.153	4.217	.045
Error	5340.199	56	95.361		
Total	332448.000	60			
Corrected Total	6546.600	59			
a. R Squared = .184 (Adjusted R Squared = .141)					

Based on the table above, it can be seen that the significance value for the learning model is 0,018 (sig. < 0.05), it means that there is a significant difference between student's mathematical problem solving ability in cooperative learning model class and in contextual learning model class, thus reject Ho and accept Ha. It shows that there are differences between student's mathematical problem solving ability taught by using geogebra-assisted cooperative learning model and contextual learning model.

Cooperative learning model is a teaching and learning strategy that emphasizes on student's attitudes/behaviors in working or helping among others in the structure of regular collaboration in groups, consisting of 2 or more students to solve problems that prioritize cooperation in solving problems to apply their knowledge and ability in order to achieve learning goals so that student's academic learning outcomes are increasing and students can receive a variety of diversity from their friends, and obtain social skills development. This is supported by Vygotsky's learning theory which focuses on the relationship dialectical between individuals and society in the formation of their knowledge. Focusing on sociocultural aspects of learning, such as social interaction through dialogue and verbal communication with adults because there are mutual influences between language and action in social conditions (Slavin,

2006). Vygotsky viewed that language as central to the learning process (Oakley, 2004). The existence of social interaction with peers (peer tutors) or even with the teacher, will affect student's communication ability in learning. Thus, the existence of social interaction between students in a group or other groups and responsibility in groups and equipped with teachers who act as motivators, facilitators and moderators will enable more quality discussion and more effective learning.

Top of Form

Bottom of Form

Besides that, the meaningful learning theory from Ausubel and constructivism learning theory are also theories that strengthen cooperative learning model. Constructivism learning theory considers that in the teaching and learning process, the acquisition of knowledge begins with the occurrence of cognitive conflict. Bell (1978) states that this cognitive conflict can only be overcome through self-regulation. At the end of the learning process, knowledge will be built by children through their experiences from the interaction in their environment. Meaningful learning theory from Ausubel emphasizes the importance of students to associate experiences, phenomena, and new facts into their cognitive structure. Both of the theory emphasize the importance of experience assimilation into the cognitive structure and emphasize that the learning process is the way for students to be active leraners.

In addition, the contextual learning model is an approach that emphasizes the whole process of student's involvement to be able to find material that is learned and relate it to real life situations, thus encourages students to be able to apply it in their daily lives. The contextual learning model is closely related to daily life (personal, social and cultural context) so that students have the knowledge/skills that can be flexibly applied from one problem to another. Thus, learning outcomes are expected to be more meaningful for students. The learning process takes place more naturally in the form of student's activities working and experiencing, not merely the transfer of knowledge from teacher to student. Therefore, the role of the teacher is not only as a conveyer of information but also as a facilitator, as a mediator, as a companion and also as a student colleague in finding student's knowledge.

The contextual learning model with its components is a learning model that is supported by many learning theories. The constructivism theory, which emphasizes the importance of students building or contradicting their own knowledge, Dewey's learning theory of the importance of asking and reflecting in learning. Piaget's learning theory about the importance of authentic and learning assessment by discovering student's own knowledge during the learning process, Ausubel's learning theory which emphasizes the importance of meaningful learning, Bruner's learning theory which also emphasizes the importance of learning discovery, Vygotsky's learning theory, Piaget and Bruner's theory about the importance of learning in groups.

Contextual learning in this research give positive ieffect to MPSA because student's MPSA improved after implementing this learning model. It is in accordance with a statement from Duff (2012) that, in general the lessons taught by cooperative learning are more fun and students can connect the material with their own lives. Teaching and learning activities during the middle of learning and practice tests also reflect student's learning environments on cooperative learning more allow students to get a chance to understand the material learned.
The result of student's learning motivation shown in Table 5:

Table 5. Result of Hypothese 2

Tests of Between-Subjects Effects					
Dependent Variable:Motivasi					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	159.988[a]	3	53.329	7.486	.000
Intercept	397882.672	1	397882.672	5.585E4	.000
Gender	42.740	1	42.740	5.999	.017
Model	40.658	1	40.658	5.707	.020
Gender * Model	75.328	1	75.328	10.574	.002
Error	398.945	56	7.124		
Total	399420.000	60			
Corrected Total	558.933	59			
a. R Squared = .286 (Adjusted R Squared = .248)					

Based on the table above, it can be seen that the significance value for the learning model is 0,020 (sig. < 0,05), it means that there is a significant difference between student's learning motivation in cooperative learning model class and in contextual learning model class, thus reject Ho and accept Ha. It shows that there are differences between student's learning motivation taught by using geogebra-assisted cooperative learning model and contextual learning model. In students 'learning motivation, after being given treatment, student's learning motivation with cooperative learning models is higher than students who learn with contextual learning models. This is shown by the average score of student learning motivation after being given treatment in experiment class I of 82.37, while in experiment class II it was 80,70.

In cooperative learning model, students are required to cooperate in solving the problems given. The sense of mutual responsibility in the discussion group made students more active to ask, answer, share, and communicate in groups of each and between groups. The positive effect of the learning model made student's learning motivation better. It is in accordance with the statement from Bettice (2012) that in learning process students are motivated by their own internal goals and positive external integration.

In contextual learning model, students are more focused on student's learning activities in finding and understanding the concepts of mathematical problem solving. Coupled with student's learning experiences in the real world, supporting students to do more activities in learning groups supported by their respective learning experiences. It makes student's learning motivation in cooperative learning model class more optimal than the contextual learning model class.

Further research result of the process of student's answer of mathematical problem solving test, classification of students that had good category can be seen in Table 6 below.

Table 6. Number of Students Get "Good" Category

No. Soal	Experiment I				Experiment II			
	T.I	T.II	T.III	T.IV	T.I	T.II	T.III	T.IV
1	16	5	2	5	18	9	1	6
2	19	20	11	5	22	21	16	15
3	20	16	5	8	22	21	13	10
4	15	4	2	4	23	4	4	5

Explanation: T.I : Understand the problem
T.II : Devising a plan
T.III : Carrying out the plan
T.IV : Looking back

Based on the data in Table 6, it is explained that the number of students in both categories in experiment class II is more than experiment class I at each step of problem solving. In cooperative learning model, most students are able to follow the learning process. That is, the available steps can be reached by students who have low, medium and high prior mathematical ability. Through a process of teacher guidance and collaboration between students in groups, students become more confident to succeed in their learning assignments. Meanwhile, in contextual learning model, active learning activities are dominated by students with high prior mathematical ability, while students with medium and low prior mathematical ability tend to follow the direction of more than group friends who are considered more capable. The process of finding in this learning model makes students more active for reasoning and high-level thinking. Thus making students understand problem solving by accompanying step by step. It makes the process of student's answer in contextual learning model better than in cooperative learning model.

CONCLUSION

Based on the results of data analysis on student's mathematical problem solving ability, the researchers obtained some conclusions as follows:

1. There are differences between student's mathematical problem solving ability taught by using GeoGebra-assisted cooperative and contextual learning model.
2. There are differences between student's learning motivation taught by using GeoGebra-assisted cooperative and contextual learning model
3. The process of student's answer taught by using contextual learning model is better than cooperative learning model.

SUGGESTION

Based on the conclusions that have been described above, the authors proposed some suggestions as follows:

1. Teacher should use cooperative learning model as an alternative in teaching and learning activities to increase student's learning motivation while contextual learning model should be used as an alternative in teaching and learning activities to increase student's mathematical problem solving ability.
2. Teachers are expected to improve paedagogic ability and add insight into innovative learning model and integrate ICT in learning.
3. The next researcher should undertake further research with more samples and include several schools in several different areas.
4. The researcher should then examine other variables such as reasoning and communication, mathematical connections, mathematical communication, and mathematical understanding ability.

References

Agyei, D. & Voogt, J. (2010). ICT use in the teaching of mathematics: Implications professional development of pre-service teachers in Ghana. *openjournalaccess@springer.com*.

Arends, R.I. (2004). *Learning to Teach*, *6th Edition*. Boston: McGraw Hill.

Becta (2003). What the Research Says about ICT and Motivation. Available online at www. Becta.org.uk/research.

Bell, F., H. (1978). *Teaching and Learning Mathematics* (*In Secondary School*). Pittsburgh: Wm.C.Brown Co. Publisher.

Bettice, K. 2012. Motivating Students in the High School Mathematics Classroom. *Education Senior Action Reasearch Projects*. Pp: 2.

Darmawijoyo. 2011. Pembelajaran Matematika Berbasis Web. *Jurnal Sistem Informasi (JSI),* Vol. 3 No. 1 Pp. 294-303

Dornyei, Z. 2001. *Teaching and Researching Motivation*. Pearson Education Limited: Edinburgh Gate.

Duff, J. 2012. Cooperative Learning vs. Direct Instruction: Using two Instructional Models to Determine their Impact on Student Learning in a Middle School Math Classroom. *Education Senior Action Research Projects.* Valparaiso University. Pp. 1-4

Escuder, A. & Furner, J. M. 2012. The Impact of Geogebra in Math Teachers' Professional Development. *Florida Atlantic University.* Pp: 76-84

Eviyanti, C.Y., Surya, E. & Syahputra, E. 2017. An Analysis of Students" Problem Solving Ability on Opportunities Material in IX Grade SMPN 6 Langsa. *Journal of Education and Pracice.* Vol.8, No.24 Pp. 176-182

Minarni, A. 2017. On Eight Grade Students Understanding in Solving Mathematical Problems. *Asian Social Science.* Vol. 13 No. 12 Pp: 86-96. DOI. 105539/ass.v13n12p86.

Minarni, A., and Napitupulu, E. E. 2017. Developing Learning materials based on Joyful PBL to Improve Students Mathematical Representation Ability. *International Education Studies*, Vol. 10 No. 8 Pp 33-38. DOI. 105539/ies.v10n9p23.

Nayazik, A. 2012. Pembelajaran Matematika dengan Mengintegrasikan HOM (History Of Mathematics) Untuk Meningkatkan Motivasi Belajar. *Prosiding Pendidikan Matematika UNY*. Hal: 1-8

Oakley, L. 2004. *Cognitive Development*. London: Routledge.

Picus, L. 1983. Teaching Problem Solving: A Research Syntesis. *ERIC Journal*. Pp: 1-35

Polya. 1987. *How to Solve It A New Aspect of Mathematical Method.* Princeton University Press.

Saragih, D. I. & Surya, E. 2017. Analysis the Effectiveness of Mathematics Learning Using Contextual Learning Model. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*.Vol. 34. No 1. Pp 135-143

Slavin, R. (2006). *Educational psychology* (8th ed.). Boston: Pearson/Allyn & Bacon.

Zengin, Y., *et.al*. (2012). The Effect of Dynamic Mathematics Software Geogebra on Student Achievement in Teaching of Trigonometry. *Procedia-Social and Behavioural Sciences*: Vol. 31, pp. 183-187