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THE EFFECT OF IMPLEMENTATION REASONING AND PROBLEM SOLVING (MP3M) APPLICATION MODEL THROUGH GEOGEBRA TOWARD MATEMATICS PROBLEM SOLVING AND LEARNING MOTIVATION OF VIII STUDENT SMP NEGERI 3 GIANYAR

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ABSTRACT

This study aimed to (1) to investigate whether MP3M through Geogebra had positive effect toward students's problem-solving and motivation to learn mathematics (2) to investigate whether MP3M through Geogebra had positive effect toward students's mathematics problem solving (3) to investigate whether MP3M through Geogebra had positive effect on students motivation to learn mathematics. This research was experimental research who implemented *post-test only control group design* that the population was consisted of 10 classess and chose 2 classess radomly as sample. The experimental research was the implementation of MP3M toward Geogbra which was done for 8 meetings. The data were the mathematical problem solving that was collected with the description test and the student mathematics learning motivation that was collected in the form of a questionnaire. The data were analyzed using Manova test with a significance level of 5%. The experimental result showed that, (1) the ability of students' problem solving and mathematics learning motivation who was taught by MP3M through Geogebra significantly better rather than the ability of students' problem-solving and mathematics learning motivation, the ability of students' mathematics problem solving, and the students mathematics learning motivation who was taught by the conventional learning

KEYWORDS: MP3M, Geogebra, Mathematics Problem Solving, Mathematics Learning Motivation.

1. INTRODUCTION

The development of technology in this era has many benefits that should really be used optimally one of them is the development of education. Do not let the existing of the development of technology is only used for the useless thing. In this case, computers, laptops, phones, tablets, smartphones, and similar technology are already common in the community; moreover it is not used to improve the quality of learning in schools. According to Kusairi (in Husamah, 2014) stated that development of ICT that has many benefits who have not been used optimally in the learning process so that the impact of ICT is less tangible.

In mathematics course, technology-based learning is necessary considered to support the learning process. In this case, mathematics is a lesson that has influence to various aspects such as economic, social, technological, educational, and others. Ritu Saxena (2016) states that mathematics is not just a subject but a language with a few symbols and a different relationship, furthermore there are some important aspects that are considered in teaching mathematics such as, students, teachers, curriculum, strategies and techniques. The development of mathematics is based on the process of thinking logically and systematically. Because of the role of mathematics in contributing to the development and advancement of education, that mathematics is taught in all levels of education from elementary school to university. in fact, according to (National Research Council, 1989) states that "Mathematics is the key to opportunity". Because the importance of mathematics, mathematics course should be able to packed and interesting to be able to enhance the students' understanding of mathematical concepts.

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Based on Law No. 20 Year 2003 Article 37 about the National Education System, the curriculum of primary and secondary education must include mathematics as one of the subjects. Isaac Benning (2018) stated that the curriculum suggested the use of technology to mediate constructivist teaching and learning, besides the students are guided to use the tools to explore mathematical concepts that will be used to solve a problem in relational. The implementation of learning mathematics is not just deliver the material in the form of numbers and formulas, not just memorizing formulas and solving problems, but mathematics is implemented to train students for improving the ability of mathematics problem-solving.

The mathematical problem solving is the ability of students to solve problems that are not routine in which a solution can not be directly searched but students need a reasoning process, suspect or predict, finding for a simple formula to find a solution. By Polya (in Hobri, 2020), the settlement of the problem is an attempt to find a solution and to achieve that goal is not reached soon. Problem solving is considered a "level of the most complex of cognitive activity that operates at the same time called all the intellectual part of individuals including memory, perception, reasoning, conceptualization, language, emotion, motivation, confidence, and ability to control the situation" (Caprioara, 2015). Based on these two statements, it could be concluded that solving the problem is the level of individual cognitive most complex activities that require effort to resolve problems involving all the individual parts of the intellectual, the memory, perception, reasoning, conceptualization, language, emotion, motivation, self-confidence, and the ability to control the situation. Now the problems faced by student are more complex than previously required the student's ability to solve complex problems. In solving complex problems, students must connect the previous concepts that has been learned to solve the problem. The teacher's role is very important in improving the complex problem-solving skill, the teacher role is very important. Teacher must be able to guide student to achieve a high level of competence through the development of divergent and critical thinking skill, furthermore to give student a higher level tasks that require students to think differently, critical, and creative.

But the fact is not suitable with the expectations, student in Indonesia shows that the ability of problem solving is not achieved. The result of international result showed that the quality of education in Indonesia is still low problem-solving ability; the assessment by PISA one of survey organization. PISA (Program for International Student Assessment) under the auspices of the OECD (Organization of Economic Cooperation and Development) conducted a survey on the ability of students and the education system. Al Humaira (2014) stated that the mathematical skills of students in Indonesia was ranked 64 of 65 countries or second bottom position with a score of 375 according to the last survey conducted in 2012 PISA and released at the beginning of the week in December 2013. The survey showed how the competitiveness of education in Indonesia is still low compared with other countries in the world, especially when seen from a mathematical ability possessed by Indonesian students. The research results of the TIMSS (Trends in International Mathematics and Science Study) 2015, which aimed to measure students' mathematic and science achievement over the world showed the results were not much different. Indonesian student ranks low that the scale average (397), far below Malaysia (440) and Thailand (427) in the ability to (1) understand complex information (understanding the concept), (2) theory, analysis and problem solving, (3) use the tools, procedures and problem solving, and (4) an investigation (Kemendikbud, 2015).

Based on aforementioned statement above, the educator would have to try the student to achieve the maximum result in mastering mathematics problem-solving ability. Many ways can be done, one of them by providing appropriate learning model for students. According Balim (2009: 2), the learning model that corresponds to a constructivist approach that makes student more effectively by building their own knowledge need to be used. One of learning model based on constructivism is a Learning Model Reasoning and Problem Solving which is abbreviated as MP3M (Santyasa, 2004). MP3M is a learning model that can increase student' reasoning power so that they develop the creativity to think that can make the student is trained to think logically, critically (Suryawan, 2014).

MP3M is implemented through group learning systems so that the communication between students and students, students and teachers can be occured. The dominance of teachers in learning activities can be reduced and the student tries to learn to find the concept/the subject matter independently. The learning model of reasoning and problem solving consists of five stages, such as: (1) Reading and thinking, (2) Exploration and

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planning, (3) Selecting Strategies, (4) Find your answers, (5) Reflection and expansion. MP3M is applied very relevant in an effort to foster aspects of indicators of student problem solving. It is also supported by some relevant research results one of them: 1) The results I Putu Pasek Suryawan (2012) in which the Development of Mathematics Learning Tools For Learning Model Reasoning and Problem Solving (MP3M) Open Problem Oriented able to increase the activity and student achievement of class VII. 2) The results Ni Wayan Suarsini, et al (2013) in which MP3M has been able to make a positive contribution in improving students' mathematics learning outcomes. 3) The results Annajmi (2016) which stated that through guided discovery method through Geogebra software is able to improve the understanding of the mathematical concept of junior high school student. 4) The resultof Hesti Cahyani (2016) stated that the enhacement of problem solving ability was important to face Asean economic challenges. 5) The result of Yupi Ayu (2017), stated that mathematic learning motivation was needed to increase student' enthusiasm in learning mathematics.

Related to this matter, essentially learning is a process of interaction, which is a process of construction the knowledge gained from the source through the channel or media messages specific to the recipient of the message. The use of the media also allows for more effective learning process between teacher and students. One of the media that helps student to study is Geogebra. MP3M is selected as the new integrated combination with Geogebra and is expected to increase students' mathematical problem solving ability and motivation of students. MP3M if applied aided Geogebra give ample opportunity for students to increase their knowledge by exploring the material. The implementation of MP3M through Geogebra will help to facilitate student in constructing a subject matter so that what is learned will be deemed easier to visualize. The availability of Geogebra as media in the lesson will be a positive influence on students' mathematical problem-solving skill as well as meeting in the class which is more focused to solve the problems related to the material will certainly affect the ability of mathematics problem-solving and student' motivation to learn mathematics. Besides, the motivation to learn mathematics is very important for students and teacher because it causes to change student behavior to interact and participate in mathematic learning activities to achieve certain goals. If the motivation is realized by the offender, it is a task of learning to be done properly. Therefore, teacher should try to build student motivation to learn mathematics. Based on these explanations, alleged that the implementation of MP3M through Geogebra has a tendency to be better effect rather than conventional learning toward mathematical problem solving ability.

2 MATERIALS AND METHODS

2.1

2.2 Materials

A. MP3M

MP3M is an alternative of innovative learning model that is developed based on constructivist paradigm (Santyasa, 2004). The essence of the learning model is the reorientation of learning from teacher-centered to be student-centered. MP3M provides the opportunity of empowering the potential thinking in the activities of problem-solving and decision-making in the context of complex real life. Krulik and Rudnick (1996) stated that MP3M is a learning model that was built by the concepts: (1) problem, (2) problem solving, and (3) reasoning.

Problem is a situation in which there is no clear way to solve that confronts individuals or groups to find answer. Troubleshooting is an individual or group attempts to find answer based on knowledge, understanding, skill that have been held previously in order to meet the demands of the unnormal situation (Krulik& Rudnick, 1996). So, the problem-solving activity begins with confrontation and ended when an answer has been obtained in accordance with the conditions of the problem (Santyasa, 2004). Through problem-solving activity, student will be trained to develop reasoning skill (Yonathan, 2006).

According to Joyce and Weil (1986), a learning model has five basic elements, such as: (1) The syntax is the operational steps of learning process, (2) social system is the situation and norms in learning, (3) The principle of the reaction is describing how should teacher looks, treats, and responds to students, (4) The support system is all the means, materials, tools, or a learning environment that supports learning, and (5) The impact of instructional and impact accompanist, the learning results obtained directly by destination to be achieved (impact instructional) and learning outcomes beyond the goals to be achieved (impact accompanist). The learning model of reasoning and problem solving that has five basic elements. The model consists of 5 stages

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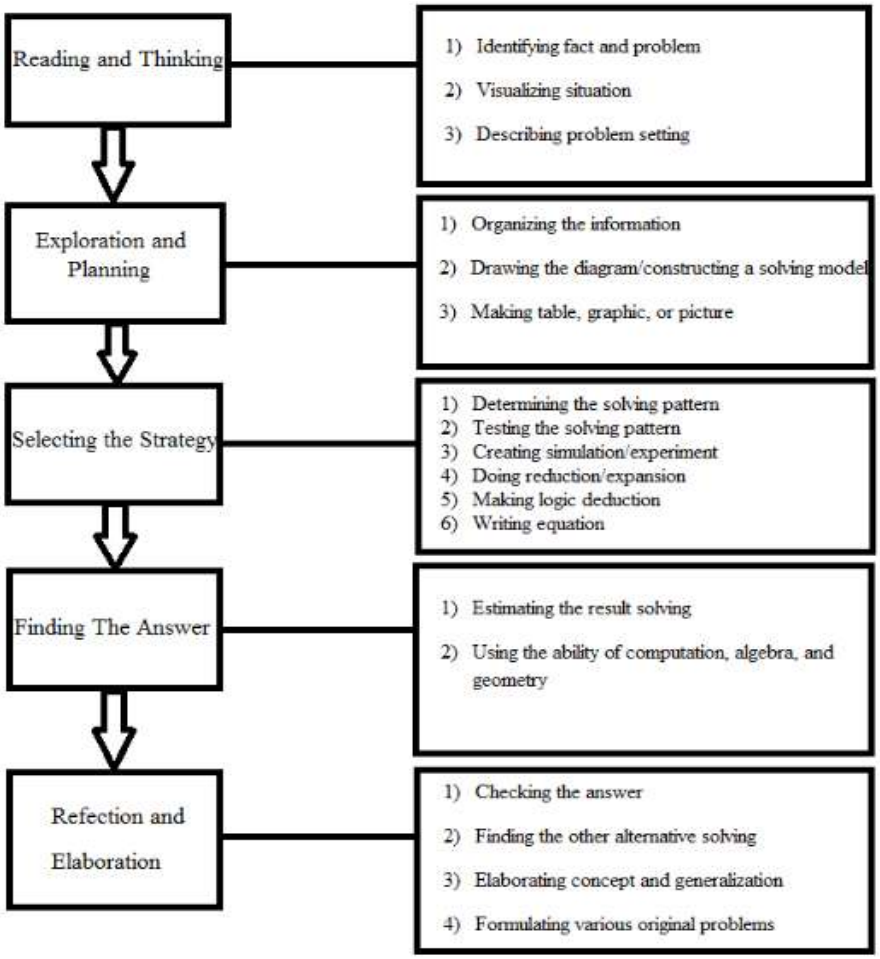
are: (1) Reading and thinking, (2) Exploration and planning, (3) Selecting the strategy, (4) Findingf the answer, and (5) The reflection and elaboration.



(Modified from Krulik and Rudnick, 1996)

Figure 1. Syntax MP3M

Based on the syntax, it appears that students will be positioned as a searcher of knowledge; it means that they are actively involved to solve the problem. By getting used of students using systematic steps in solving the problem, is expected to help student to face the difficulties in learning mathematics.

It is accordance with the opinion of the Markles's in Robbins (2011: 5) which stated that: "the student Learns what the student does", with emphasis learning activity of students or student-centered then learning will be more meaningful and more easily understood. By implementing the learning process based on the syntax above, it can be seen that the learning process of the students will be trained to solve problem.

B.Geogebra

In this case, the use of computer in learning mathematics is more relevant, because of the characteristics that is possessed by mathematics it self. Which side of the object of study in mathematics is abstract while on the other hand, student has not been able to think abstractly. So, the instructional media has an important role in bridging the gap. In this case, the computer has function as a learning media that can deliver a visual experience to the student to interact with mathematics objects. It can encourage student mathematics learning motivation because it can clarify and facilitate the understanding of abstract mathematics objects.

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One of the computer programs (software) that can be used as a media of learning mathematics is Geogebra program. Geogebra is developed by Markus Hohenwarter in 2001. According to Hohenwarter (in Mahmudi, 2010), Geogebra offers an effective opportunity to be creative learning environment that allows student to explore a variety of mathematic concepts. According to Lavicza (in Mahmudi, 2010), a number of studies show that Geogebra can encourage the process of discovery and experimentation students in the classroom. The visual features can help student effectively in applying for various mathematical conjecture.

Mahmudi (2010) mentioned some of the advantages of Geogebra program, such as, (1) The geometry painting is normally produced more quickly and accurately than by using a pencil, a ruler, or term, (2) the existence of animation and movement facility of manipulation (dragging) in Geogebra program can provide a clearer visual experience to the students in understanding the concepts of geometry, (3) it can be used as a feedback/evaluation to ensure that the painting has been made is correct, (4) Make it easier for teacher/student to investigate or show nature- properties that apply to a geometrical object.

Furthermore, according Hohenwarter & Fuchs (in Mahmudi, 2010), Geogebra is very useful as a medium of learning mathematics with a variety of activities as follows, (1) As a demonstration and visualization media, (2) As construction tool, (3) As a tools for discovery process.

C. Mathematical Problem Solving Ability

Problem is a situation that encourages a person to solve it but do not know what should be done to solve it (Reys, 1998: 23; Cahyaningrum, 2010: 14). Problem occures when there is goal to be achieved but it does not have media to achieve it (Winkel, 1996: 127; Cahyaningrum, 2010: 15). So we can conclude that the problem is a gap between the desire or expectation and the reality. In the context of mathematics learning, the problem is something that consciously understood by students to look the solution, moreover to get the settlement is not only used the easily procedures way.

Problem-solving ability is a human activity that combines the concepts and rules that have been obtained before, and not as a generic skill. This understanding implies that when someone has been able to solve a problem, then someone has had a new ability. This capability can be used to solve other problems that are relevant. The more problems can be solved by someone, and then he will get a lot of the ability to help him to face life everyday. Therefore, a person's ability to solve problem should continue to be trained so that one is able to live a life that is full complexity of the problem.

Based on those opinions, the authors concluded that there is the fundamental difference between doing exercises and finish problem in learning mathematics. In doing exercise, student is only required to get the answer immediately, for example calculation such as addition and multiplication operations, calculation of trigonometric functions, and others. While it is stated about problem in mathematics is when student can not find a solution immediately, but student needs to reason, suspect or predict, search a simple formula and then prove it. The characteristic that is called problem is requires thinking/reasoning, the solution is not to get a single, and it must be proven that challenge students to be able to guess/predict the solution.

The purpose of problem solving ability that is given to students by Ruseffendi (1991) are: (1) it can give rise to curiosity and motivation, foster creativity nature; (2) in addition to the knowledge and skills (numeracy, etc.), required the ability to skillfully read and make a true statement; (3) may give original answer, new, unique, and diverse, and can add new knowledge; (4) to improve the application of knowledge that has been gained; (5) to invite student to have the ability of problem-solving procedures, capable of making analysis and synthesis, and are required to make an evaluation of the results of the solution; (6) It is important for student activities that involve not just one field of study but (if necessary) many fields of study, can even involve other subjects outside of school; stimulate students to use all his ability. These are for student to face life now and in the future.

George Polya developed four important steps in the problem-solving ability (Suherman, 2001), such as:

a. Understanding the problem
   Inunderstand the problems student is expected to write down the information obtained from the existing problem, identify what is to be completed on the existing problem.

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b. Planning for completion
   Some strategies that can be done in planning for problem solving among other things: finding patterns in order to determine the problems of the settlement plan to be taken create tables and make diagrams to clarify the intent of the problem, write the equation, and etc.
c. Solve the problem
   Solving the problem based on planning. The implemention of strategy has been taken in the planning of solving problem, using arithmetic skill, looking at the steps to resolve to get results.
d. Checking
   Checking is done to the whole of steps which have been undertaken by rechecking steps to resolve the problems that have been conducted and concluded the settlement proceeds obtained.

The steps of problem-solving ability as described above constitute a unified whole, because the error/failure in one step will affect other steps and will ultimately affect the results of the overall solution.

D.Student Mathematics Learning Motivation

The term of motivation based on the word motive this can be interpreted as the movement force into a person to perform certain activity, in order to achieve certain goals. Thus, the motivation is the encouragement in a person tries to establish behavioral change to be better in fullfilling their needs (Uno, 2008).

To clarify the description of the mathematics learning motivation, the indicators are stated from the dimension of mathematics learning motivation is based on the theory of Bandura's learning motivation after being adapted to the theory of Good and Brophy (in Mertasari, 2003: 31) is as follows.

1. Intrinsic dimension with impulse indicator to be actively involved in the learning activity, the encouragement to find out things that relate to the lesson, the encouragement to learn independently.
2. Extrinsic dimension with the indicator impulse to avoid teacher punishment, encouragement for praise from the teacher, the urge to get praise from parents, the impulse to get good grades, and encouragement for recognition of friends.

If it is associated with learning mathematics, so the mathematics learning motivation is the encouragement that comes from within and outside the student who causes the behavior change of student to interact and participate in the learning of mathematic. Mathematics learning motivation is meant in this study is the internal and external impetus to spur student to learn math, so it is able to get the academic achievement. It causes teacher should encourage students' intrinsic motivation and extrinsic motivation while preparing appropriately in implementing the learning.

According to Hanafi and Suhana (2012), the motivation has many functions, including:

Motivation is to encourage the learning behavior of learner.

Motivation is a tool to influence the achievement of learner.

Motivation is a tool to provide.

The Board of Directors of the achievement of learning objectives.

Motivation is a tool to build more meaningful learning system.

Thus, the mathematics learning motivation is important for students and teacher because it causes to change student' behavior to interact and participate in math learning activity to achieve certain goals. If the motivation is realized by the offender, it is a task of learning to be done properly. Therefore, teacher should increase student learning motivation.

E. The Attachment of MP3M through Geogebra toward Mathematics Problem Solving Ability and Student Learning Motivation

One of the goals in teaching mathematics is to develop the ability of mathematical problem solving ability. Problem-solving ability is a human activity that combines the concepts and rules that have been obtained before, and not as a generic skill. This understanding implies that when someone has been able to solve a problem, then someone has had a new ability. This capability can be used to solve other relevant problem. The more problems can be solved by someone, so he will get a lot of ability to help him to face life everyday. Therefore, a person's ability to solve problems should continue to be trained so that troubleshooting purposes reached.

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Learning based on the conventional model is a model of learning that is most frequently used. In the conventional learning model to further highlight the relationship between students and teacher, while in the process, problem solving is also influenced by the relationship between students and students. The dominant role of the teacher will lead students' interaction with students is minimal. This will impact on student' problem solving is less than optimal.

To response this matter, the learning process of mathematics in school needs to familiarize student to construct their own knowledge and enhance their conceptions and directing student to improve mathematical problem solving. One way can be done is teaching student by constructivist that uses innovative learning who is developed based on constructivist paradigm. Through a constructivist paradigm, student can develop independent thinking because it is provided time to think and student can enhance conception.

Learning model that uses innovative learning who is developed based on constructivist paradigm is MP3M. The strength of this model is the reorientation of learning from a teacher-centered initially to be student-centered. MP3M provides the opportunity of empowering learner to think in a problem-solving activities and decision-making in the context of complex real life. MP3M makes student combines the concept and rule that have been obtained before, and not as a generic skill.

If MP3M is applied through Geogebra gives theopportunity for student to increase their knowledge by exploring the material. The implementation of MP3M through Geogebra will help to facilitate student in constructing a subject matter so that what is learned will be deemed easier to visualize. The availability of Geogebra as a tool in the lesson will be a positive influence on students' mathematical problem-solving skill as well as meetings in the class which is more focused to solve the problem related to the material will certainly affect the ability of mathematical problem solving and student learning motivation.

Looking at the characteristics of MP3M through Geogebra needs the encouragement that comes from within and outside the student who caused to change student behavior to interact and participate in the learning of mathematics. If the motivation is realized by the offender, it is a task of learning to be done properly. Therefore, teacher should increase student learning motivation.

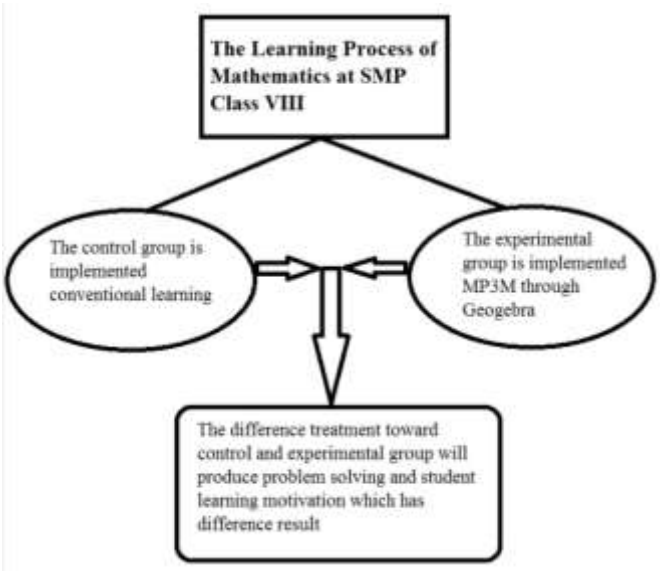

Figure 2. Mindset

F. The Attachment of MP3M through Geogebra to Problem Solving

Problem-solving ability is a human activity that combines the concepts and rules that have been obtained before, and not as a generic skill. Teacher has a role in improving students' mathematical problem solving ability by giving math problem in a variety of ways. Teacher needs to ask student regurarly to justify the answers and

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alleged that obtained that will bring student to combine the concepts and rules that have been obtained previously.

MP3M through Geogebra will certainly affect the student in mathematics problem solving. Especially on selecting step strategy, of course student should know the concept of what is right if it is used of resolving a given problem. Through Geogebra student is facilitated to visualize concept or idea that already exist, making it easier for student to visualitze problem that seems abstract. Based on this explanation, it is alleged that the application of MP3M through Geogebra has a tendency to be better effect rather than conventional learning toward mathematics problem-solving skill.

G. The Attachment of MP3M through Geogebra toward Student Mathematics Learning Motivation

Motivation is the encouragement that is contained in a person tries to establish the behavioral change to be better for fullfilling their needs. So, the mathematics learning motivation is important for student and teacher because it causes to change student behavior to interact and participate in mathematics learning activity to achieve certain goals. If the motivation is realized by the offender, it is a task of learning to be done properly. Therefore, teacher should increase student mathematics learning motivation.

Based on the explanation above, alleged that the implementation of MP3M through Geogebra has a tendency to be better effect rather than conventional learning to student mathematics learning motivation. It is thought to occur in the exploration step, where student uses traditional concepts that have been owned previously to solve the problem. How far this effect needs to be evidenced empirically.

2.3 Methods

This study was a quasi-experimental research (quasi experiment). The population in this research is class VIII SMP Negeri 3 Gianyar in academic year 2019/2020. Class VIII SMP Negeri 3 Gianyar consited of 10 classes and two classes were randomly selected as samples. Two classes as a sample were 43 students in the experimental class (class VIII F) and 44 students in the control class (class VIII H).

The steps that have been done in the sampling of this research are: first, to test the equality of all classes. The equivalence test was conducted by using F-test (Anova test). Before determining the sample for this study the the equality of whole classes were tested by using value of final asssessment (PAS) VII grade second semester of 2019/2020 academic year of learning mathematics by using test f-test. Criteria testing on test F-test is if F count> F table (0.05; 9; 424), the classes of the population is said to be unequal. Conversely, if F count < F table (0.05; 9; 424), the classes of the population can be said to be equivalent. The test was performed at a significance level of 5% with a degree of freedom for the numerator 10-1 = 9 and the degrees of freedom for the denominator 434-10 = 424.

Table 1. Test Results Class Equality

ANOVA					
Score					
	Sum of Squares	Df	mean Square	F	Sig.
Between Groups	223 485	9	24 832	.424	.922
Within Groups	24837.529	424	58 579		
Total	25061.014	433			

Based on Table 3.2 can be obtained F count = 0.424 with a significance value of 0.922. For a significant level of 5%, df = 10-1 = 9 numerator and denominator df = 434-10 = 424 obtained F table = 1.90. Because of F <F table (0.424 <1.90) then the whole class mates of the population can be said to be equivalent. After it was confirmed to match, and then taken two samples random sampling. In this study, the independent variable was MP3M through Geogebra; meanwhile the dependent variable was mathematical problem solving and student mathematics learning motivation.

The instruments were used in data collection of student mathematics problem solving were a test description (essay), and the data on student mathematics learning motivation using a questionnaire. Problem solving test

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was used a test of learning materials for junior high math class VIII. The material included in these test was the Cartesian coordinates and the straight line equation. Total item of mathematical problem solving test was 5 items. The scoring test of the ability of student mathematical problem solving ability was done by scoring in accordance with aspects: (1) understand the problem, (2) create a problem-solving plan, (3) implement the settlement planning issues, (4) rechecking. Source: (Sudiarta, 2013: 171).

Mathematics learning motivation questionnaire used is based upon dimensions: (1) intrinsic and (2) extrinsic,with the total items on defense motivation questionnaire was 24 items. Each item contained five answer choices were Always (SL), Frequently (SR), sometimes (KK), Rare (JR), and Never (TP)

3 RESULTS AND DISCUSSION

3.1 Prerequisites Test

The assumption test is does to aim to examine the distribution of the data, the variance between groups, variance-covariance matrix between groups, and the colinearity bound variable. The first assumption test that was done was the normality distribution test of data, the second one was the homogeneity test of variance between groups, and homogeneity matrix test between the variance and the third one was colinearity test.

A. Bivariate Normality Test

The normality distribution test data using the Kolmogorov-Smirnov statistic. The criteria of the data is data have a normal distribution if a significant number that is greater than 0.05, and in other cases the data are not normally distributed. Mechanical analyzes were performed with SPSS 23.0 for window. There was the result summary of the analysis of normality test distribution of mathematical problem
solving ability and mathematics learning motivation datawere presented in Table 2.

Table 2. The Results Summary of the Analysis of Normality Test of Mathematical Problem Solving Ability and Student Mathematics Learning Motivation Data

Treatment		Kolmogorov-Smirnova		
		statistics	df	Sig.
Mathematical problem solving ability	The learning model of reasoning and problem solving (MP3M) throughGeogebra	.114	43	.192
	Conventional learning	.117	44	.151
Motivation to learn mathematics	The learning model of reasoning and problem solving (MP3M) throughGeogebra	.129	43	.068
	Conventional learning	.090	44	.200

Based on Table 2. It was apparent that all Kolmogorov-Smirnov statistic variables was greater than 0.05. Thus, all the data were normally distributed with the following explanation.

a. For data mathematical problem solving ability in the experimental class of Kolmogorov-Smirnov had a value of 0.114 with 0.192 significance value. The Statistics showed the number of significance greater than 0.05, so it can be stated that the data of mathematical problem solving ability of experimental class was normal distribution.
b. For data of mathematical problem solving ability in the control class Kolmogorov-Smirnov had a value of 0.117 with 0.151 significance value. The Statistics showed the number of significance greater than 0.05, so it can be concluded that the data of mathematical problem solving ability of control class was normal distribution.
c. The mathematics learning motivation of experimental class Kolmogorov-Smirnov had a value of 0.129 with 0.068 significance value. The Statistics showed the number of significance greater than 0.05, so it can be concluded that the data of mathematics learning motivationof experimental class was normal distribution.
d. For data of mathematics learning motivation of control class Kolmogorov-Smirnov had a value of 0.090 with a significance value of 0.200. The Statistics showed the number of significance greater than 0.05, so it can be stated that the data of mathematics learning motivationof control classwas normal distribution.

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B. Homogeneity of Variance Test

Homogeneity test of variance between groups can be done by using statistical levene. The testing criteria uses the data that has the same variance (homogeneous) if the numbers generated significance greater than 0.05. This homogeneity test using statistical values using Levene test, homogeneity test results based approach applied learning models can be presented in Table 3.

Table 3. The Summary of the Result of Homogeneity of Variance

	F	DF1	DF2	Sig.
Mathematics Problem Solving Ability	.030	1	85	.863
Mathematics Learning Motivation	3,535	1	85	.063

Homogeneity test results as shown in Table 3. It was seemed that significant value to the data of mathematics problem solving ability and student mathematics learning motivation had the significance greater than 0.05, thus the research data above was homogeneous.

C. Homogeneity of Variance Matrix Test

Homogeneity test variance-covariance matrix between the dependent variable using the Box's Test Equality Covariance Matrices with SPSS 23.0 for Window. Homogeneity test was done to the data of group mathematics problem-solving ability and student mathematics learning motivation using Box's test M together. The summary of the results of homogeneity of variance-covariance matrix was presented in Table 4.

Table 4. The Homogeneity of Variance-Covariance Matrix Test

Box's M	3,058
F	.993
DF1	3
DF2	1323463.652
Sig.	.395

Based on the test result of Table 4.4 Box's M similarity variance-covariance matrix simultaneously generating significant figure of 0.395 is greater than the value of $\alpha = 0.05$. This means that the matrix of variance on variable mathematical problem solving ability and student mathematics learning motivation were homogeneous.

D. Colinearity Test

Besides normality and homogeneity test, one of the requirements that must be fulfilled in the Manova analysis are two variables are not correlated highly. The colinearity test is used to determine whether there is connection or a fairly high correlation between the dependent variable. The summary of the multikolinieritas result test was presented in Table 5.

Table 5. The Summary of the Results of Colinearity Test Correlations

		Mathematical Problem Solving Ability	Mathematics Learning Motivation
Mathematical Problem Solving Ability	Pearson Correlation	1	.471 **
	Sig. (2-tailed)		.000
	N	87	87
Mathematics Learning Motivation	Pearson Correlation	.471 **	1
	Sig. (2-tailed)	.000	
	N	87	87

**. Correlation is significant at the 0:01 level (2-tailed).

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The criteria for the testing of colinearity if r_{y1y2} value <0.8 then it shows a high correlation does not occur on the dependent variable. Based on the test results in Table 4.5 show colinearity r_{y1y2} = 0.471 value smaller than 0.8. It can be concluded that there is no relationship/fairly high correlation between variables of mathematical problem solving ability and motivation to learn mathematics.

3.2 Hypothesis Testing

The hypothesis testing in this study was to test three hypotheses already formulated previously. Hypothesis testing was through multivariate analysis. The result of multivariate statistical test was used to test the first hypothesis test in this study. The result of the multivariate analysis on the data of this study was presented in Table 6.

Table 6. Summary of Multivariate Testing Multivariate Tests

Effect		Value	F	Hypothesis Df	Error Df	Sig.
Intercept	Pillai's Trace	.996	9904.299b	2,000	84,000	.000
	Wilks' Lambda	.004	9904.299b	2,000	84,000	.000
	Hotelling's Trace	235 817	9904.299b	2,000	84,000	.000
	Roy's Largest Root	235 817	9904.299b	2,000	84,000	.000
Class	Pillai's Trace	.409	29.006b	2,000	84,000	.000
	Wilks' Lambda	.591	29.006b	2,000	84,000	.000
	Hotelling's Trace	.691	29.006b	2,000	84,000	.000
	Roy's Largest Root	.691	29.006b	2,000	84,000	.000

a. Design: Intercept + Class
b. Exact statistics

A. First Hypothesis Testing

The first hypothesis put forward in the study of mathematical problem solving ability and student mathematics learning motivation between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was better than group learning with conventional learning model. In statistical hypothesis as follows:

H_0: Mathematical problem solving ability and student mathematics learning motivation between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was better than or equal to a group of students learning with conventional learning model. This hypothesis can be formulated as follows.

$$H_1 : \begin{bmatrix} \mu_{11} \\ \mu_{21} \end{bmatrix} \leq \begin{bmatrix} \mu_{12} \\ \mu_{22} \end{bmatrix}$$

Against

H_1: Mathematical problem solving ability and student mathematics learning motivation between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was better than group of students learning with conventional learning model. This hypothesis can be formulated as follows.

$$H_1 : \begin{bmatrix} \mu_{11} \\ \mu_{21} \end{bmatrix} > \begin{bmatrix} \mu_{12} \\ \mu_{22} \end{bmatrix}$$

The hypothesis was tested that H_0, where H_0 is rejected criterion states that if the level of significance to Pillai's Trace, Wilk's lambda, Hotelling's Trace, and Roy's Largest Root smaller than 0.025. Based on figures obtained Table 4.6 F statistic is equal to 29.006 and 0.000 significance figure of less than 0.025 to Pillai's Trace, Wilk's lambda, Hotelling's Trace, and Roy's Largest Root. So the nol hypothesis (H_0) is rejected and it can be concluded that the mathematical problem solving ability and student mathematics learning motivation between

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group of student learning with the learning model of reasoning and problem solving (MP3M) through Geogebra better than groups of students learning with conventional learning models.

In testing of hypothesis that the second and third can be seen in the results of analysis test of between-subjects analysis effects. The result for displaying the significance value for each unit of analysis is the data of mathematical problem solving ability and student mathematics learning motivation. There was the statistical test analysis result for test the second and third hypotheses can be presented in Table 7.

Table 7. The Test of Between-Subjects Effects

Source	dependent Variable	Type III Sum of Squares	Df	mean Square	F	Sig.
Corrected Model	Mathematics Problem Solving Ability	804.422a	1	804 422	43 683	.000
	Mathematics Learning Motivation	1205.924b	1	1205.924	29 262	.000
Intercept	Mathematics Problem Solving Ability	103920.698	1	103920.698	5643.331	.000
	Mathematics Learning Motivation	751196.729	1	751196.729	18228.108	.000
Class	Mathematics Problem Solving Ability	804 422	1	804 422	43 683	.000
	Mathematics Learning Motivation	1205.924	1	1205.924	29 262	.000
Error	Mathematics Problem Solving Ability	1565.256	85	18 415		
	Mathematics Learning Motivation	3502.927	85	41 211		
Total	Mathematics Problem Solving Ability	106094.000	87			
	Mathematics Learning Motivation	755313.000	87			
Corrected Total	Mathematics Problem Solving Ability	2369.678	86			
	Mathematics Learning Motivation	4708.851	86			

a. R Squared = .339 (Adjusted R Squared = .332)
b. R Squared = .256 (Adjusted R Squared = .247)

B. Second Hypothesis Testing

The second hypothesis put forward in research that there are differences in mathematical problem solving ability of students between group of student learning with the learning model of reasoning and problem solving (MP3M) through Geogebragroup learning with conventional learning model. In statistical hypothesis as follows:

H_0: Mathematical problem solving ability of students between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was not better or the same as the group of students who studied with conventional learning model. This hypothesis can be formulated as follows.

$$H_0 : \mu_{11} \leq \mu_{12}$$

Against

H_1: Mathematical problem solving ability of students between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra better than group of student learning with conventional learning model. This hypothesis can be formulated as follows.

$$H_1 : \mu_{11} > \mu_{12}$$

Hypothesis 2 were tested against the test of between-subjects effects that H_0, where the criteria stated that Ho is rejected if the significance level of F was smaller than 0.025. Based on figures obtained Table 7, F statistic was equal to 43.683 and the number sig. 0.000 <0.025. So the nol hypothesis (H_0) was rejected and it could be concluded that the ability of students' mathematical problem solving among groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was better than group of student learning with conventional learning model. The average mathematics problem solving ability of students learning group learning model of reasoning and problem solving (MP3M) through Geogebra was 37,

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C. Third Hypothesis Testing

The third hypothesis proposed in the study that there is a difference between the student mathematics learning motivation group learning model of reasoning and problem solving (MP3M) through Geogebra by group learning with conventional learning model. In statistical hypothesis as follows:

H0: Mathematics learning motivation between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was not better or the same as the group of student who studied with conventional learning model. This hypothesis could be formulated as follows.

$$H_0 : \mu_{21} \leq \mu_{22}$$

Against

H1: Mathematics learning motivation between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was better rather than group of student learning with conventional learning model. This hypothesis could be formulated as follows.

$$H_1 : \mu_{21} > \mu_{22}$$

Hypothesis 3 tested against the test of between-subjects effects that H0, where the criteria states that H0 was rejected if the significance level of F is smaller than 0.025. Based on figures obtained Table 4.7 F statistic was equal to 29.262 and the number sig. 0.000 <0.025. So the nol hypothesis (H0) was rejected and it can be concluded that students' mathematics learning motivation between groups of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra better than group of student learning with conventional learning model. The average motivation to learn mathematics group of students learning with the learning model of reasoning and problem solving (MP3M) through Geogebra was 96.65 it was greater that compared with the group of student learning with conventional learning model was 89.20.

3 CONCLUSION

Based on data analysis and hypothesis testing that has been done, it appeared that, (a) the problem-solving ability and student mathematics learning motivation who was taught by MP3M through Geogebra was better than problem solving ability and motivation to learn mathematics students who was taught by the conventional learning model, (b) the ability mathematical problem solving of students who was taught by MP3M through Geogebra was better than the ability of mathematical problem solving of students who was taught by the conventional learning model, (c) the student ability of mathematical problem solving who was taught by MP3M through Geogebra was better than problem solving ability mathematics students who was taught by the conventional learning model.

MP3M through Geogebra had positive contribution to problem-solving ability and student mathematics learning motivation because, (a) student become more enthusiastic in participating learning activities, (b) the student was able to understand the problem that was given in the worksheets with the collaboration using Geogebra, (c) student is trained to formulate solving patterns in group discussions, (d) the student was easier to solve the problem of learning materials, (e) Student has the opportunity to apply mathematics solving problem and learn independently by solving problems in the exercises.

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REFERENCES

[1] Annajmi. 2016. Peningkatan Kemampuan Pemahaman Konsep Matematik Siswa SMP Melalui Metode Penemuan Terbimbing Berbantuan Software Geogebra. Unicersitas Pasir Pangaraian.
[2] Ayu, Yupi. 2017. Upaya Meningkatkan Motivasi Belajar Matematika Melalui Model Pembelajaran ARIAS Pada Siswa Kelas VIII H SMP Negeri Mojolaban Tahun Pelajaran 2016/2017. FKIP UNS.
[3] Balim, A. G. 2009. *The Effects of Discovery Learning on Students' Success and Inquiry Learning Skills*. Egitim Arastirmalaria-Eurasian Journal of Educational Research, 35, 1-20.
[4] Benning, Isaac. 2018. *Using Technology in Mathematics: Professional Development for Teachers*. University of Otago.

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

[5] Cahyani, Hesti. 2016. Pentingnya Peningkatan Kemampuan Pemecahan Masalah Melalui PBL untuk Mempersiapkan Generasi Unggul MEA. Universitas Negeri Semarang.
[6] Cahyaningrum, N.2010.Meningkatkan Kemampuan Kemampuan pemecahan masalah Matematika Melalui Penerapan *Problem Based Learning* Pada Siswa Kelas IVIII F Smp Negeri 1 Sedayu. Yogyakarta.tidak diterbitkan.
[7] Caprioara, D. (2015). Problem Solving-Purpose and Means of Learning Mathematics in School. *Procedia-Social and Behavioral Sciences*, 191, 1859-1864, 2 June 2015.
[8] Hobri. 2020. *The Effect of Jumping Task Based on Creative Problem Solving on Students' Problem Solving Ability*. International Journal of Instruction
[9] Joyce, Bruce R. & Marsha Weil. 1986. *Models of Teaching*. USA: Prentice – Hall.
[10] Krulik, S., & Rudnick, J. A. 1996. *The new sourcebook for teacing reasoning and problem solving in Junior and Senior High School*. Boston: Allyn and Bacon.
[11] Mahmudi, Ali. 2010. *Membelajarkan Geometri dengan Program Geogebra*.Makalah terdapat pada *Seminar Nasional Matematika dan Pendidikan Matematika*.Seminar diselenggarakan oleh Jurusan Matematika FMIPA Universitas Negeri Yogyakarta.
[12] Mertasari, N M S. 2003. "Pengaruh Model Tes Terhadap Motivasi Belajar dengan Mempertimbangkan Kesukaran Tes (Eksperimen Pada Sekolah Lanjutan Tingkat Pertama di Kota Singaraja)". *Tesis* (tidak diterbitkan). IKIP Negeri Singaraja.
[13] Robbins, Joanne K. 2011. "Problem Solving, Reasoning, and Analytical Thinking in a Classroom Environment". *Jurnal The Behavior Analyst Today, Volume 12, Nomor 1, 2011, hlm 3*
[14] Ruseffendi, E.T. 1991. *Pengantar kepada membantu Guru Mengembangkan* Kompetensinya *dalam Pengajaran Matematika untuk Meningkatkan CBSA* (Cetakan Kedua). Bandung:Tarsito.
[15] Santyasa, I. W. 2004. "Model Problem Solving dan Reasoning Sebagai Alternatif Pembelajaran Inovatif". Disajikan dalam Konvensi Nasional Pendidikan Indonesia (Konaspi) V, Surabaya, tanggal 5 – 9 Oktober 2004.
[16] Saxena, Ruti. 2016. *Teaching Mathematical Modeling in Mathematics Education*. TIT group of Institutions Bhopal
[17] Suherman, Erman. 2001. *Evaluasi Proses dan Hasil Belajar Matematika*. Jakarta: Depdikbud.
[18] Suryawan, I Putu Pasek. 2012. "Pengembangan Perangkat Pembelajaran Matematika Untuk Model Pembelajaran Penalaran Dan Pemecahan Masalah (MP3M) Berorientasi Masala Terbuka Sebagai Upaya Meningkatkan Aktivitas dan Prestasi Belajar Siswa Kelas VII". *Artikel Tesis, Juli 2012*
[19] Suryawan, Pasek. 2014. "Pengembangan Perangkat Pembelajaran Matematika Untuk Model Pembelajaran Penalaran Dan Pemecahan Masalah (MP3M) Berorientasi Masala Terbuka"**.** *Jurnal Wahana Matematika dan Sains, Volume 8, Nomor 1, April 2014, hlm 26-44*
[20] Uno, H B. 2008. *Teori Motivasi dan Pengukurannya*. Jakarta: Bumi Aksara.
[21] Yonathan. 2006. *Implementasi Model Pembelajaran Penalaran dan Pemecahan Masalah Terbuka Untuk Meningkatkan Kompetensi Penalaran dan Komunikasi Matematik Siswa Kelas VII SMPN 1 ToliToli*. Jurnal Kreatif Tadulako Online, Volume 4, Nomor 11, ISSN 2354-614X