The Impact of Learning Generative Model on Mathematical Problem-Solving Ability in 10th Grade Students

Irham Habibi Harahap[1], Bornok Sinaga[2], Pargaulan Siagian[3]

{irhamharahap3@gmail.com[1*], Bornoksinaga45@gmail.com[2], Pargaulansiagian19@gmail.com[3]}

Postgraduate Mathematics Education study program, Medan State University Medan, North Sumatra, Indonesia, Jalan Willem Iskandar/Pasar V, Medan 2023, Indonesia[1], Lecture of Mathematics Education Program, State University of Medan, Jalan Willem Iskandar/Pasar V, Medan 2023, Indonesia[2], Lecture of Mathematics Education Program, State University of Medan, Jalan Willem Iskandar/Pasar V, Medan 2023, Indonesia[3]

Abstract. This study aims to gain the influence of the use of Learning Generative Model on the ability to solve mathematical problems in the tenth grade students. The study was conducted in an experimental research of students in the tenth grade students. The number of samples used in this experimental research in the experimental group and control group was 34 students respectively. The research instrument used was a test instrument in the form of an essay which was validated beforehand. The data analysis in this study used a t-test that had previously been tested for normality and homogeneity. The results of the study showed that there was an impact of the use of Learning Generative Model on the ability to solve mathematical problems in the tenth grade students.

Keywords: Learning Generative Model, Problem Solving Ability.

1 Introduction

The right of every citizen to be fulfilled by the government in any situation so that the achievements of national education can be realized is education. Likewise, what is included in Article 3 of Law No. 20 of 2003 on the achievement of national education refers to the development of students to become human beings who believe and fear of God, noble morals, healthy, knowledgeable, wise, innovative, independent, and become a responsible and democratic population.[1]

Education is essential for every individual in order to gain knowledge and be able to develop every potential they have. Teachers play a huge role in education. High or low an education comes from the tactics of an educator who can share or spread the source of knowledge and

[1] Winata, K. A., Zaqiah, Q. Y., Supiana, S., & Helmawati, H. Kebijakan pendidikan di masa pandemi. *Ad-Man-Pend: Jurnal Administrasi Manajemen Pendidikan*, *4*(1), 1-6. (2021)

AISTEEL 2023, September 19, Medan, Indonesia

DOI 10.4108/eai.19-9-2023.2340512

meaning of the day that can motivate students to realize their goals. Related to the main role of a teacher, the teacher must have a variety of skills, not only the academic skills that educator must have, but also related to the tactics of an educator in his expertise in order to motivate the students, so that they have a desire to learn which will improve the interests of the students as well as skills within them.[2]

Mathematics according to Rahmayani and Amalia (2020) is the basic knowledge needed for students to support their learning success in pursuing higher education.[3] Mathematics is one of the compulsory fields of study in the level of education for students from the lower and middle levels. According to Wulandari (2020), mathematics trains students in concentration, in which case mathematics not only introduces concepts, skills and ways of thinking but also formulas that challenge students in solving the problems that are distributed.[4] Students have great curiosity, increase creativity and equip students with the skills needed to learn mathematics in activities outside of school.

One of the main things in learning mathematics so that students can solve problems in the form of skills in understanding problems, building mathematical forms, solving mathematical forms, solving models and interpreting the solutions obtained. The ability to solve mathematical problems is defined as the ability of the student to answer non-routine mathematical problems given in the form of maths either in context or text so that they can test their skills in solving problems[5].

Havill and Havill (2020) define problem-solving ability as the competence of learners in finding solutions to mathematical problems with phase-monitoring tactics in formulating solutions based on phases of problem solving that include understanding problems, solving problems and reviewing.[6] The ability to solve problems is so important to each student because according to Utami and Puspitasari (2022) problem solving is a general achievement of learning mathematics; problem solving that includes ways, stages and tactics including the main step of the mathematics curriculum as well as the basic skills in learning math is problem solvement.[7] The importance of having problem solving abilities is described in the

---

[2] Fatonah, K. Peran Pendidik Dalam Pengelolaan Media Pembelajaran Pada SD/MI. *Journal Al-Ilmu*, *1*(2), 21-26. (2022)

[3] Rahmayani, V., & Amalia, R. Strategi peningkatan motivasi siswa dalam pembelajaran matematika di kelas. *Journal on Teacher Education*, *2*(1), 18-24. (2020)

[4] Wulandari, S. Media pembelajaran interaktif untuk meningkatkan minat siswa belajar matematika di smp 1 bukit sundi. *Indonesian Journal of Technology, Informatics and Science (IJTIS)*, *1*(2), 43-48. (2020)

[5] Septhiani, S. Analisis Hubungan Self-Efficacy Terhadap Kemampuan Pemecahan Masalah Matematika. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *6*(3), 3078-3086. (2022)

[6] Havill, J., & Havill, J. How to Solve It. In Discovering Computer Science. https://doi.org/10.1201/9781003037149-1. (2020)

[7] Utami, H. S., & Puspitasari, N. Kemampuan pemecahan masalah siswa smp dalam menyelesaikan soal cerita pada materi persamaan kuadrat. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, *1*(1), 57-68. (2022)

research of Muslihah and Suryaningrat (2021) where the main achievement in mathematical learning is the ability to solve problems.[8]

However, behind the importance of problem-solving ability there is the fact that these abilities are still very weak among the students in Indonesia.[9] The weakness in the ability to solve mathematical problems of students can be obtained from the 2015 and 2018 PISA scores. The 2015 PISA score show that Indonesia has an average score of 386 for math skills, which is ranked 62nd out of 70 countries. The 2018 PISA score show that Indonesia's average score is 379 with the 73rd position which is the 7th position from below. This indicates that Indonesia is still below the average.

In addition, the results of the interview with educator in High School 1 Barumun which were conducted showed that students were at a low level of problem-solving ability. This is depicted by the value of the learning acquisition at the end of the semester. The low ability of students in solving problems according to Indahsari & Fitrianna (2019) is caused by students who are not used to carrying out the stages of problem solving correctly, starting from understanding the problem, designing problem solutions, realizing and retesting the solution to problem-solving.[10] Besides that, according to Sriwahyuni and Maryati (2022) the reason for the ability to solve problems of students is still low because the activity of students during learning is not play an active role that it has an impact on the category of ability to resolve mathematical problems of learners.[11] Therefore, the ability to solve mathematical problems of students can be achieved optimally by using learning generative forms.

Learning generative model is a model of learning that provides opportunities for students to be able to independently construct the concept of new topics through the activation of information, so that they can create elements of connectivity, memory, institutions and interpretation.[12] Learning generative model is known as a constructivism-based learning model that prioritizes the new cognitive alignment of students with information that students previously have. This model prioritizes learners to actively participate in building their own

---

[8] Muslihah, N. N., & Suryaningrat, E. F. Model Pembelajaran Contextual Teaching and Learning terhadap Kemampuan Pemecahan Masalah Matematis. Plusminus: Jurnal Pendidikan Matematika, 1(3), 553-564. (2021)

[9] Damianti, D., & Afriansyah, E. A. Analisis kemampuan pemecahan masalah matematis dan self-efficacy siswa SMP. INSPIRAMATIKA, 8(1), (2022)

[10] Indahsari, A. T., & Fitrianna, A. Y. Analisis kemampuan pemecahan masalah siswa kelas X dalam menyelesaikan SPLDV. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *2*(2), 77-86. (2019)

[11] Sriwahyuni, K., & Maryati, I. Kemampuan Pemecahan Masalah Matematis Siswa pada Materi Statistika. *Plusminus: Jurnal Pendidikan Matematika*, *2*(2), 335-344. (2022)

[12] Lestari, S., Andinasari, A., & Retta, A. M. Model pembelajaran generatif untuk meningkatkan kemampuan representasi matematis peserta didik. *IndoMath: Indonesia Mathematics Education*, *3*(1), 44-51. (2020)

information[13]. Therefore, students are free to give an idea or a solution and respond to the obstacles obtained[14].

The steps in the learning generative model according to Huda and Jazwinarti (2019) begins with the first step of exploration.[15] The educator directs the learners on this step to carry out exploration of information, ideas or initial understanding that has been obtained from previous learning. Furthermore, the students are assigned to problems in the focusing step, with a note that the problems given must be clear. In order to get a pattern of a mathematical sign and to predict the solution of the problem, the students are given instructions. This step can raise the indicator of mathematical problem-solving ability and propose a plan for the solution of a given problem.

In the challenge step, the solution given by the students are examined to find out the truth. Here, the students are required to explain the argument on the evidence that is designed and to show the conclusion of the task that they perform. Then, the knowledge that has been obtained from solving various daily problems related to the material is used by the learners. In this step, a number of problems that support the ability to solve mathematical problems are given to learners in order to obtain a pattern or conclusion from solving a problem.

Earlier studies conducted by Rahmawati et al., (2022), Fattah and Rahmat (2021) and Sinaga (2020) have shown that there was a positive impact of learning generative models on students' mathematical problem-solving abilities.

Based on the explanation above, the author intends to carry out a study entitled “The Impact of Learning Generative Models on Mathematical Problem-Solving Ability in 10th Grade Students”. The aim of this study is to find out the impact of the application of Learning Generative Model on the ability to solve mathematical problems in the tenth grade students.

2 Method

The research carried out was an experimental study that was divided into the experimental group and the control group and implemented in High School 1 Barumun, Padang Lawas. The number of samples used during this experimental research in the experimental group and the control group each consisted of 34 students. A true experimental design designed with a pretest-posttest control group design model was used in this study. The following illustrates the experimental design in this study:

---

[13] Mirunnisa, Z. R. MODEL PEMBELAJARAN GENERATIF UNTUK MENUMBUHKAN SOFT SKILL SISWA DALAM PEMBELAJARAN MATEMATIKA. In *Prosiding Seminar Nasional Universitas Jabal Ghafur* (Vol. 1, No. 1, pp. 40-51). (2021)

[14] Maryanti, I., Sakinah, N., & Situmorang, H. F. Pengaruh Model Pembelajaran Generatif Learning Terhadap Kualitas Pembelajaran. *Jurnal Manajemen Pendidikan Dasar, Menengah dan Tinggi [JMP-DMT], 3*(3), 105-113. (2022)

[15] Huda, S. N., & Jazwinarti, J. Pengaruh Penerapan Model Pembelajaran Generatif terhadap Kemampuan Penalaran Matematis Peserta Didik Kelas VIII SMPN 1 Payakumbuh Tahun Pelajaran 2019/2020. *Jurnal Edukasi dan Penelitian Matematika*, *8*(3), 240-246. (2019)

Table 1. Research Design

E	O_1	X_1	O_2
K	O_3	X_2	O_4

Description: E = Experimental Group,

K = Control Group,
O1 = Experimental Group's Pretest,
O2 = Experimental Group's Posttest,
O3 = Control Group's Pretest,
O4 = Control Group's Posttest,
X1 = Application of learning generative forms in the experimental group,
X2 = Application of learning conventional forms in the control group.

The research instrument used was a test instrument such as an essay which had been validated beforehand. The data analysis in this study used the t-test that has previously been carried out the normality and homogenity test as a prerequisite test for data analysis.

Results and Discussion

Results of Descriptive Statistical Analysis

The results of the descriptive statistics of this study are described in the following table:

Table 2. Calculation Results of Descriptive Statistics

Group	Test	Mean	Median	Standard Deviation	Minimum	Maksimum	N
Experimental	Pretest	54.08	48.61	18.44	16.67	86.11	34
	Posttest	88.67	91.67	10.29	60.00	100.00	34
Control	Pretest	47.38	41.67	19.13	16.67	83.33	34
	Posttest	83.43	83.33	12.69	63.89	100.00	34

Source: Results of Primary Data Processing (2023)

From table 2, it is concluded that in general the acquisition of the ability to solve mathematical problems is sufficiently good. This result can be seen through the mean and median scores, which scores close to the maximum possible score of 100. The average score on initial problem-solving skills of students included the middle category in the experimental group and the control group because they were in the range of 50. Furthermore, it can be observed that the experimental and control groups obtain the results of better mathematical problem-solving skills after receiving application during the study. This was observed from the average post-test scores of the experimental and the control group scores were equally greater than the pre-test scores.

3 Prerequisite Test Results

Prerequisite tests in the form of normality and homogenity tests are carried out before testing the hypothesis. In order to obtain the distribution of information on each group of samples observed as normal or not, performed normality examination with the help of SPSS version 26. The normality test criterion is that if the sig value (probability) is greater than 0.05, then the distribution of the data used is normal. In contrast, if the sig score is lower than 0.05, then

the distribution of the study data used is not normal. The following describes the results of the normality test with SPSS version 26:

Table 3. SPSS Output of Normality Test Results

		Pretest_Ex	Posttest_Ex	Pretest_C	Posttest_C
N		34	34	34	34
Normal Parameters[a,b]	Mean	47.3862	88.6765	54.0856	83.4316
	Std. Deviation	19.13439	10.29672	18.44070	12.69343
Most Extreme Differences	Absolute	.149	.144	.146	.129
	Positive	.149	.136	.146	.129
	Negative	-.129	-.144	-.130	-.110
Test Statistic		.149	.144	.146	.129
Asymp. Sig. (2-tailed)		.052[c]	.072[c]	.062[c]	.161[c]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Source: Results of Primary Data Processing (2023)

From the Kolmogorov-Smirnov normality test assisted by SPSS version 26, obtained a higher sig score than 0.05 on the pretest of experimental group, the posttest of experimental group, the control group's pretest and the control group's posttest were 0.052; 0.072; 0.062; 0.161. So from this results, it can be summed up that the data has normally distributed and can be used in the following research.

After the data used was distributed normally, the researchers then examined the homogeneity of the two groups with a homogenity test. The following table describes the results of the SPSS version 26 homogenity test:

Table 4. SPSS Output of Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Score	Based on Mean	4.013	1	134	.095
	Based on Median	2.809	1	134	.096
	Based on Median and with adjusted df	2.809	1	126.122	.096
	Based on trimmed mean	3.800	1	134	.093

Source: Results of Primary Data Processing (2023)

From the output SPSS version 26 above related to the homogenity test, obtained a sig score of 0.095 which was higher than 0.05. Therefore, it can be concluded that the data of both sample groups come from the same population and have the same variance.

To find out the differences between the forms of learning applied in the tenth grade students, the researchers used a hypothesis test, which was paired sample t-test. Here are the SPSS output results for testing the two groups' hypotheses shown in the following table:

Table 5. SPSS Output of Hypothesis Test Results

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Pretest_Ex - Posttest_Ex	41.29029	15.94600	2.73472	46.85412	35.72647	15.099	33	.000
Pair 2	Pretest_C - Posttest_C	29.34598	18.16146	3.11466	35.68281	23.00915	9.422	33	.000

Source: Results of Primary Data Processing (2023)

Through the SPSS output above, a significant value of 0,000 is obtained. This value of significance is lower than 0.05. In addition, the t count score > t table is 1.692. So there is an average difference between the learning outcomes of the experimental group and the control group. This means that there is an impact of the application of learning generative models on the ability to solve mathematical problems in the tenth grade students.

4 Discussion

From the results of the acquisition that has been carried out using two class groups, the X-1 class as an experimental group using learning generative form and X-2 as a control group using learning conventional form, the following results are obtained:

In the descriptive statistical test, the average score of the experimental group was 54.08 higher than the control group that obtained the average score of 47.38 before receiving the application seen on the basis of the pre-test value of mathematical problem-solving ability. After the application was carried out, the average score of the experimental group rose to 88.67 and the control group increased to 83.43.

In the calculation of the data normalization test, it is known that the pre-test and post-test scores of the experimental group as well as the pretest and posttest score of the control group are higher than 0.05, which meet the normalizing test conclusion criteria, which is higher than the sig value of 0.05. So the data used is distributed normally and can be used for homogenity testing. In the homogenity test, the sig value of 0.095 was obtained higher than 0.05, so the data on both groups of samples were homogeneous.

Once all the pre-conditional tests are carried out, then it can be continued with the hypothesis test. In the hypothesis test, the significance score of 0,000 was obtained, lower than 0.05. In addition, the t count score > t table is 1.692. That means there is an average difference between the learning outcomes of the experimental group and the control group. Thus, there is

an impact of the use of learning generative forms on the ability to solve mathematical problems in the tenth grade students.

This is because learning activity like a moving generator becomes more active. Similar to an active moving generator, there is a connection that together supports every part of the generator. Just as there is one part inside a generator that is passive or not moving while performing its responsibilities, then the work of the generator may not work or die which makes the work obstructed.

It can be said that the learning generative model has successfully replaced the mathematical learning activity so that it is much more interactive and the students become more involved in the learning activity through this study. As learning activities are implemented, it become more active and depict more interesting learning stages. In following the learning, participants become much more participative and become so interactive between individuals to public communication between students in groups or between groups discussions. The subject of learning mathematics has been successfully presented in a simpler way through the application of learning generative models. Students who are actively and directly involved in analyzing all the parts of the study subject they are studying can immediately feel the distortion. The learning activity of the student becomes more meaningful stemming from the smooth learning process with learning generative model. In exploring the purpose of the whole in order to realize the learning topics obtained can be carried out by the students individually or in groups.

This is reinforced by the results of research that has been carried out by Rahmawati et al., (2022) where the t count score > t table is 3,087 > 2,000 then Hi is accepted, it can be summarized that there is an impact of the learning generative model on the ability to solve mathematical problems in 8th grade Junior High School 9 in Jambi.

5 Conclusion

From the analysis of research data that has been carried out, it can be concluded that the learning generative model can create an influence on the ability to solve mathematical problems in the tenth grade students. This can be seen from obtaining the results of the test hypothesis paired sample t test which results obtained a significance value of 0.000 smaller than 0.05. In addition, we obtain the value of t count score > t table 1.692. So there is an average difference between the learning outcomes of the experimental group and the control group which means that the learning generative model has an impact on the results of the ability to solve mathematical problems.

References

Winata, K. A., Zaqiah, Q. Y., Supiana, S., & Helmawati, H. Kebijakan pendidikan di masa pandemi. *Ad-Man-Pend: Jurnal Administrasi Manajemen Pendidikan*, *4*(1), 1-6. (2021)

Fatonah, K. Peran Pendidik Dalam Pengelolaan Media Pembelajaran Pada SD/MI. *Journal Al-Ilmu*, *1*(2), 21-26. (2022)

Rahmayani, V., & Amalia, R. Strategi peningkatan motivasi siswa dalam pembelajaran matematika di kelas. *Journal on Teacher Education*, *2*(1), 18-24. (2020)

Wulandari, S. Media pembelajaran interaktif untuk meningkatkan minat siswa belajar matematika di smp 1 bukit sundi. *Indonesian Journal of Technology, Informatics and Science (IJTIS)*, *1*(2), 43-48. (2020)

Septhiani, S. Analisis Hubungan Self-Efficacy Terhadap Kemampuan Pemecahan Masalah Matematika. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, *6*(3), 3078-3086. (2022)

Havill, J., & Havill, J. How to Solve It. In Discovering Computer Science. https://doi.org/10.1201/9781003037149-1. (2020)

Utami, H. S., & Puspitasari, N. Kemampuan pemecahan masalah siswa smp dalam menyelesaikan soal cerita pada materi persamaan kuadrat. *Jurnal Inovasi Pembelajaran Matematika: PowerMathEdu*, *1*(1), 57-68. (2022)

Muslihah, N. N., & Suryaningrat, E. F. Model Pembelajaran Contextual Teaching and Learning terhadap Kemampuan Pemecahan Masalah Matematis. Plusminus: Jurnal Pendidikan Matematika, 1(3), 553-564. (2021)

Damianti, D., & Afriansyah, E. A. Analisis kemampuan pemecahan masalah matematis dan self-efficacy siswa SMP. INSPIRAMATIKA, 8(1), (2022)

Indahsari, A. T., & Fitrianna, A. Y. Analisis kemampuan pemecahan masalah siswa kelas X dalam menyelesaikan SPLDV. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, *2*(2), 77-86. (2019)

Sriwahyuni, K., & Maryati, I. Kemampuan Pemecahan Masalah Matematis Siswa pada Materi Statistika. *Plusminus: Jurnal Pendidikan Matematika*, *2*(2), 335-344. (2022)

Lestari, S., Andinasari, A., & Retta, A. M. Model pembelajaran generatif untuk meningkatkan kemampuan representasi matematis peserta didik. *IndoMath: Indonesia Mathematics Education*, *3*(1), 44-51. (2020)

Mirunnisa, Z. R. MODEL PEMBELAJARAN GENERATIF UNTUK MENUMBUHKAN SOFT SKILL SISWA DALAM PEMBELAJARAN MATEMATIKA. In *Prosiding Seminar Nasional Universitas Jabal Ghafur* (Vol. 1, No. 1, pp. 40-51). (2021)

Maryanti, I., Sakinah, N., & Situmorang, H. F. Pengaruh Model Pembelajaran Generatif Learning Terhadap Kualitas Pembelajaran. *Jurnal Manajemen Pendidikan Dasar, Menengah dan Tinggi [JMP-DMT], 3*(3), 105-113. (2022)

Huda, S. N., & Jazwinarti, J. Pengaruh Penerapan Model Pembelajaran Generatif terhadap Kemampuan Penalaran Matematis Peserta Didik Kelas VIII SMPN 1 Payakumbuh Tahun Pelajaran 2019/2020. *Jurnal Edukasi dan Penelitian Matematika*, *8*(3), 240-246. (2019)