

Solving Mathematics Problems Through Reflective Learning for High School Students

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ABSTRACT

This research is a quasi-experimental study because the treatment was tested and measured its effect on groups of samples. The experimental design used in the study was the design of a non-equivalent pretest and posttest control group. The population in this study were all students of the Sei Rampah Exemplary Vocational School in class X consisting of 145 students, and a sample of 40 students was chosen randomly. To obtain data in this study used an instrument, namely a set of problem-solving tests with indicators (a) formulating the problem, (b) restating the problem in a form that can be resolved, (c) arranging hypotheses (temporarily) and strategies for solving it, (d) carry out solving procedures, and (e) evaluate the settlement. The results of this study indicate that the problem-solving ability of male students is better than female students when viewed based on the posttest scores obtained by male students significantly different from female students. Another thing also shows that reflective learning is significantly better in improving students' mathematical problem-solving abilities than ordinary learning.

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INTRODUCTION

Through good mathematics education, students can indeed obtain various kinds of provisions in facing challenges in the global era. In the 2013 curriculum itself, the use of technology in learning became something that was highly recommended. The learning process in the 2013 curriculum requires students to participate actively and provide sufficient space for students' creativity, interests, and talents (Tucker, 2012; Firmansyah, 2017; Dilla, et. al. 2018; Sriwahyuni, 2022). Attention plays an essential role in the learning process, without full notice and is impossible to get high achievements (Firmansyah, 2017; Dilla, et. al. 2018; Suherman, 2021; Nababan, 2021; Syafrizal, et. al. 2020).

The development of modern science and technology is currently influenced by the development of human thought and attitude. It can be emphasized that the effort to improve the learning process through the selection of appropriate and innovative learning models in learning mathematics in schools is an essential requirement to do (Irvan, I., & Muslihuddin, R. 2020; Triana, et al. 2021). This cannot be separated from the critical role of the development of mathematics in various disciplines. The results of the Program for International Student Assessment (PISA) 2012 test and the 2011 Trends in International Mathematics and Science Study (TIMSS) show that the quality of mathematics learning in Indonesia has not improved. According to (Yeager, D. & Dweck, C., 2012), HR capable of facing challenges in the information and globalization era can think critically, logically, systematically, and creatively or are known for their mathematical thinking abilities to be able to solve problems correctly. One of the mathematical skills that students need to master is the ability to solve mathematical problems. NCTM problem-solving standards (Ferrini-Mundy, J. 2000), namely:

1. Establishing that learning programs from pre-kindergarten through grade 12 must allow students.

2. Building new mathematical knowledge through problem-solving.
3. Solve problems that arise in mathematics and other contexts.
4. Monitor and reflect on the process of solving mathematical problems.

In the Curriculum Content Standards, it is mentioned that mathematics at the junior high school level aims to have students have the following abilities: Understanding mathematical concepts, explaining the interrelationships between concepts and applying concepts or algorithms flexibly, accurately, efficiently, and precisely in problem-solving.

We are using reasoning on patterns and traits, doing mathematical manipulation in generalizations, compiling evidence, or explaining mathematical ideas and statements. Solve problems that include the ability to understand problems, mathematical design models, solve models, and interpret the solutions obtained.

Communicate ideas with symbols, tables, diagrams, or other media to clarify the situation or problem. Having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, and being tenacious and confident in problem-solving.

Judging from these two goals, problem-solving is part of the mathematics curriculum, which is quite essential in the process of learning mathematics. Through problem-solving activities, essential aspects of mathematical abilities such as the application of rules to non-routine problems, pattern discovery, generalization, mathematical communication, and others can be developed better (Fitri, S., & Zahari, C.L, 2018). The importance of problem-solving is also emphasized in (Ferrini-Mundy, J. 2000), which states that problem solving is an integral part of mathematics learning so that it cannot be separated from mathematics learning. This is in line with (Mushlihuiddin, et al., 2018) opinion, which states that problem-solving is essential in mathematics, not only for those who will later explore or learn mathematics but also for those who will apply it in other fields of study and life daily.

Affective skills embodied in creative thinking include experiencing problems and opportunities, tolerating uncertainty, understanding the environment and others' creativity, open, bold, risking, self-control, curiosity, expressing and responding to feelings and emotions and anticipating something unpredictable. Whereas the metacognitive skills embodied in creative thinking include designing strategies, setting goals and decisions, predicting based on incomplete data, understanding creativity and things others do not understand, diagnosing incomplete information, constructing multiple judgments, controlling emotions and developing elaboration of problem solutions and plan (Tanjung et al., 2020; Nani Sugiarti, 2022; Yenita Sesriani, 2022; Faridatul Husna, 2022).

Says that the ability to solve problems is a skill in students to be able to use mathematical activities to solve problems in mathematics, problems in other sciences and problems in daily life (Sugiarni, et al., 2018; Hafidzah, et al., 2021). Based on these opinions, problem solving skills are needed to train students to become accustomed to dealing with various problems in their lives that are increasingly complex, not only to problems in mathematics itself but also problems in other fields of study and problems in daily life. Therefore, a person's ability to solve mathematical problems needs to be continuously trained so that someone is able to solve various problems they face.

However, the reality in the field is not in accordance with what is expected, mathematics learning still tends to be oriented towards textbooks, it is not uncommon to find mathematics teachers still guided by their teaching habits by using learning steps such as: presenting learning materials, giving examples of questions and asking questions students work on the practice questions contained in the textbooks they use in teaching and then discuss them with students. Learning like this certainly can not develop students' mathematical problem solving abilities. Students can only work on math problems based on what the teacher exemplifies, if given different problems they will have difficulty in solving them.

Realizing the importance of mathematics learning activities that have the potential to develop students' mathematical problem solving abilities, reflective Learning is seen as having many advantages if it is used as an alternative to learning mathematics to develop these abilities. Reflective Learning is learning by involving reflective thinking activities in the process. a generic for those intellectual and affective activities in which

individuals engage to explore their experiences to lead a new understanding and appreciation. The statement implies that reflection is an intellectual and affective activity involving students in an effort to explore their experiences to reach new understandings and appreciations.

When reflective thinking takes place on a student, he learns what he is facing, assumes, evaluates, behaves, and applies his understanding. This is very good because if this goes on continuously then in the end this thinking activity will arrive at a deeper understanding, change of mind, and ultimately solve the problem. Conclude further that reflection helps students to develop problem-solving skills. Thus, reflective Learning can develop student awareness of prospective teachers (students) to reflect (Insuasty, E.A. & Castillo, L.C.Z., 2010; Mushlihuiddin, R. 2018). Students will be trained to always design the best strategies in choosing, remembering, re-identifying, organizing the information they face, and in solving problems.

RESEARCH METHOD

This research is a quasi-experimental study because the treatment was tested and measured its effect on groups of samples. The experimental design used in the study was the design of a non-equivalent pretest and posttest control group. The population in this study were all students of the Sei Rampah Teladan Private High School in class X consisting of 145 students, and a sample of 40 students was chosen randomly. To obtain data in this study used an instrument, namely, a set of problem-solving tests with indicators:

1. Formulating the problem.
2. Restating the problem in a form that can be resolved.
3. Arranging hypotheses (temporary) and strategies for solving it.
4. Carry out solving procedures.
5. Evaluate the settlement.

RESULTS AND DISCUSSION

This research data on the results of tests of students' mathematical problem-solving abilities are described and analyzed based on factors: learning, gender. Data description of students' mathematical problem-solving abilities is presented in Table 1 below.

Table 1. Descriptive data of students' mathematical problem-solving abilities

Category	Data	Group					
		Experiment			Contol		
		Pretest	Posttest	N-Gain	Pretest	Posttest	N-Gain
Man	Average	3,70	7,44	0,60	1,62	5,13	0,41
	St.dev	1,63	1,65	0,24	1,45	1,67	0,15
Woman	Average	1,26	5,83	0,52	1,60	4,72	0,37
	St.dev	1,72	1,91	0,12	1,55	2,63	0,28
All	Average	1,22	3,27	0,33	0,85	2,63	0,20
	St.dev	1,78	1,49	0,25	1,13	2,25	0,21

Table 1 shows that students who receive reflective learning show improved problem-solving abilities better than students who obtain normal Learning. This result is also supported by the posttest value of students who get reflective Learning better than students who get ordinary Learning. But overall, the average posttest of students who received reflective Learning was still low, amounting to 3.27. If viewed as a whole, the improvement of students' mathematical problem-solving abilities that obtain reflective Learning is moderate. At the same time, students who get ordinary Learning are classified as low.

When viewed from Learning and gender, the improvement of mathematical problem-solving abilities of male students who receive reflective Learning and normal Learning is classified as moderate. Another thing that shows that male students' problem-solving ability is better than female students when viewed based on the posttest scores obtained between male students is significantly different from that of female students.

Furthermore, to show the presence or absence of significant differences in improving students'

mathematical problem-solving abilities, a t-test statistical analysis was performed. The results of normality test calculations show that the data increase in mathematical problem-solving abilities in reflective Learning is normally distributed. Still, in normal Learning, the data are not normally distributed. Thus to find out whether or not there was a difference in the improvement of the two sample groups based on Learning, a difference test was made to improve the mathematical problem-solving ability using the Mann-Whitney U test. The following table 2 is the result of statistical calculations.

Table 2. Difference Tests in Improving Mathematical Problem Solving Ability based on Learning

Group	Mathematical Problem Solving Ability			
	Comparison Enhancement	Z	Sig.	H ₀
Exp : Con	0,33 : 0,20	-3,546	0,000	Rejected

By From the results of the Mann-Whitney U test in Table 2, the probability value (sig.) = 0,000 is less than 0.05, this means that the null hypothesis is rejected or in other words, the improvement in mathematical problem-solving abilities of students who obtain reflective learning is significantly better than students who get regular learning.

The study results have shown that overall achievement and improvement in problem-solving abilities among students who get reflective learning is better than those who get ordinary learning. In other words, the results of this study indicate that reflective learning is significantly better at improving students' mathematical problem-solving abilities than ordinary learning.

If we look at the characteristics of reflective learning and ordinary learning, it is only natural that differences in the results of abilities obtained by students after participating in learning. The main difference is in reflective learning; students are allowed to play an active role in the learning process. In reflective learning, students are trained and accustomed to mathematical thinking through problem-based questions and social interaction through discussion (group discussions and class discussions). Presentation of problem-based questions allows students to have a very large role in efforts to understand concepts, develop procedures, find principles, and apply concepts, procedures, and principles in solving the given problem.

CONCLUSION

Based on the results of research and data analysis, it can be concluded when viewed from Learning and gender, the improvement of mathematical problem-solving abilities of male students who receive reflective Learning and normal Learning is classified as moderate. Another thing that shows that male students' problem-solving ability is better than female students when viewed based on the posttest scores obtained between male students is significantly different from that of female students. The study results have shown that overall achievement and improvement in problem-solving abilities among students who get reflective learning is better than those who get ordinary learning. In other words, the results of this study indicate that reflective learning is significantly better at improving students' mathematical problem-solving abilities than ordinary learning.

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