The 3rd International Conference on Education Innovation and Social Science, August 2024
ISSN (Online): 2961-9602

IMPLEMENTATION OF PROBLEM BASED LEARNING MODELS TO IMPROVE THINKING ABILITY STUDENT CRITICISM REVIEWED FROM LEARNING STYLE

Irham Habibi Harahap
Universitas Muslim Nusantara Al Washliyah Medan
irhamhabibiharahap@umnaw.ac.id

Keyword

Problem Based Learning, Critical Thinking, Learning Style.

Abstract

The development of students' critical mathematical thinking skills and attention to individual uniqueness in the learning process needs to be given attention, in order to be able to create an inclusive learning environment and support the development of each student's potential. The aim of this research is to determine the differences in the achievement and improvement of students' critical mathematical thinking skills from two different learning models and based on learning styles. The experimental group used a problem-based learning approach, while the control group used a conventional learning approach. This research uses a quantitative quasi-experimental method with a pre-test and post-test non-equivalent group design. This data was collected through a mathematical critical thinking ability test and a learning style questionnaire, which were completed by 40 students of SMP Swasta Sriwijaya Medan. The results of this study showed that students who took part in problem-based learning, as well as students with a kinesthetic learning style, performed better compared to the group who took part in conventional learning. However, if you look at auditory and kinesthetic learning styles, students who take part in problem-based descriptive learning have better performance. Therefore, it can be concluded that problem-based learning is quite effective in developing critical mathematical thinking skills, especially for students with a kinesthetic learning style.

INTRODUCTION

School is a place for fostering human resources in accordance with the development of science and technology. Education is a process of cultivating character or the crystallization of the values of human life. Because until now the world of education is seen as an effective tool in trying to preserve and pass on the values of life. Appropriate curriculum, approaches, methods, strategies and models, adequate facilities and professional human resources are aspects that are interrelated to achieve the planned learning objectives. Education is the only solution to create reliable human resources, smart, and also have high morality that supposed to be able to apply his/her knowledge for human welfare. For that reason human beings must get appropriate education in order to be his/her asset for his/her future

Based on the results of Trends in International Mathematics and Science Study (TIMMS) in 2015 which was carried out in fourth grade elementary school students, Indonesia is ranked 44th out of 49 countries.

Hadi, S., & Novaliyosi, N. (2019) stated that students in Indonesia needs to hone their higher order thinking skills through implementing more meaningful learning. Apart from that, it's wrong Another educational survey is the Program for International Students Assessment (PISA) also shows that students' thinking abilities in our country it is still at a low level. PISA results in 2018

ISSN (Online): 2961-9602

even decreased compared to the PISA results in 2015. Based on these facts, the learning process is nurturing Students' higher level thinking abilities are very necessary.

The ability to think critically is one of the keys to achieving competencies that are much needed in the 21st era (Annisa et al., 2021). In this case, mathematics teachers also have a role in developing students' critical thinking skills. Critical thinking skills aim to provide academic training to students, one of which is at the junior secondary education level. Critical thinking skills include problem-solving abilities such as creative expression, innovation, as well as the ability to communicate and collaborate.

Problem-based learning is a learning model that focuses on the role of students by giving them tasks or challenges related to real world problems (Dewi & Sahrina, 2021). This aims to facilitate the development of critical thinking abilities, problem solving skills, as well as to gain a deep understanding of essential knowledge and concepts from sequence and series material. The problem-based learning process involves several steps, including: (1) the teacher assigns problems to students, (2) students discuss in small groups, (3) students conduct independent research related to the problem, (4) students return to the initial group to share information, learning with friends, and collaborating in solving problems, (5) students are asked to present the solutions they find, and (6) teachers help students evaluate the entire learning process that has been done (Zakaria, 2022).

The results of the development of students' critical thinking abilities based on the explanation above can be influenced by difficulties that arise during the learning process. One factor that might cause this difficulty is a mismatch in students' learning styles in terms of receiving, organizing and processing new information during learning activities (Cici Marshela & Linda Yarni, 2023). A person's learning style can be categorized into three types: visual, auditory and kinesthetic learning styles, although there may also be a combination of these three types (Sa'adah & Ariati, 2020). Students' learning styles have differences when they do not receive attention in learning strategies so that it can make it difficult for students to understand, organize and process the new information they receive (Zahra, 2022). Variations in student learning styles will also influence learning achievement, including the development of critical thinking skills, both in achievement and improvement (Alexandro & Situmorang, 2021).

A number of research results show that students' critical thinking abilities in the junior high school context are relatively low. Research conducted by (Novita & Hidayati, 2022) revealed the level of students' critical thinking abilities in solving integral calculus description problems. The results of this study show that students' ability to identify and provide reasons is at the level of 7.69%, their ability to generalize reaches 82.05%, while their ability to analyze and evaluate is at 15.38%. Another study conducted by (Edigan, 2018) which identified students' mathematical critical thinking abilities in integral calculus subjects, showed findings that some students could formulate problems correctly, but were still incomplete; They also have not been able to determine the facts of the problem comprehensively and accurately. Apart from that, they are not yet skilled at using appropriate evidence, are not able to draw conclusions that are in accordance with the facts, and are not skilled at providing more in-depth explanations. Furthermore, students are not yet able to integrate their tendencies and abilities in decision making. Similar findings were also found in the results of the calculus exam, with the following indicators: (1) students' ability to analyze data reached 38.70%, (2) in assessing the truth of arguments, 12.91%, (3) in concluding and providing logical argumentation from the analysis results reached 74.20%, and (4) in formulating problem solving strategies reached 48.38%.

Based on the explanation above, the aim of this research is to identify differences in students' mathematical critical thinking abilities in learning based on their learning style factors. This research focuses on how to achieve and improve critical thinking skills students' mathematics in the context of problem-based learning, both in relation to learning styles and to students' overall understanding.

ISSN (Online): 2961-9602

METHOD

Location and Time of Research

The research is conducted at SMA Swasta Sriwijaya Medan. The research is conducted in the second semester of 2023/2024.

Population and Sample

The population of this research is all the students of VIII grade of SMP Swasta Sriwijaya Medan. The sample of the research is 20 the students of the VIII grade from A class and 20 students of the VIII grade from B class of SMP Swasta Sriwijaya Medan.

Research Design

This research used a quasi-experiment with a pretest-posttest non-equivalent group research design. The research instrument used was a test instrument to measure students' mathematical problem solving abilities. This test is in the form of descriptive questions given before treatment (pre-test) and after treatment (post-test). The material used is rows and series. The population that was the subject of this research included class VIII students at SMP Swasta Sriwijaya Medan.

The sampling process for this research used a cluster random sampling technique involving two classes or study groups. The sample was selected from the first group (experimental group) which consisted of 20 students, and the second group (control group) which also consisted of 20 students. The experimental group used a problem-based learning model while the control group followed conventional learning (CL).

Table 1. Learning Style Identification Instrument

No	Statement
1	I prefer to learn through visualizing images, graphs, or diagrams.
2	I prefer to learn through reading and repeating information.
3	I understand the material more easily when listening to verbal explanations.
4	I like discussing with others to understand topics more deeply.
5	I learn better when I do practice or hands-on exercises.
6	I prefer to learn through practical application or real world situations.
7	I feel comfortable studying alone and independently without the help of others.
8	I prefer to learn gradually with clear steps.
9	I always record lesson material completely and neatly.
10	I prefer to study at night when it is quiet.

The next step is to carry out a normality test, homogeneity test, and examine the difference in the average initial abilities of students based on the test results in the two groups. Previously, a pre-test of critical mathematical thinking skills was carried out at the beginning of learning. Then a post-test of critical mathematical thinking skills was given to students. Data regarding pre-test and post-test scores on mathematical critical thinking skills were then analyzed statistically using the Independent Samples t-test Mann-Whitney U test. Normality test scores to evaluate the increase in students' mathematical critical thinking skills were classified based on Table 1 (Rismayanti et al ., 2022).

ISSN (Online): 2961-9602

Table 2. Normalized Gain Score Categories

Score Intervals	Normalized Gain Score Categories
$70 \leq x \leq 100$	High
$30 \leq x < 70$	Middle
$0 \leq x < 30$	Low

RESULTS

Students were classified based on the results of the learning style questionnaire, as shown in Table 2. In this study, only students who fell into the categories of visual, auditory and kinesthetic learning styles were selected as research samples. Based on Table 2, in the problem-based learning group, there are 9 students with a visual learning style, 5 students with an auditory learning style, and 6 students with a kinesthetic learning style. On the other hand, in the Conventional Learning (CL) group, there were 8 students with a visual learning style, 5 students with an auditory learning style, and 7 students with a kinesthetic learning style.

Table 3. Classification of Student Learning Styles

Gaya Belajar	Learning Model		Total
	PBL	**CL**	
Visual	9	8	17
Auditory	5	5	10
Kinestetik	6	7	13
Total	**20**	**20**	**40**

Data from the pretest and posttest of critical mathematical thinking skills are processed and analyzed, both in total and in the context of learning styles. The descriptive statistical graph of students' critical mathematical thinking abilities in problem-based learning can be seen in Figure 1 below.

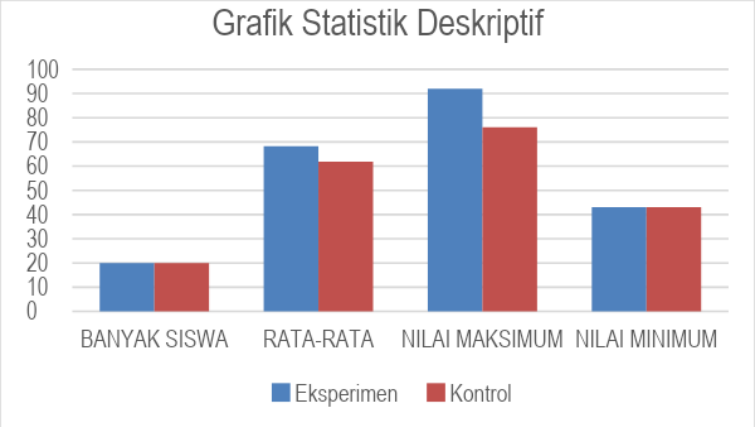

Figure 1. Descriptive statistical graph of Students' Mathematical Critical Thinking Ability in Problem Based Learning Class VIII at SMP Swasta Sriwijaya Medan.

ISSN (Online): 2961-9602

From the data in Figure 1 above, it can be concluded that the average test results for students' mathematical critical thinking abilities in the experimental class were significantly higher than those in the control class. This shows that the scores of students in the experimental class are superior to the scores of students in the control class. And it can also be seen from the results of the visual, auditory and kinesthetic learning styles questionnaire. This shows that students tend to understand and remember information better when it is presented visually and are able to create mind maps and understand topics more deeply and students are able to involve themselves in physical activities or direct practice as an effective learning method.

DISCUSSION

Based on the results of research regarding the achievement of critical mathematical thinking skills, it was concluded that overall there were significant differences between the two groups. In this context, the achievement of critical mathematical thinking skills of students who use PBL is higher than students who use CL. The difference in the average achievement of students' overall mathematical critical thinking skills illustrates that learning using PBL is more effective than CL in developing students' mathematical critical thinking skills.

From a theoretical perspective, the achievement of critical mathematical thinking skills must be understood in a long-term context that evaluates the impact of Problem-Based Learning on the development of critical thinking skills (Pratama & Lestari, 2017). The short-term empirical findings from this research are consistently in line with the results of research by (Setiana & Purwoko, 2020) which shows that the critical thinking abilities of students with a kinesthetic learning style tend to be superior to students who have a visual and auditory learning style.

Specifically, students with a kinesthetic learning style seem to benefit more from problem practice than other aspects such as problem visualization or interaction with the teacher. This indicates the effectiveness of PBL in improving the critical thinking skills of students who have a kinesthetic learning style, where practice questions have a significant role. It is known that PBL continues to provide a variety of learning activities for students with different learning styles, with the hope that this will have a positive impact on the development of students' critical thinking abilities in junior high school in the long term. The results of this study reflect empirical evidence in the short term. However, in the long run, the results of achievement

CONCLUSION

Based on the results of research that has been conducted, it shows that in terms of achieving and improving critical mathematical thinking skills, problem-based learning and the influence of the kinesthetic learning style are superior to conventional learning. In the problem-based learning (PBL) group, there were 9 students with a visual learning style, 5 students with an auditory learning style, and 6 students with a kinesthetic learning style. On the other hand, in the Conventional Learning (CL) group, there were 8 students with a visual learning style, 5 students with an auditory learning style, and 7 students with a kinesthetic learning style. So the average of students' mathematical critical thinking ability tests in problem-based learning and the influence of learning styles for the experimental class was 68.2 and for the control class 61.8.

ACKNOWLEDGEMENT

I express gratitude and appreciation to headmaster of SMP Swasta Sriwijaya Medan for helping me in conducting research

REFERENCES

Annisa, A. M., Ariyanti, I., & Patahuddin, N. (2021). Pengaruh Pembelajaran Model PAT-UT 1 dengan Bantuan Laboratorium Mini Terhadap Hasil Belajar Matematika Siswa. Jurnal Cendekia : Jurnal Pendidikan Matematika, 5(1). https://doi.org/10.31004/cendekia.v5i1.556

Cici Marshela, & Linda Yarni. (2023). Dampak Media Sosial Pada Prrestasi Belajar Siswa di SMAN 1 HARAU. Jurnal Kajian Penelitian Pendidikan Dan Kebudayaan, 1(1).

https://doi.org/10.59031/jkppk.v1i1.61

Dewi, I. L. K., Zaenuri, Dwijanto, Mulyono, Waluya, S. B., & Rochmad. (2021). Conceptual understanding and productive disposition in trigonometry through generative learning. Journal of Physics: Conference Series, 1918(4), 042050. https://doi.org/10.1088/1742-6596/1918/4/042050

Dewi, K., & Sahrina, A. (2021). Urgensi augmented reality sebagai media inovasi pembelajaran dalam melestarikan kebudayaan. Jurnal Integrasi Dan Harmoni Inovatif Ilmu-Ilmu Sosial (JIHI3S), 1(10). https://doi.org/10.17977/um063v1i10p1077-1089

Edigan, F. (2018). Penggunaan Media Berbasis Komputer dengan Metode Inkuiri untuk Menigkatkan Hasil Belajar Fisika Prodi Matematika FKIP UIR. SATIN - Sains Dan Teknologi Informasi, 2(1). https://doi.org/10.33372/stn.v2i1.338

Hadi, S., & Novaliyosi, N. (2019). TIMSS Indonesia (Trends in international mathematics and science study). In Prosiding Seminar Nasional & Call for Papers. Retrieved from http://jurnal.unsil.ac.id/index.php/sncp/article/view/1096

Novita, R., & Hidayati, N. (2022). Analisis Kemampuan Berpikir Kritis Matematis Pada Siswa SMK.Jurnal Theorems
(The Original Reasearch Of Mathematics), 7(1).

Pratama, L. D., & Lestari, W. (2017). Kemampuan Berpikir Kritis Siswa dalam Menyelesaikan Soal Performance Task. Seminar Matematika Dan Pendidikan Matematika.

Rismayanti, T. A., Anriani, N., & Sukirwan, S. (2022). Pengembangan E-Modul Berbantu Kodular pada Smartphone untuk Meningkatkan Kemampuan Berpikir Kritis Matematis Siswa SMP. Jurnal Cendekia : Jurnal Pendidikan Matematika, 6(1). https://doi.org/10.31004/cendekia.v6i1.1286

Rotherham, A. J., & Willingham, D. T. (2010). 21st-century" skills. American Educator, 17(1), 17-20. Retrieved from https://dbweb01.aft.org/sites/default/files/periodicals/RotherhamWillingham.pdf

Setiana, D. S., & Purwoko, R. Y. (2020). Analisis kemampuan berpikir kritis ditinjau dari gaya belajar matematika siswa. Jurnal Riset Pendidikan Matematika, 7(2). https://doi.org/10.21831/jrpm.v7i2.34290

Zahra, N. F. (2022). Teori Perkembangan Kognitif. In Research Gate

Zakaria, Y. (2022). Pembelajaran Bahasa Inggris Berbasis Learning Management System (LMS) . Nuansa Informatika, 16(1). https://doi.org/10.25134/nuansa.v16i1.4976