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THE EFFECT OF MATHMAGIC-ASSISTED PROBLEM-BASED LEARNING ON MATHEMATICAL REPRESENTATION ABILITY AMONG SEVENTH-GRADE STUDENTS

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Abstract

The purpose of this study is to show the mathematical representation ability between students who take part in learning using the mathmagic-based problem-based learning model and the mathematical representation ability of students who use the convention method of lecture. The type of research used is experimental research. In this research, the design used is Quasi Experimental (Pseudo Experiment). This research was conducted at SMP Negeri 4 Sungai Raya, which is located in Kapur Village, Sungai Raya Sub-District, Kubu Raya Regency, West Kalimantan. The population in this study were all students of SMP Negeri 4 Sungai Raya with sampling techniques in this study using teacher consideration and interviews. The data collection tools used in this study were written tests and questionnaires. Data analysis in this study was quantitative analysis and qualitative data analysis. The conclusion is the results of the effect mathmagic-based problem-based learning model (experimental class) were higher than the results of the mathematical representation ability using the lecture method (control class). Students response to learning using mathmagic-based problem-based learning model on students' mathematical representation ability on algebraic material in class VII SMP Negeri 4 Sungai Raya was positive. The students showed active involvement in the learning process, both individually and in group work and showed the ability to express and express their own ideas in the learning context. This positive response reflects that mathmagic-based problem-based learning can be an effective learning model in improving students' engagement and understanding of the subject matter.

Keywords: mathematical representation ability, student responses, problem-based learning model.

1. Introduction

Mathematics is an abstract discipline that requires logical and analytical thinking skills. To help students understand mathematical concepts, teachers must use various forms of representation that are appropriate to the cognitive level of students (Lesh et al., 1987). Mathematical representations include various forms, such as verbal, symbolic, visual, and concrete representations (Goldin, 2002). This is in line with the opinion of the Ministry of Education, Culture, Research, and Technology (2022), which emphasizes the importance of mathematics education in developing

logical, analytical, and systematic thinking skills, as well as the ability to communicate using symbols or other media. Therefore, learning mathematics should not only focus on memorization but also on understanding and logical thinking.

According to Nurfitriyanti, et al (2020) Students' mathematical reasoning is related to mathematical representation skills, which means that students' mathematical representation is still relatively low the reason why present mathematical problems is still low because they are less able to formulate mathematical concepts in a new form. In addition, students' representation power has also not developed adequately because they are rarely given the opportunity to express their own work when solving problems in a way that they understand. In learning mathematics, many students have difficulty answering math problems, and most of them do not utilize their representation skills. Based on observations made by researchers at SMP Negeri 4 Sungai Raya, it was concluded that the learning model used by teachers in the classroom was a conventional learning method with the lecture method so that there were several obstacles during the learning process which resulted in learning only through one direction. In addition, the KKM applicable at SMP Negeri 4 Sungai Raya is 73 with Curriculum 13 while the value of class VII A in the 2022/2023 school year, out of 38 students only 19 were complete, 21 others were not complete.

To address this issue, the implementation of a more interactive learning model that encourages students to think critically is essential. Problem-based learning has the idea that learning objectives can be achieved if educational activities are centered on tasks or problems that are authentic, relevant, and presented in a context. It aims to give students the experience that they will need in their professional lives". Problem-Based Learning (PBL) is a student-centered learning approach, where they are given real, challenging problems as a starting point in the learning process. According to Barrows and Tamblyn (1980), PBL is a learning strategy that uses problems as a stimulus to develop critical thinking skills, problem solving, and independent learning.

In the context of learning mathematics, PBL encourages students to understand concepts by exploring information from various sources, discussing ideas, and using various mathematical representations to solve problems (Hmelo-Silver, 2004). The problem-based learning model can refer to students' curiosity, motivate them to discuss to solve a problem that makes the development of new knowledge more meaningful to students and can foster students' representation skills to solve a given problem (Hamruni,2012)

In addition, combining a problem-based learning model based on mathmagic can make mathematics learning more engaging and enjoyable for students. MathMagic is a math learning approach based on games, puzzles, and math tricks. It aims to increase students' interest and understanding of math in a fun and interactive way (Liljedahl, 2005). Mathmagic enhances mathematics learning outcomes through interactive and motivating games (Irawan & Febriyanti, 2016). Added that mathmagic makes it easier for students to understand basic mathematical concepts in a fun way (Handojo & Ediati, 2008). The use of technology such as Android

applications for math magic, according to the study), can capture the attention of students who are already accustomed to technology, while also helping them understand the material in a more engaging and accessible way (Cahyati et al. 2023). Thus, this study aims to explore how the mathmagic-based problem-based learning model can enhance students' mathematical representation skills, particularly in algebra material for seventh-grade junior high school students.

2. Methods

The type of research used is experimental research. In this study, the design used was Quasi Experimental (Pseudo Experiment). This research has been conducted at SMP Negeri 4 Sungai Raya, which is located in Kapur Village, Sungai Raya Sub-District, Kubu Raya Regency, West Kalimantan. The population in this study were all students of SMP Negeri 4 Sungai Raya with sampling techniques in this study using teacher consideration and interviews. The data collection tools used in this study were written tests and questionnaires. Data analysis in this study was quantitative analysis and qualitative data analysis.

3. Result and Discussion

Result

Based on the research involving 36 students from class VIIB and VII F of SMP Negeri 4 Sungai Raya, a summary of the research findings was obtained in the form of descriptive statistics for the class after they were given a formative test consisting of questions created based on the indicators of students' mathematical representation abilities.

Statistic Descriptive

Statistic Descriptive	Lecture (Control Class B)	Mathmagic-based Problem-Based Learning (Eksperimen Class of VII F)
Mean	34,7	78,8
Modus	40	80
Median	40	60
Standard Deviation	14,6	17,8

Student Test Results

Value	Number Of Students Based On Test Results		Category
	Lecture (Control Class B)	Mathmagic-based Problem-Based Learning (Eksperimen Class of VII F)	
86-100	0	12	Very High
76-85	0	11	High
60-75	4	12	Enough
35-59	18	1	Low
<34	14	0	Very Low

The research results show a clear difference between the control group and the experimental group in terms of students' mathematical representation skills. In the control group that used the lecture method, the average student scores were relatively low, reflecting overall inadequate performance. The most frequently occurring value (mode) falls within the low to very low category, specifically below 59, indicating that the majority of students are struggling to achieve good grades. Additionally, the median score is also in the low category, meaning that half of the students scored below 59. A small standard deviation indicates that students' scores tend to cluster around low scores with little variation among students. On the contrary, the experimental group that used the mathmagic-based problem-based learning model showed significantly better results. The average score of the students is higher, reflecting an overall improvement in mathematical understanding. The mode is in the very high category, ranging from 86 to 100, indicating that the majority of students have managed to achieve the maximum score. The median score is also in the high category, indicating that half of the students achieved good grades. Although the standard deviation in the experimental group tends to be larger, this indicates a wider variation in the results; however, the majority of students showed good outcomes.

Based on the results of the questionnaire, this was given to 36 seventh-grade students in class VII F who used the problem-based learning model based on mathmagic, with a total of 12 questions in the questionnaire and using four response options: strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD). (STS). For the category of student responses, they are divided into four parts: very positive, positive, less positive, and not positive. By 36 students, 44% provided very positive responses, 50% gave positive responses, and only 6% provided less positive responses. Particularly in the categories of very high and high representation abilities, the majority of students provided positive and very positive responses. This indicates that students with higher representation abilities tend to respond more positively to the mathmagic-based problem-based learning model.

Based on the results of the hypothesis test conducted, a significance value of 0.035 was obtained, and this significance value is <0.05. According to the decision-making rules for the

independent sample t-Test, if the significance value is <0.05, then there is a difference in the average mathematical representation ability of students who use the mathmagic-based problem-based learning model compared to those who learn through the lecture method.

Based on the table, the Pearson correlation value (r) obtained is 0.228 with a significance level of 0.000. This indicates that the null hypothesis is rejected because the significance value is less than 0.05 ($p < 0.05$) and the alternative hypothesis (Ha) is accepted. It can be stated that there is a relationship between students' mathematical representation abilities and their responses. The positive correlation value of r at 0.228 indicates that there is a positive and direct relationship between mathematical representation abilities and student responses. If students' mathematical representation abilities increase, then their responses also improve. It can be concluded that the results of students' mathematical representation abilities and their responses are related, with a p-value of ($p<0.05$) and a Pearson correlation (r) of 0.228.

Discussion

This research aims to examine the influence of the mathmagic-based problem-based learning (PBL) model on students' mathematical representation skills and to describe students' responses to this learning method. PBL has advantages in encouraging active student engagement, enhancing critical thinking skills, and strengthening conceptual understanding through student-centered learning. Data was collected through formative tests conducted in two classes, namely VII B as the control class using the lecture method and VII F as the experimental class using PBL. The test results indicate that students in class VII F performed better, with more students in the very high and high categories, while class VII B was dominated by the low and very low categories. This difference can be explained by the use of more active and interactive learning models, which align with Barrows & Tamblyn's (1980) theory of student-centered learning.

The use of the Mathmagic application also significantly contributes to enhancing the appeal of learning mathematics, as expressed by Setyono. (2007). Mathmagic presents material in a fun and concrete way, making it easier for students to understand abstract concepts. In the learning process, students are encouraged to think critically through a series of stages, starting from problem identification to analysis and mathematical representation. This culminates in high results in the indicators of mathematical representation skills, which include the ability to create equations, outline solution steps, and interpret representations.

The results of the hypothesis test show a significance value of 0.035, indicating a significant difference between the two learning methods, supporting that mathmagic-based PBL is more effective in improving students' mathematical representation skills compared to the lecture method. In addition, the students' response to this learning model is also positive, with many students feeling more motivated and active. The average response reached 79.05, indicating the effectiveness of using mathmagic in enhancing students' cognitive, affective, and conative aspects. There is also a significant positive correlation between mathematical representation skills and student responses, indicating that PBL is effective in improving overall student engagement and understanding. Thus, this research shows that the application of interactive and enjoyable learning models has a significant impact on students' learning outcomes.

4. Conclusion

The conclusion is the results of the effect mathmagic-based problem-based learning model (experimental class) were higher than the results of the mathematical representation ability using the lecture method (control class). Students response to learning using mathmagic-based problem-based learning model on students' mathematical representation ability on algebraic material in class VII SMP Negeri 4 Sungai Raya was positive. The students showed active involvement in the learning process, both individually and in group work and showed the ability to express and express their own ideas in the learning context. This positive response reflects that mathmagic-based problem-based learning can be an effective learning model in improving students' engagement and understanding of the subject matter.

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