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The Use of Eliciting Activities Model to Improve Mathematical Representation Ability and Self-Efficacy in Elementary Schools

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Abstract

This study aims to determine improvements in mathematical representation ability and self-efficacy in ratio material among fifth-grade elementary school students using Model-Eliciting Activities (MEAs). This research employs a mixed-method approach with a quasi-experimental nonequivalent control group design. The experimental group received treatment using Model-Eliciting Activities (MEAs), while the control group was taught using conventional learning methods. Data collection techniques in this study included tests, questionnaires, documentation, observation, and interviews. Data analysis consisted of descriptive statistics, prerequisite tests, and final hypothesis testing (T-test, Z-test, mean difference test, and gain test). The results of this study indicate that Model-Eliciting Activities (MEAs) have a significant effect on the mathematical representation ability of fifth-grade students in the Sultan Agung cluster in the ratio material. This is demonstrated by the analysis results using the paired sample t-test, which produced a t-value (t_calculated) greater than the t-table value (13.047 > 2.145). Model-Eliciting Activities (MEAs) are effective in improving students' mathematical representation ability, as shown by the independent sample t-test results, where t_calculated was greater than the t-table value (2.52 > 2.048). There is a significant difference in self-efficacy between students who received MEA-based learning and those who received conventional learning. The analysis using the independent samples t-test showed that the t-calculated values for self-efficacy were 2.935, 2.522, 2.699, and 2.871 for the magnitude, strength, and generality dimensions, respectively. Given that the t-table value was 2.048, it can be concluded that the t-calculated values for the self-efficacy questionnaire results in the experimental and control classes, across the dimensions of magnitude, strength, and generality, were greater than the t-table value.

Keywords: ***Model-Eliciting Activities (MEAs); representation ability; self-efficacy***

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Introduction

Mathematics is one of the basic sciences that everyone must master because it plays a vital role in education and everyday life. According to Skemp (Sholihah & Mahmudi, 2015), mathematics is a valuable technique with a general purpose: to meet other needs. Mathematics is also an important tool in science, technology, trade, and other professions.

Not a few students consider mathematics difficult to understand. Strengthened by Fleming's opinion, he said that sometimes students find mathematics difficult, lose interest, and eventually hate it (Antipolo, 2021). Students who form a negative impression of mathematics are less likely to adjust well to school (Siregar, 2017). However, it is undeniable that mathematics is one of the important supporting sciences in everyday life and supports the progress of science and technology (Case, 1992; Gooding, 2009; Seifi et al., 2012).

Initial studies conducted by researchers at SD Negeri 1 Ngargosari and SD Negeri 2 Ngargosari on learning mathematics with comparative materials showed that students' mathematical representation abilities were still very low, while based on researchers' observations, students' self-efficacy was also very low. In the initial study at SD Negeri 1 Ngargosari in learning mathematics on comparative material, out of 16 grade 4 students, only 25% of students, or around five students, had good mathematical representation abilities and self-efficacy; the rest, or around 75% of students, did not show mathematical representation abilities and self-efficacy. Meanwhile, the initial study conducted at SD Negeri 2 Ngargosari, with 14 students, showed that almost all students' mathematical representation abilities and self-efficacy remained very low. Of the 14 students, only 21% or around 3 students had good mathematical representation abilities and self-efficacy.

By considering the description above, the author seeks to determine whether Model-Eliciting Activities (MEAs) learning contributes to students' self-efficacy regarding mathematical representation. The objectives of this study are (1) to prove the quality of learning by using the eliciting activities (MEAs) model in improving the representation ability of fifth grade elementary school students in the Sultan Agung Cluster, Sukorejo District in mathematics learning; (2) to describe the representation ability of fifth grade elementary school students in the Sultan Agung Cluster, Sukorejo District in mathematics learning in terms of self-efficacy in the eliciting activities (MEAs) model.

Research Methods

This study uses a mixed-method research method. Mixed research is used as a guideline for collecting and analyzing data by combining quantitative and qualitative approaches at each stage of the research process. According to Creswell (2010), mixed research is a research approach that combines qualitative research with quantitative research.

The combination model used in this study is the sequential explanatory type. Sequential explanatory research is a combination research method that sequentially combines quantitative and qualitative methods, with the first stage conducted using quantitative methods and the second using qualitative methods (Sugiyono, 2013: 415).

This study aims to determine the increase in mathematical representation ability and self-efficacy regarding comparative material among grade V elementary school students through model-eliciting activities (MEAs), so the research method used in this study is the experimental method. Sugiyono (2016:72) explains the experimental research method as a research model used to determine the effects of specific treatments on others under controlled conditions.

Results and Discussion

In this study, learning with model-eliciting activities (MEAs) was applied to class V of SD Negeri 1 Ngargosari in mathematics subjects. The research was conducted on September 14, 2020, for the first meeting, September 15, 2020, for the second meeting, September 16, 2020, for the third meeting, September 17, 2020, for the fourth meeting, September 18, 2020, for the fifth meeting, and September 19, 2020, for the sixth meeting. Model Eliciting Activities (MEAs) is a learning approach that develops students' conceptual understanding by having them communicate their mathematical thinking through mathematical modeling and problem-solving.

The learning outcomes in this study are the mathematical representation ability scores from the pretest and posttest results of mathematics students. The pretest is the taking of students' initial ability scores before treatment is carried out. The pretest is carried out at the first meeting. The posttest is the final assessment of students after learning and is conducted at the sixth meeting, after treatment has been carried out twice. The KKM score for mathematics subjects in this study is 70. The following are the data from the pretest and posttest results in the experimental class

1. Experimental Class Pretest Learning Results

Data yang sudah diperoleh kemudian dikategorikan dalam kriteria ketuntasan untuk mengetahui besarnya ketuntasan hasil belajar sebelum dilakukan treatment. Berdasarkan tabel di atas besarnya persentase siswa yang belum lulus KKM pada rentang nilai 50-59 sebesar 18,75%; rentang 60-64 sebesar 62,5%; dan rentang 65-69 sebesar 12,5%. Siswa yang sudah tuntas KKM berada pada rentang 70-74 sebesar 6,25%. Jumlah persentase siswa yang belum tuntas KKM sebesar 93,75% dan yang sudah tuntas KKM sebesar 6,25%.

1. Postest Learning Results of E

The data obtained is then categorized against the completion criteria to determine the level of completion of learning outcomes before treatment is carried out. Based on the table above, the percentage of students who have not passed the KKM in the 50-59 range is 18.75%; in the 60-64 range, 62.5%; and in the 65-69 range, 12.5%. Students who have completed the KKM are in the range of 70-74 at 6.25%. The total percentage of students who have not completed the KKM is 93.75%, and those who have completed it is 6.25%.

2. Pretest Learning Results of Control Class

The data obtained is then categorized against the completion criteria to determine the level of completion of learning outcomes before treatment is carried out. The percentages of students who have not passed the KKM are: 14.29% in the 55-59 range; 57.14% in the 60-64 range; and 21.43% in the 65-69 range. Students who have completed the KKM are in the 70-74 range, at 7.14%. The total percentage of students who have not completed the KKM is 92.86%, and those who have completed it is 7.14%.

3. Posttest Learning Results of Control Class

The data obtained is then categorized against the completion criteria to determine the level of completion of learning outcomes after treatment. The percentage of students who have not completed the KKM in the range of 65-69 is 21.43%, and those who have completed the KKM in the range of 70-74 are 7.14%; the range of 75-79 is 35.71%; and in the range of 80-84 is 28.57%; and in the range of 85-89 is 7.14%. The percentage of students who have not completed the KKM is 21.43%, while those who have completed it are 78.57%.

4. Comparison of Learning Outcome Data for Experimental Class and Control Class

From the descriptions of the two research class groups, the results for each class can be seen. The pretest and posttest data were then analyzed using SPSS version 23 to obtain descriptive statistics. The following is a comparison table of the descriptive results for the pretest and posttest scores of the experimental and control classes.

Both class groups have different results. Data before treatment showed a difference in average pretest scores: 61.81 in the experimental class and 62.79 in the control class. The highest score was 70 in both the experimental and control classes, while the lowest score was 55 in both classes. The standard deviation in the experimental class was 3,851, and the control class was 3,984.

There was also a difference in the average score of the two classes in the posttest score. The average value in the experimental class was 83.56, while in the control class it was 76. The highest value was in the experimental class, namely 93, while the control class was 87. The lowest value in the experimental class was 72, and in the control class it was 67. The standard deviation in the experimental class was 6,418, and the control class was 6.064.

Based on the calculations, the average student learning outcomes for the two class groups show that the class using the model-eliciting activities (MEAs) learning model achieves higher average results than the class using the conventional learning model in mathematics. The experimental class has an average value of 83.56, while the control class has an average result of 76. The average difference between the two classes is 7.56. Thus, it can be concluded that the average learning outcomes of students using the model-eliciting activities (MEAs) learning model are higher than those using the conventional model.

The results of the study showed that the use of Model-Eliciting Activities (MEAs) significantly improved the mathematical representation ability and self-efficacy of fifth-grade students in the comparison group. This can be seen from the results of the paired sample t-test, which showed a t-count value greater than the t-table value (13.047 > 2.145), and the independent sample t-test, which showed a t-count value of 2.52 greater than the t-table value of 2.048 for mathematical representation ability. Furthermore, the t-count value for self-efficacy (2.935) is greater than the t-table value of 2.048, indicating a significant difference between the experimental and control groups. The positive effect of using MEAs on mathematical representation ability can be explained based on the constructivist theory that underlies this approach. According to this theory, learning that actively involves students in solving real-world context-based problems can improve their conceptual understanding (Piaget, in Woolfolk & Perry, 2003).

MEAs allow students to construct their own knowledge through the process of assimilation and accommodation, thereby improving their ability to represent mathematical problems visually, symbolically, and verbally. This finding is consistent with previous research by Pratiwi (2017), in which students who used the MEA approach showed better mathematical representation skills than those who used the conventional approach.

In addition, students' self-efficacy also increased through the MEA's approach. This is consistent with Bandura's theory (1978), which posits that self-efficacy is influenced by students' success experiences (performance accomplishments) during the learning process. In this study, students were allowed to face and solve mathematical problems that were relevant to their lives, which increased their confidence in their mathematical abilities. This is supported by the results of Hanifah's (2015) study, which found that MEAs not only improved mathematical representation skills but also strengthened students' self-efficacy.

The results of this study also support Maesaroh's (2017) study, which showed that MEA-oriented learning devices were effective in improving students' mathematical problem-solving abilities and self-efficacy. These findings indicate that MEAs help students develop a better conceptual understanding through an approach relevant to everyday life, which aligns with the principles of reality and self-assessment in MEAs (Chamberlin & Moon, 2005).

Thus, the results of this study are not only relevant to improving mathematics learning outcomes at the elementary school level but also provide theoretical contributions in supporting the effectiveness of MEAs in mathematics learning. This study opens up opportunities for further exploration of the application of MEAs at various levels of education and other materials.

Conclusion

This study concludes that (1) Model Eliciting Activities (MEAs) significantly improve students' mathematical representation skills. The results of the paired sample t-test show that the calculated t-value is greater than the t-table, which means that there is a significant difference before and after treatment; (2) The results of the independent sample t-test between the experimental group and the control group show that the group using MEAs has a higher score than the group using the conventional method. (3) The increase in self-efficacy of students who learn with MEAs is more significant than that of students who learn using the conventional method. This can be seen in the higher self-efficacy scores on the magnitude, strength, and generality dimensions compared with the control group.

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