

APPLICATION OF MODEL-ELICITING ACTIVITIES (MEAs) FOR LEARNING MATHEMATICS BASED ON STUDENTS' INITIAL MATHEMATICAL ABILITIES

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ABSTRACT

This study aims to analyze the application of the Model-Eliciting Activities (MEAs) for learning mathematics based on students' initial mathematical abilities and school origin. It was conducted at SDN Batujajar 3, SDN Sukamaju and SDS Yayasan Beribu by using a quantitative research approach. The research method used the survey method and Two Ways ANOVA test analysis to determine the relationship between students; initial mathematics learning outcomes, students' origin school, and students' initial mathematical abilities with a sample of 81 students. In this study, it was found that in learning using the Model-Eliciting Activities there were differences in students' mathematics learning outcomes based on students' school origin, students' mathematics learning outcomes based on students' initial mathematical abilities, and there was an interaction between school origin and students' initial mathematical abilities in determining mathematics learning outcomes. In addition, the interaction that occurred shows that SDS Yayasan Beribu had better than SDN Batujajar 3 and SDN Sukamaju.

Keywords: Model-Eliciting Activities, Mathematics Learning Outcomes, School Origin

INTRODUCTION

The actual issue in mathematics learning today is how to develop creative, critical, and logical reasoning abilities in students, and make it a crucial goal that must be achieved in learning mathematics (Rosidi, 2023). Because mathematical reasoning abilities are non-algorithmic, complex, and involve independence, it is not uncommon to involve uncertainty so that it requires a lot of consideration and interpretation (Partono et al., 2021). Mathematical reasoning abilities also often involve diverse criteria sometimes trigger conflicts, produce open solutions, and require serious efforts. Therefore, students' initial mathematical abilities need to be constructed continuously to activate higher mathematical abilities (Maryati & Monica, 2021).

Students often assume that exploring and understanding mathematics can only be comprehended by a few students (Safithri et al., 2021). Although many learning models can generally train students' mathematical reasoning abilities, they can be only

trained by listening to learning mathematical activities carried out by educators (Suryani et al., 2020). Then, the mathematical problem solving that is explained is only one way which does not cause stimulation to make wide interpretations for students. After that, it ends with practice problems which tend to be different. This is called rote learning which can be interpreted as a learning activity that makes students tend to memorize without understanding what is being taught. This is often not realized by educators so it does not seem eccentric if the students' initial mathematical abilities are quite varied and quantitatively very different. (Nisa et al., 2023).

Then, what can be done to improve students' mathematical reasoning abilities is to use techniques, strategies, and learning approaches that can require students to be able to understand the material without having to be centred on educators in the process of teaching and learning activities. In other words, the approach can be student-centered or it can teach students independently. An alternative learning that is designed to train students' mathematical abilities and reflect student activeness is the Model-Eliciting Activities (MEAs) (Al Ayyubi & Rohmatulloh, 2023). In addition, the MEAs approach is fairly little used in learning to construct students' initial mathematical abilities (Suryani et al., 2020).

Thus, mathematical abilities which include creative, critical, and logical reasoning abilities, to higher order reasoning can be further optimized with the MEAs approach in identifying models, concepts, and mathematical elements that are correlated with real life in solving mathematical problems. Because mathematical concepts in learning tend to be abstract without the involvement of students' daily lives, it is necessary to use media that can visualize these concepts so that they become concrete with the help of GeoGebra in their implications for illustrating the material being taught. That is why this study aims to analyze the application of the Model-Eliciting Activities to mathematics learning outcomes in terms of students' initial mathematical abilities based on school origin. Therefore, this study is expected to be one of the insights into learning mathematics in schools in the application of effective mathematical approaches to increase students' intellectual potential.

LITERATURE REVIEW

Model-Eliciting Activities (MEAs)

Mathematics learning methods that emphasize contextual problem-solving are known as model-liciting activities (MEAs). Students are trained in problem-solving, creative thinking, and mathematical modelling through a series of tasks that require them to create mathematical models that can be used to solve real-world problems. MEAs also improve students' understanding of the relationship between mathematics and the real world, and this is proven to increase students' interest and motivation to learn mathematics (Pertamawati & Retnowati, 2019).

Designing a strong yet cost-effective bridge is an example of model-liciting activities (MEAs). This task requires students to consider a variety of factors, such as building materials, building style and financial issues. The task also allows them to apply mathematical concepts such as structural calculations, material properties, and cost estimation. Thus, Model-Eliciting Activities (MEAs) encourage students to use their mathematical thinking to solve real problems (Chamberlin, 2021). Model-Eliciting Activities (MEAs) is a learning method that focuses on real problems that require creative problem-solving and mathematical modelling. This method allows students to create models or solutions to complex problems. They also concentrate more on the process rather than the result (Niss & Blum, 2020).

In addition, the historical development of the Model-Eliciting Activities was carried out by researchers at Rutgers University, USA, who first developed this model in the 1990s. This method emerged as an innovative approach to mathematics learning that focuses on solving real problems. In this regard, the MEA model also has certain characteristics, such as the presence of several important features that distinguish it from conventional learning methods. It focuses on real-world problems, requires creative reasoning, supports collaboration between students, requires mathematical modelling, prioritizes process over outcome, and encourages reflection and self-evaluation.

Learning using Model-Eliciting Activities also aims to improve students' abilities in problem-solving, mathematical modelling, teamwork, and application of mathematical concepts in the real world. Next, MEAs help students master deeper mathematical concepts and improve creative, critical, and analytical skills. With this model, of course, educators can directly implement it in learning mathematics. This application is very

important to know the extent to which this learning model affects the learning process. The process of designing real-world problems, developing modelling guides, collaborating with students, presenting solutions, and reflecting are all examples of activities that involve engaging with the model. Educators are essential to support students in mathematical modelling and problem-solving.

It is known that several case studies have been conducted to evaluate how effective model-triggered activities are in improving students' problem-solving skills and mastery of mathematical concepts. The results showed that MEAs can significantly improve students' problem-solving skills and mastery of mathematical concepts. Nevertheless, some challenges occur including preparing the design of problems that are relevant to the real world, conducting student performance assessments, and developing modelling guidelines. Creating MEAs still has enormous potential to improve the quality of mathematics learning, both in formal and informal education systems.

It can be said that the Model-Eliciting Activities is a learning model that emphasizes problem-solving in a case to be studied. Then, this problem indeed refers to problem-solving involving the real world so that it is easy to understand and apply. So, the students will be more motivated and enthusiastic about learning.

Initial Mathematical Abilities

The basic understanding, ability, and proficiency in mathematics required to understand more complex concepts in the future are called early mathematical abilities. These skills include the ability to solve math problems, understand number concepts and operations, and understand shape and space. Research showed that students who have strong initial mathematical abilities tend to have better success in the future in understanding more complex mathematical concepts at higher education levels (Suryani et al., 2020).

This is due to the importance of having a strong foundation in the basic concepts of mathematics. As a result, educators must pay special attention to the development of their students' early mathematical abilities. This can be achieved by using learning approaches that reinforce a basic understanding of mathematics through real-life experiences and applications in everyday life (Nisa et al., 2023). Early mathematical abilities are the basic ability to understand mathematical concepts including

understanding numbers, counting operations, measurement, geometry, and mathematical patterns at the early developmental stages of children. This ability serves as the basis for more complex understanding in the future. Early mathematical abilities are important for children's academic development. They contribute to the development of critical thinking, problem-solving, and mathematical modelling skills, and provide a solid foundation for further learning mathematics. Of course, some factors can influence early mathematical abilities such as genetics, learning experiences, family environment, and preschool education. These are some of the factors that influence children's early mathematical abilities, as well as interactions with the surrounding social and cultural environment.

Various learning strategies can be used to improve early mathematical abilities. These strategies emphasize concept understanding, mathematical games, the use of manipulatives, and the application of concepts in everyday life. Studies show a positive relationship between early mathematical abilities and reading, writing, and other academic skills. Good early mathematical abilities will strengthen connections between disciplines and prepare children to learn better in the future.

Many people do not realize how important these skills are, so these skills are rarely explored to understand. Several things do affect the difficulty of building these skills because they do not have adequate learning materials, and improve the quality of preschool education and other early education. Talking about early mathematical abilities has a huge impact on children's development and education, both in formal and informal education. Parents and educators should understand the importance of building children's early mathematical abilities and creating an environment that supports this development.

By applying these skills to learning, the children can easily understand what the educators are saying. It can be concluded that early mathematical abilities are the ability to think deductively so that it can produce a theory that can be communicated in an artificial language that can be exact, and intelligence in mathematics (Sanvi & Diana, 2022). Also, it can communicate the results of scientific activities. Students who have high initial mathematical abilities can affect learning outcomes as well (Zulkarnain, 2020).

By having high initial mathematical abilities, students will find it easier to understand and comprehend a lesson that is being, will be, and has been delivered by

the educators. Besides that, students who have this initial mathematical ability tend to be able to have achievement. (Agustina et al., 2021). Initial mathematical abilities consist of several things, including mathematical reasoning, mathematical communication, and mathematical reasoning. (Fitriani et al., 2021). These include mathematical reasoning, mathematical communication, mathematical problem solving, understanding of mathematical concepts, being able to think critically and producing creative thinking.

GeoGebra

GeoGebra is a math software that integrates the concepts of geometry, algebra, and calculus. The software allows users to create images, graphs, and tables and integrate them all in an integrated environment, which helps students and educators visualize mathematical concepts in a way that is easy to understand (Suryawan & Permana, 2020). In mathematics learning, GeoGebra is effective in improving students' understanding of abstract mathematical concepts and allowing them to see the relationships between various mathematical elements more concretely. It allows educators to create interactive and immersive learning experiences for their students (Yanti et al., 2019).

Besides that, GeoGebra combines geometry and algebra concepts in a single platform. The software allows users to create geometric constructions, perform algebraic calculations, and visualize mathematical relationships dynamically. It serves as a fairly practical tool that allows students to perform many mathematical tasks, such as creating geometry drawings, performing algebraic calculations, plotting function graphs, and exploring mathematical concepts in an ever-changing environment.

GeoGebra has been widely used as a tool in various levels of education to teach students mathematics. The software not only allows educators to teach mathematical concepts more interactively but also allows students to see mathematical concepts through dynamic visualizations (Diva et al., 2023). The use of this software in mathematics learning has a positive effect on students' interest in mathematics, problem-solving ability, and understanding of mathematics concepts. In addition, the use of this software can help students prepare to understand more complex mathematical concepts in the future.

Despite its many benefits, using this software in learning presents some problems. The challenges include that educators must be trained to use this software, there is no readily available technology, and GeoGebra must be incorporated into the

mathematics curriculum. Many studies have been conducted to investigate the use of GeoGebra in mathematics learning. This research addressed how the use of GeoGebra affects students' understanding of mathematics, how to use it to build effective teaching strategies, and how to use it in the classroom.

From the above literature review, it is clear that GeoGebra is a useful tool in mathematics learning that can help students understand mathematical concepts better through visualization and exploration. However, the challenges that users face must be overcome and effective integration must be done. It is often used to make it easier to do math problems, create problems, and even find a solution to a problem to be solved or found. This application can be obtained easily and practically (Wahyuni et al., 2022). Many studies used this software to determine the level of student ability in learning mathematics. This software can be an alternative to increase students' learning motivation. Enthusiasm in learning is certainly needed because it affects students' learning outcomes. (Nuritha & Tsurayya, 2021)

METHODOLOGY

This study was conducted at SDN Batujajar 3, SDN Sukamaju, and SDS Yayasan Beribu by using a quantitative research approach. This research method used the survey method and Two Ways ANOVA test analysis to determine the relationship between students' mathematics learning outcomes, students' school origin, and students' initial mathematical abilities. The population of this study were grade VI students at SDN Batujajar 3, SDN Sukamaju, and SDS Yayasan Beribu with a sample of 31 students at SDN Batujajar 3, 30 students at SDN Sukamaju, and 20 students at SDS Yayasan Beribu with a total of 81 students in the inferential statistical analysis. This research instrument used tests and questionnaires. Testing the data analysis requirements used consists of normality test and homogeneity test using Kolmogorov-Smirnov assisted by SPSS version 26 software.

RESULT AND DISCUSSION

RESULT

Alternative Hypothesis (H_1) and Null Hypothesis (H_0) are as follows:

H_0 : There is no difference in mathematics learning outcomes based on students' school origin

H_1 : There are differences in mathematics learning outcomes based on students' school origin

H_0 : There is no difference in mathematics learning outcomes based on students' initial mathematical abilities

H_1 : There are differences in mathematics learning outcomes based on students' initial mathematical abilities

H_0 : There is no interaction between school origin and students' initial mathematical abilities in determining mathematics learning outcomes.

H_1 : There is an interaction between school origin and students' initial mathematical abilities in determining mathematics learning outcomes.

The test criteria are:

- 1) Accept H_0 if sig. value $\geq 0,05$;
- 2) Reject H_0 if sig. value $< 0,05$.

Table 1. Between Subjects Factors

	Value Label	N
School Origin	SDN Batujajar 3	31
	SDN Sukamaju	30
	SDS Yayasan Beribu	20
Initial Mathematical Abilities	High	23
	Medium	26
	Low	32

Based on Table 1 above, it is known that the number of students at SDN Batujajar 3, SDN Sukamaju, and SDS Yayasan Beribu amount to 31, 30, and 20 students with a total of 81 students. Then, based on the initial mathematical abilities of students who have been classified in the high, medium, and low categories are 23, 26, and 32 students.

Table 2. Descriptive Statistics

School Origin	KAM	Mean	Std. Deviation	N
SDN Batujajar 3	High	79.30	6.617	10
	Medium	64.10	3.247	10
	Low	52.36	4.296	11
	Total	64.84	12.23	31
SDN Sukamaju	High	88.70	5.926	10
	Medium	73.38	2.264	8
	Low	64.58	2.429	12
	Total	74.97	11.17	30
SDS Yayasan Beribu	High	90.00	.000	3
	Medium	86.38	3.021	8
	Low	75.33	2.345	9
	Total	81.95	6.700	20

Based on Table 2 above, it is known that the mean value of students' overall mathematical initial abilities at SDN Batujajar 3, SDN Sukamaju, and SDS Yayasan Beribu is 64.84, 74.97, and 81.95. While the standard deviation values are 12.23, 11.17 and 6.7. Then the total mean and standard deviation values at school origin based on students' initial mathematical abilities are presented in diagram 1 as follows.



Diagram 1. Total Mean and Std. Deviation

Based on Diagram 1 above, it can be known that the accumulated value of students' learning outcomes based on school origin classified into high, medium, and low categories has a mean value of 84.78, 73.81, and 63.41, while the standard deviation value of students is 7.525, 9.802, and 9.725. This can be seen by the number of students in the high, medium, and low categories as many as 23, 26, and 32 students. So, it can be

concluded that the total mean and standard deviation values of 81 students are 72.81 and 12.62.

Table 3. Tests of Normality

	Statistics	df	Sig.
Standardized Residual	.083	81	.200*

Based on Table 3 above, it can be seen that the Standardized Residual value is 0.200. From this data, it is obtained that the significance value is greater than 0.05 and it can be concluded that the data is normally distributed.

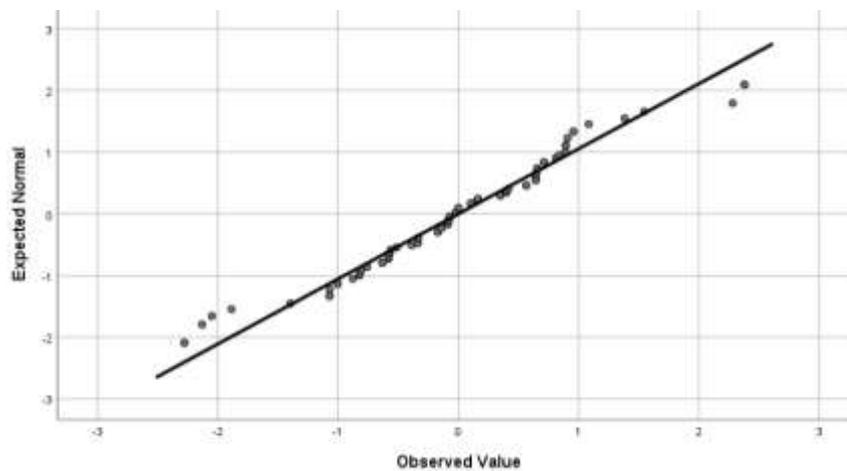


Figure 1. Normal Q-Q Plot of Standardized Residuals

In Figure 1 above, it is known that most of the Standardized Residual value data of mathematics learning outcomes based on students' initial mathematical abilities are around the diagonal line. This indicates that the data is normally distributed. Furthermore, it will be continued with the variance homogeneity test.

Table 4. Levene's Test of Equality of Error Variances^b

	Statistics	df1	df2	Sig.
Based on Mean	3.270	8	72	.063

Based on Table 4 above, it can be known that the Sig. Based on the Mean is 0.063. From this data, it is obtained that the significance value is greater than 0.05, so it can be

concluded that the variance of the value of the student's math learning outcomes variable is homogeneous.

Table 5. Tests of Between-Subjects Effects

Source	Type III Sum of Square	df	Mean Square	F	Sig.
School Origin	3924.272	2	1962.136	117.894	.000
KAM	5415.662	2	2707.831	162.699	.000
School Origin *KAM	298.583	4	74.646	4.485	.003

Based on Table 5 above, it can be known that the Sig. School Origin, Mathematical Initial Ability, and School Origin*KAM are 0.000, 0.000, and 0.003. From the data obtained, the significance value is smaller than 0.05, so it can be concluded that there are differences in mathematics learning outcomes based on students' school origin, there are differences in mathematics learning outcomes based on students' initial mathematical abilities, and there is an interaction between school origin and students' initial mathematical abilities in determining mathematics learning outcomes. Furthermore, the interpretation of the output of post hoc tests of school origin and students' initial mathematical abilities is continued to describe in more detail the results of the hypothesis obtained.

Table 6. Multiple Comparisons of School Origin

School Origin	School Origin	Mean Difference	Std. Error	Sig.
SDN Batujajar 3	SDN Sukamaju	-10.13*	1.045	.000
	SDS Yayasan Beribu	-17.11*	1.170	.000
SDN Sukamaju	SDN Batujajar 3	10.13	1.045	.000
	SDS Yayasan Beribu	-6.98*	1.178	.000
SDS Yayasan Beribu	SDN Batujajar 3	17.11*	1.170	.000
	SDN Sukamaju	6.98*	1.178	.000

Based on Table 6 above, the significance value between SDN Batujajar 3 and SDN Sukamaju, SDN Batujajar 3 and SDS Yayasan Beribu, and SDN Sukamaju and SDS Yayasan Beribu is 0.000. From the data obtained, the significance value is smaller than 0.05, so it can be concluded that there is a difference in students' math learning outcomes based on school origin between SDN Batujajar 3 and SDN Sukamaju, SDN Batujajar 3 and SDS Yayasan Beribu, and SDN Sukamaju and SDS Yayasan Beribu. This is also evidenced by the * sign on the Mean Difference value which shows that the differences that occur in students' mathematics learning outcomes based on school origin can be said to be real.

Table 7. Multiple Comparisons of Initial Mathematical Abilities

KAM	KAM	Mean Difference	Std. Error	Sig.
High	Medium	10.97*	1.168	.000
	Low	21.38*	1.115	.000
Medium	High	-10.97*	1.168	.000
	Low	10.40*	1.077	.000
Low	High	-21.38*	1.115	.000
	Medium	-10.40*	1.077	.000

Based on Table 7 above, it can be known that the significance value between students' initial mathematical abilities classified as high vs medium, high vs low, and medium vs low is 0.000. From this data, it is obtained that the significance value is smaller than 0.05, so it can be concluded that there are differences in students' mathematics learning outcomes based on initial mathematical abilities classified as high vs medium, high vs low, and medium vs low. This is also evidenced by the * sign on the Mean Difference value which shows that the differences that occur in mathematics learning outcomes based on students' initial mathematical abilities can be said to be real.

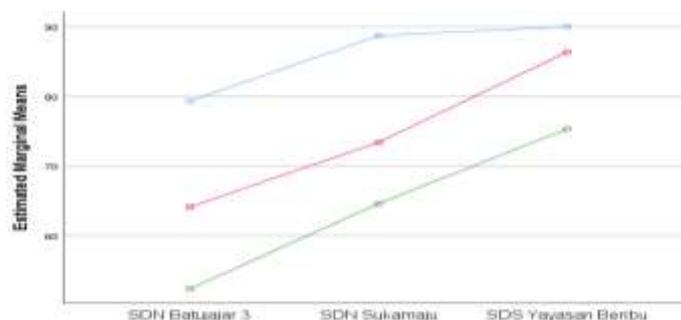


Figure 2. Estimated Marginal Means of Learning Outcomes

Based on Figure 2 above, it can be known that the Profile Plot on the variable of school origin and students' initial mathematical abilities with high, medium, and low categories. The blue line shows that students' initial mathematical abilities are in the high category, the red line is in the medium category, and the green line is in the low category. So, it can be said that students who have high initial mathematical abilities at SDS Yayasan Beribu are better than students at SDN Sukamaju and SDN Batujajar 3, then, students who have medium initial mathematical abilities at SDS Yayasan Beribu can be said to be better than students at SDN Sukamaju and SDN Batujajar 3, and students who have low initial mathematical abilities at SDS Yayasan Beribu can be said to be better than students at SDN Sukamaju and SDN Batujajar 3.

DISCUSSION

Based on the explanation of the research results above, it can be known that the use of Model-Eliciting Activities (MEAs) on students' initial mathematical abilities classified by school origin, namely SDN Batujajar 3, SDN Sukamaju, and SDS Yayasan Beribu amounted to 31 students, 30 students, and 20 students. Students who have mathematical initial abilities in the high, medium, and low categories from the three schools amount to 23 students, 26 students, and 32 students. The number of students is classified based on the student's initial mathematical abilities with basic concepts and calculations that have implications for more complex mathematics learning materials at the primary and secondary levels. Therefore, the test on the mathematical initial abilities of basic-level students is related to basic mathematical operations and basic logic regarding concrete reasoning (Pancawardana et al., 2023).

The Model-Eliciting Activities are oriented towards realistic-based things so that supporting media is needed in learning to make students understand better, considering that today technology is inherent in everyday life which is a guide for students, it will be more supportive if creative reasoning in students can be activated through visualized digital-based things. That is why GeoGebra becomes crucial in understanding mathematical concepts, both in the context of analysis and geometry (Lailiyah & Mardiyah, 2021; Lestari & Sundi, 2021; Utaminingsih & Subanji, 2021). Each student who is classified as high, medium, and low in initial mathematical abilities is classified in each school, where students who are classified as high, medium, and low at SDN

Batujajar 3 are 10, 10, and 11 students, then students at SDN Sukamaju are 10, 8, and 12 students, and students at SDS Yayasan Beribu are 3, 8, and 9 students.

In this case, students at SDN Batujajar 3 have an average value of 79.3, 64.1, and 52.36 in the category of students' initial mathematical abilities classified as high, medium, low and a standard deviation value of 6.617, 3.247, and 4.296. In addition, SDN Sukamaju has an average value and standard deviation classified by high, medium, and low categories of 88.7, 73.38, 64.58 and 5.926, 2.264, 2.429. Then, at SDS Yayasan Beribu it is 90, 86.38, 75.33 and 0.000, 3.021, 2.345. However, from these descriptive statistics, it is necessary to prove the validity of the differences and interactions that occur in students' mathematics learning outcomes based on their initial mathematical abilities that have been classified against the school of origin of students. So, it is necessary to do the Two Ways ANOVA test which is based on inferential statistics.

In this study, the ANOVA Two Ways test is carried out with the prerequisite that the values are normally distributed and homogeneity is accepted, but if both conditions are rejected, it is necessary to switch to the Median Test. Based on inferential statistical tests that have been carried out using Kolmogorov-Smirnov, the standardized residual value shows a significance value greater than 0.05 so that the data can be said to be normally distributed or can be seen through the points that are on the normal diagonal line Q-Q plot of standardized residual. In addition, the homogeneity test of the significance value based on mean shows data greater than 0.05, which can be concluded that the value of the student's math learning variable is homogeneous. By applying these aspects, the ANOVA Two Ways test can be carried out.

In the ANOVA Two Ways test, it is found that there were differences in mathematics learning outcomes based on students' school origin, there were differences in mathematics learning outcomes based on students' initial mathematical abilities, and there is an interaction between school origin and students' initial mathematical abilities in determining mathematics learning outcomes with a significance value that is less than 0.05. In addition, the differences that occur in students' mathematics learning outcomes based on school origin and students' initial mathematical abilities are real or can be accounted for. In other words, the interaction that occurs can also be done and shows the results that the initial mathematical abilities of students in the high category at SDS Yayasan Beribu are better than SDN Batujajar 3 and SDN Sukamaju, and this is also

positioned equally for the initial mathematical abilities of students in the medium and low categories. It can be explained that the mathematics learning outcomes of SDS Yayasan Beribu are better than those of SDN Batujajar 3 and SDN Sukamaju, and then the mathematics learning outcomes at SDN Batujajar 3 are better than those at SDN Sukamaju.

The treatment of the Model-Eliciting Activities for students at SDN Batujajar 3, SDN Sukamaju, and SDS Yayasan Beribu with the help of GeoGebra can be said to make a significant difference in mathematics learning outcomes in understanding concepts and optimizing the initial mathematical abilities that have been owned by students in the high, medium, and low categories. Thus, this is in line with previous research conducted by Nurhusain (2021), Pohan et al. (2023), Rusliah et al. (2021), Salafy & Susannah (2022), dan Wijayanti et al. (2021) where mathematics learning using the Model-Eliciting Activities which is implied to students' real life has a significant effect, both from the context of differences and students' learning interactions.

CONCLUSIONS

In this study, it can be concluded that in learning using the Model-Eliciting Activities carried out, there are differences in mathematics learning outcomes based on students' school origin, there are differences in mathematics learning outcomes based on students' initial mathematical abilities, and there is an interaction between school origin and students' initial mathematical abilities in determining mathematics learning outcomes. Then, the difference is salient to students' mathematics learning outcomes based on school origin between SDN Batujajar 3 and SDN Sukamaju, SDN Batujajar 3 and SDS Yayasan Beribu, and SDN Sukamaju and SDS Yayasan Beribu. In addition, the differences in students' mathematics learning outcomes based on initial mathematical abilities categorized as high vs medium, high vs low, and medium vs low can be said to be real. By having interaction, the results show that the initial mathematical abilities of students in the high category at SDS Yayasan Beribu are better than SDN Batujajar 3 and SDN Sukamaju, and it is also positioned similarly to the students' initial mathematical abilities in the medium and low categories. Next, the application of the Model-Eliciting Activities in GeoGebra-assisted mathematics learning based on the student's initial mathematical abilities from three schools provides a significant

difference. Therefore, for further research, it is hoped that it can explain the categorization of students' cognitive levels through Jean Piaget's theory or by classifying students' mathematics learning outcomes based on gender.

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