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Application of Eliciting Activities (MEA) Model Learning with a Scientific Approach to Improve Mathematical Representation Skills

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ABSTRACT

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This research aims to determine: (1) To examine the differences in increasing representational abilities and mathematical learning independence for students who are given learning using the activity elicitation model and students who are given scientific learning. (2) To learn about the process of responding to kids who learn utilizing the activity elicitation approach. Those who approach learning scientifically. This is an example of experimental study. This study's population consisted of all pupils in class VIII of SMP Asy-Syafiiyah Medan, and the research sample was drawn at random from two classes. The study's findings indicate that (1) beginning mathematics abilities have an impact on students' mathematical representation abilities and (2) abilities have an impact. Students' independence in early mathematical learning. The increase in mathematical representation abilities of students who get MEA learning and those who receive scientific approach learning differs. (2) Using the eliciting events learning model to complete student answers is superior to learning using a scientific approach. Thus, scientifically based learning activity elicitation models can be employed as an alternative in learning mathematics to increase mathematical representation abilities.

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A. INTRODUCTION

Mathematics lessons are lessons that are able to provide students with lessons to gain knowledge systematically or how to solve a mathematical problem (Hasratuddin, 2018). One of the goals of learning mathematics is to develop mathematical representation ability. This indicates that mathematical representation is one of the very important abilities in learning mathematics (Purwasih, R., & Bernad, 2018a). Mathematics is a very important subject at primary and secondary education levels. In principle, mathematics is learning that occurs in exact science which is a teaching and learning process. The definition of learning according to (Prihaswati, Martyana., 2021) is the process of changing behavior as a result of interactions that occur between students and learning resources, changes that occur intentionally (by design) or that are carried out accidentally and can be the benefits are taken (by utilization). So the definition of learning does not only include student interactions with teachers but also student interactions with other learning sources.

According to Puskur, as reported by (Saragih, Sahat, 2018) noted that mathematics learning taught at the elementary education, secondary school and university levels has the purpose of educating students to be able to adapt to the changes that continue to occur in the world. Mathematics learning relies on basic logical, reasonable, critical, accurate, honest, efficient and effective thinking. (Widyasari, N., Dahlan, JA, Dewanto, 2016) representation will allow students to arrange the thinking process, representation is useful to help organize mathematical ideas more concretely and realistically as material for thought. According to (Damayanti, N., 2022) mathematical representation is a statement of mathematical concepts (problems, propositions, definitions) which are used to portray the outcomes of their work in a given way (conventional or non-conventional) as a result of the interpretation of their thoughts." The importance of students' mathematical representation abilities was expressed by (Hartati, I., Sucianti, I., Wahyuni, 2021) stating that the importance of mathematical representation for students to have is very helpful in understanding mathematical concepts in the form of images, symbols and written words. According to (Ertin, Aini, 2018), representation is a very significant aspect in mathematics teaching and learning theory, not only because it uses a symbolic system which is very important in mathematics, syntax and semantics.

From various expert perspectives above, it can be determined that mathematics is a subject that really needs to be given attention to. However, the reality on the ground is that the quality of mathematics classes in Indonesia is still far from what we expected. This is evident from the survey results of the Program for International Student Assessment (OECD, 2019) which has conducted an evaluation of mathematics lessons for students in Indonesia with disappointing results, namely 71% of students did not reach the minimum level of competence in mathematics, seen among groups of students who have low competence with details: 43% are at level 1a; 37% in 1b; 16% in 1c; and 4% did not even reach level 1c, meaning that 25% of Indonesian students' mathematics skills were at level 1, so we can conclude that Indonesian students' mastery of mathematics is at the bottom. This happened not because of the number of teaching hours mathematics in Indonesia is the least. On the contrary, judging from the research results of the Trends International Mathematics and Science Study (IEA, 2016), in one year, students in Indonesia receive an average of 169 hours of mathematics lessons. This is much more than in other countries. (Widayati, 2012) stated that "representational abilities are the basis for understanding mathematical ideas". Mathematical concepts or ideas can be represented in a variety of ways, including in the form of pictures, concrete objects, tables, graphs, numbers, or written mathematical symbols. In learning mathematics, teachers must be able to translate complex mathematical ideas into representations that students can understand (Purwasih, R., & Bernad, 2018b).

Representational abilities are expressions of mathematical ideas (problems, statements, definitions, etc.) that are used to show (communicate) the results of their work in a certain way (conventional or unconventional way) as a result of the interpretation of their thoughts (Ertin, Aini, 2018). Representation is something that cannot be separated in mathematics learning.

However, expectations are inversely proportional to reality. Mathematical representation abilities are still in the low category. Students who have low representation abilities will make it difficult for students to digest the questions given, while students who have representation abilities can easily take steps to solve a problem. This can be seen from research (Rahmawati, R., Azizah, 2018) on junior high school students, stating that students' mathematical representation abilities have not been achieved optimally due to students' lack of understanding of the concept as a whole. Students are still fixated on formulas which results in them only knowing the formula without knowing how the formula is used.

From the results of the analysis of indicator achievement (Rahmawati, Hasri., 2022), it was found that one of the indicators with the lowest level of achievement was the verbal representation indicator. This was also proven by researchers by giving questions to 26 students in class VIII-3 of Medan Asy-Syafiiyah International Middle School with set material. It can be seen in the picture below the results of students' answers, students' representation abilities.

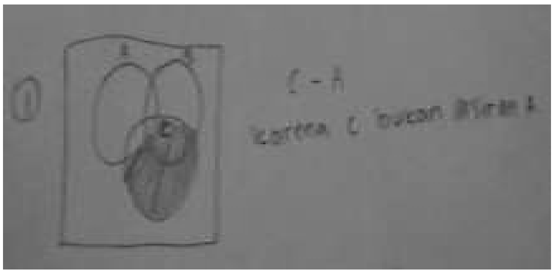

Figure 1. Results of work on Student Learning Representations

From the answers above it can be seen that students are able to work on mathematical representation problems, but in creating equations or mathematical models students experience difficulties. From the results of students' answers and interviews, it can be concluded that most students' mistakes in mathematical representation are due to students not understanding problems that they are not used to doing. Thus, it can be concluded that students' mathematical representation abilities are still relatively low. The low ability of students' mathematical representation is possibly caused by the lack of appropriate learning models used by teachers. Based on the results of observations during the observation, it is known that the teacher while teaching still uses direct learning. In learning, students also appear less active. When given exercises in the form of questions that are not the same, with example questions explained by the teacher, most students are less able to work on the questions. Apart from that, based on the results of interviews with mathematics teachers, it was concluded that mathematics is still a difficult subject for students. This identifies that teaching still needs improvement to maximize students' abilities in mathematical representation.

Students' mathematical representation abilities in mathematics learning are related to students' learning independence. Several studies also show that if student learning independence is high, there is a positive and significant relationship between student learning independence and the learning outcomes they obtain, such as research conducted by (Kalelioglu., 2018) explaining that "students who display more adaptive self-regulatory strategies demonstrate better learning". This means that students who have more active independence show better learning. Thus it can be said that the independence possessed by a student is able to support his learning abilities. Therefore, learning independence needs to be improved.

The cultivation of student autonomy is crucial as it fosters a personal disposition that is important for every individual. Utari Sumarno (Lestari, 2019) suggests that independence in students leads to improved learning outcomes. Independent students are capable of effectively monitoring, evaluating, and organizing their own learning. They are also able to save time efficiently and have the ability to direct and control their own thoughts and actions. Furthermore, independent students do not rely on others for emotional support. Students with autonomous learning possess the ability to critically evaluate intricate problems, demonstrate proficiency in both individual and group work, and have the confidence to articulate their thoughts. (Jumaisyaroh, T. Napitupulu, 2015).

To improve students' mathematical representation abilities and students' learning independence, learning improvements need to be made. In implementing education in schools, the main thing that is hoped for is the success of the learning process. In efforts to increase success in mathematics learning today, many methods, models and approaches have been developed. The teacher's role is as a teacher/facilitator, while students are individuals study. However, in the implementation of all these things, there are many obstacles, starting from the facilities and infrastructure available at the school, inadequate human resources, and many other problems that arise. However, teachers are expected to be able to apply methods that are appropriate and appropriate to teaching mathematics, teachers are expected to instill existing principles or formulas.

The implementation of learning in the classroom really depends on the choice of model, learning strategies implemented by the teacher, determining learning media and the teacher's readiness in carrying out the learning process so that they are able to lead students to achieve the desired learning goals. Therefore, a learning model is needed that can improve students' mathematical representation abilities and learning independence. One of the learning models is the Eliciting Activities (MEA) Model.

According to (Chamberlin and Moon, 2018) The Eliciting Activities (MEA) Model is an alternate approach to mathematics learning that aims to engage students in an active role during the learning process in the classroom. The Eliciting Activities (MEA) approach presents genuine challenges in the process of learning. One trait is that when real situations are presented, students can establish stronger connections with abstract mathematical concepts.

The process of learning through Model Eliciting Activities (MEA) involves students engaging with real-life scenarios, collaborating in small groups, and formulating mathematical models to provide solutions (Gustia, D., Hanifah, Jenab, & Afrilianto, 2019). Model Eliciting Activities (MEA) are utilized to facilitate students in assessing the effectiveness of a mathematical model, organizing information and connections, making predictions (applying the model to a new problem or data set), and recognizing patterns or rules. This process aids students in selecting and constructing the most suitable mathematical model as a problem-solving strategy.

In addition, the Eliciting Activities (MEA) Model offers a method for educators to gain a deeper comprehension of students' cognitive processes while they tackle an issue. In addition to the learning model, successful learning also necessitates attention to the technique. The Scientific approach is one of the approved methods for learning according to the 2013 Curriculum. The Scientific Approach is a method of acquiring knowledge that encompasses the actions of seeing, inquiring, collecting data, logical thinking, and representing information. As per Ghozali (2017), the scientific approach enhances active and engaging learning experiences. It enables students to build their knowledge and skills by conducting investigations in the field. Additionally, scientific learning fosters students' abilities to observe, question, reason, and articulate their understanding of natural phenomena or direct experiences.

The utilization of the Eliciting Activities (MEA) Model, combined with a Scientific approach, aims to facilitate engaging and purposeful learning activities. The goal is to enhance students' proficiency in mathematics and foster their autonomy in learning. Despite the positive findings from previous research, I, as a researcher, aim to investigate whether there is a distinction in enhancing students' mathematical representation skills and learning autonomy between those who engage in Model Eliciting Activities (MEA) with a scientific approach and those who engage in traditional scientific learning. Every pupil have a distinct amount of basic mathematical proficiency.

From the above description and the identified concerns, it is evident that the quality of Model Eliciting Activities (MEA) learning, which incorporates a scientific approach and promotes student learning independence, remains subpar. The implementation of Model Eliciting Activities (MEA) learning, coupled with a scientific approach, is expected to enhance students' mathematical representation skills and foster their independent learning. The author conducted research titled "Application of Eliciting Activities (MEA) Model Learning Using a Scientific Approach to Enhance Students' Mathematical Representation Ability and Learning Independence" due to this reason.

Discussions in MEA and Scientific subjects serve as effective tools for enhancing students' mathematical representation skills and fostering their independent learning. These discussions aim to cultivate a more conducive classroom environment and instill a genuine enthusiasm for mathematics. The teacher's function as a learning partner, mediator, and facilitator results in a more intimate interaction between teachers and pupils. Consequently, this leads to teachers gaining a more comprehensive comprehension of the limitations and advantages of instructional resources, as well as the distinctive aptitudes of students.

B. RESEARCH METHODS

The author must pay attention to the format of the article citation in the manuscript by considering the second name followed by the year of publication; for one author, write “Alberto (1993)” while for two authors, write “Alberto and Jun (1992)”. If there are three or more authors, write “Alberto et al. (1990)” with a note: the point after 'al.' not after 'et'. The author must consider the following conditions if the in-text citation format includes page numbers. For a single referenced page number, use the abbreviation "p." whereas if there are multiple pages, use "pp." Example: Russeffendi (2005, p. 52) suggests that in quasi-experimental research, the subjects' group is not random, but researchers accept the subject's conditions as they are.

Researchers tested a treatment, namely Model Eliciting Activities (MEA) learning with a scientific approach to students' representational abilities and learning independence. Because of this, this research is experimental research. During the research, the researcher used the classes that were available because the researcher could not group students randomly. If class randomization is carried out, it will disrupt the effectiveness of learning activities at school. Therefore, this research is a type of quasi-experimental research. The research was carried out at Asy-Syafiiyah International Middle School, Medan, even semester of the 2022/2023 academic year on set material. The reason for choosing this research location was because at Asy-Syafiiyah International Middle School, Medan, research had never been carried out on the application of eliciting activities (MEA) learning models and scientific approaches. to improve students' mathematical representation abilities and learning independence.

The population in this study were all class VIII kids at Asy-Syafiiyah Middle School Medan for the 2022/2023 academic year. The research sample was recruited from two courses at random. The learning tools and research instruments utilized in this research were first validated by validators in order to generate learning tools and research instruments that were suitable as measuring tools. The learning materials used in this research are the Learning Implementation Plan (RPP) and Student Worksheets (LKPD) for each experimental class 1 and 2. The validation results of the learning tools are presented in table 1. This research comprises the stages of planning, implementation, analysis, and report writing. The research procedures can be observed in table 1 below:

Table 1. Summary of Learning Device Validation Results

No.	The object being assessed	Average Total Validity Value	Validation Level
1.	Experimental Class Lesson Plan 1	4.6	Valid
2.	Experimental Class 2 Lesson Plan	4.6	
3.	Experimental Class 1 Student Worksheet (LKPD).	4.7	
4.	Student Worksheet (LKPD) Experimental Class 2	4.6	

Research design

The quasi-experimental design used is based on (Ruseffendi, 2012), namely a non-equivalent control group design. Design a research plan for the experiment as follows:

Experiment Class : O X_1 O
Class Control : O X_2 O

Description:

O : The pre-test questions are the same as the post-test questions on representational ability and student independence questionnaires

X_1 : Treatment using the Eliciting Activities (MEA) Model
X_2 : Treatment using a scientific approach

C. RESULT AND DISCUSSION

The research results are in the form of quantitative data and Examined utilizing a combination of descriptive and inferential statistics. Descriptive statistical analysis in this research aims to obtain an overview of students' abilities before and after treatment. Describe the interactions of students in groups that received the Model Eliciting Activities (MEA) learning treatment: Results of Initial Mathematics Ability (KAM)

Based on the pretest data on mathematical reasoning ability, the lowest score (Xmin), highest score (Xmax), average score (Xaverage) and standard deviation (s) were obtained for the experimental and control classes as shown in table 2 below:

Table 2. Pretest Result Data on Students' Representation Ability

Type	N Statistics	Range Statistics	Minimum Statistics	Maximum Statistics	Statistical Mean	Std Error	Std Deviation Statistics
Class Pre Test Experiment	25	28	32	60	43.52	1,622	8,109
Control Class Pre Test	25	28	32	60	43.04	1,638	8,188

Based on Table 1 above, it shows that the average KAM score for each research sample class is relatively the same. Next, it is necessary to carry out analytical tests which include normality tests, homogeneity tests and sample class mean difference tests. The calculation results are presented in table 2. below:

Table 3. Results of the Student Representation Pretest Normality Test

	Class	Statistics	df	Sig	Statistics	df	Sig
Student Representation Ability	Pre Test Experiment	1.64	25	0.83	0.925	25	0.67
	Pre Test Control	1.65	25	077	0.923	25	0.61

From Table 3 are the results of the normality test using the SPSS 23 application by calculating the pre-test for the experimental class and control class. Based on the table above, because the sample number is 50, namely N=25, it can be seen from the Shapiro-Wilk table calculations that the experimental class pretest data is Sig. 0.67 > 0.05 and the control class obtained Sign. 0.61 > 0.05. So it can be concluded that the pre-test for the experimental class and control class has a normal distribution.

Results of Students' Mathematical Representation Ability

The results of descriptive analysis of the mathematical representation ability data for students in the two learning groups based on the grouping of students' initial mathematics ability (KAM) categories are presented in Table 4 below:

Table 4. Description of Mathematical Representation Ability Data for Students in Both Learning Groups for the KAM Category

KAM Category	Learning					
	MEA			Scientific		
	Pretest	Posttest	*N-Gain*	Pretest	Posttest	*N-Gain*
Tall	60	100	0.94	56	100	0.71
Currently	51.47	96.43	0.77	49.13	87.20	0.50
Low	32	72	0.62	32	72	0.42

Based on Table 4 above, it can be seen that there is an increase in the average mathematical representation ability of students who receive MEA and those who receive the Scientific Approach. For MEA, students with high KAM obtained an average increase in mathematical representation ability (N-Gain) that was greater than students with medium KAM and low KAM. In the scientific approach, students with moderate KAM obtain an average increase in mathematical representation ability (N-Gain) that is higher than students with high KAM and low KAM. In addition, students who received MEA had an average increase in mathematical representation ability (N-Gain) that was greater than students who used a scientific approach for each pair of KAM categories.

Based on Hake's (1998) categories, the average mathematical representation ability of students taught with high, medium and low MEA, KAM is included in the N-Gain category medium and high $(0,3 < g \leq 0,7)$. Meanwhile forhigh KAM category scientific approach, medium and lowincluded in the medium and high N-Gain categories $(0,3 < g \leq 0,7)$.

Normality test

The normality test is intended to see whether the students' mathematical representation ability data in both classes is normally distributed or not. The calculation results are presented in table 5 below.

Table 5. Normality Test of Students' Representation Ability

Type	Class	Statistics	Df	Sig	Statistics	df	Sig
Mathematical Representation Ability	MEA Class Pretest	1.64	25	0.83	9.25	25	0.67
	Class Posttest MEA	1.32	25	2.00	2.00	25	1.67
	MEA Class Posttest	1.59	25	1.04	9.38	25	1.36
	Class Pretest Scientific	1.32	25	2.00	9.46	25	2.05

Based on Table 4, the results of the normality test using the SPSS 23 application by calculating the pre-test for the MEA model class (experiment) and the class using the scientific approach (control). Based on the table above, because the sample number is less than 50, namely N=25, it can be seen from the Shapiro-Wilk table calculations that the pretest data for the experimental class is Sig. 0.67 > 0.05, posttest experimental class Sig. 0.16 > 0.05 while the control class pretest obtained Sign. 0.136 > 0.05 and control class posttest Sig. 0.205 > 0.05. So it can be concluded that the pre-test and post-test of the experimental class and control class have a normal distribution

Discussion

One essential quality that students must possess is the ability to advocate for their fellow pupils. Mathematical representations are symbolic expressions that convey the results of mathematical work by interpreting thoughts and concepts in a certain technique, whether it be a conventional or unconventional approach. Representation is an integral part of mathematical learning that cannot be detached. While the objectives of mathematics learning in Indonesia do not explicitly mention the importance of representation, it can be inferred from the objectives of problem solving and mathematical representation. This is because solving mathematical problems requires the ability to create mathematical models and interpret solutions, which are indicators of representation.

A total of 26 students from each class participated in the mathematics critical thinking abilities test. The data analysis focused on the 26 students who took the final test (post-test) for this study. Following the implementation of the discovery learning model, the students underwent a mathematics critical thinking skill assessment to evaluate the extent of the discovery learning model's impact post-therapy.

Hudojo observed that representation is a mental image of the learning process which may be understood through mental development within a person and is expressed as visualized in verbal form, visuals or concrete items. This indicates that the process of representing or symbolizing something occurs in a person's mind. Then the ramifications of his ideas are given in the form of statements, illustrations or notations (Nuriadin, I., Kusuma, YS, Sabandar, J., and Dahlan, 2015).

The purpose of this research is to address the problem formulation and hypothesis (temporary assumptions), meaning to find out whether the difference in enhancing mathematical representation abilities using MEA is bigger than using Saintifk. Before carrying out a statistical test for the hypothesis utilizing Anacova with the help of SPSS 23, a normality and homogeneity test of the N-Gain data was carried out. The results demonstrate normal and homogenous based on normality and homogeneity tests.

D. CONCLUSION AND SUGGESTIONS

Based on the findings, KAM has a greater impact on students' mathematical representation skills in MEA learning compared to scientific learning. The mathematics learning independence of children who receive MEA learning is more strongly influenced by KAM compared to scientific learning. Students who get MEA learning demonstrate greater mathematical representation ability compared to those who receive scientific learning. Utilizing the MEA learning model to complete student answers is superior to employing a scientific technique for learning. Students' superior performance in the mathematical representation ability exam indicates that learning with the MEA model is more effective than the scientific method.

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