

22. J._Phys._Conf._Ser._2021

by Nur Rusliah

Submission date: 16-Jun-2023 10:13AM (UTC+0800)

Submission ID: 2116999613

File name: 22._J._Phys._Conf._Ser._2021.pdf (428.98K)

Word count: 3223

Character count: 18380

PAPER · OPEN ACCESS

Mathematical problem-solving skills on relation and function through Model-Eliciting Activities (MEAs)

To cite this article: Nur Rusliah *et al* 2021 *J. Phys.: Conf. Ser.* **1778** 012016

View the [article online](#) for updates and enhancements.

You may also like

- [The development of mathematics learning tools based on number heads together model to improve mathematical problem-solving skills of grade vii junior high school students](#)

A Lestari, D Permana, E Musdi *et al.*

- [An analysis of students problem solving skills using a realistic mathematics approach on integers materials](#)

T N Sipayung and D Anzelina

- [Analysing the problem-solving ability through the Problem-Based Learning model on the subject statistics in the grade VIII B of Kanisius junior high school Kalasan](#)

Y K Pandu and C P Prabaningrum



ECS **Connect with decision-makers at ECS**

Accelerate sales with ECS exhibits, sponsorships, and advertising!

▶ Learn more and engage at the 244th ECS Meeting!

Mathematical problem-solving skills on relation and function through Model-Eliciting Activities (MEAs)

Nur Rusliah, Rhomiy Handican, Laswadi, Ria Deswita and Mesi Oktafia

State Islamic Institute of Kerinci, Jl. Muradi, Sumur Gedang, Pesisir Bukit, Sungai Penuh, Jambi 37152, Indonesia

E-mail: nurrusliah@iainkerinci.ac.id

Abstract. Mathematics relation and function is one of important topics in junior high school. This study aims to see differences in the problem-solving abilities of junior high school students who use the Model-Eliciting Activities (MEAs) and conventional models in learning mathematics relation and function. This research is a quantitative study using a quasi-experimental approach with a non-equivalent control group design. The population in this study was all of the seventh-grade students at a State Junior High School in Sungai Penuh, Jambi, Indonesia, and the sample was two groups experimental group and control group. The data collection technique used is a test of mathematical problem-solving skills. The data were analyzed by using the independent t-test to find comparisons or differences. The research result showed that there were differences in the mathematical problem-solving skills of junior high school students who used MEAs and other students who did not use MEAs. This difference occurs as a result of different treatment received by students, by MEAs students are required to be more active in understanding and formulating problems.

1. Introduction

Mathematics is a compulsory subject at every level of education in Indonesia, from elementary schools to higher education. The goals of mathematics learning are to have the ability to understand a problem, design mathematical models, and interpretation of the solutions obtained and from it, students can solve problems [1]. The problem is a question that must be answered. However, not all questions could be considered as a problem [2]. A question called "problem" if the question is challenging to answer and cannot be done routinely. Problem-solving is one of the goals in mathematics learning [3]. Therefore the ability to solve problems is very important in learning mathematics.

In mathematics learning, each student has a different level of problem-solving skills. Teachers must optimize students' mastery of concepts and problem solving with critical, logical, systematic, and structured thinking habits [4]. This part is very important in the mathematics curriculum because it can be facilitated the students to solve any problems with their knowledge skills that are not routine [5].

Problem-solving is a capability that is very important for students. The problem is a conflict, an obstacle for students in completing their learning tasks in the class [6]. But the problem must be solved so the students' thinking processes develop is needed. Something can be seen as a problem depending on how someone gets the problem according to his ability and in junior high school mathematics, there



are problems for low classes but not problems for high classes [7]. The ability of problem-solving is the main of mathematics [8]. Problem-solving skills are not only needed to understand mathematics in the future but also for use in solving problems that occur every day and also used in various other sciences [9].

Problem-solving is an attempt to find a way out of difficulty to achieve a goal that is not so easy to achieve immediately. There are four steps of problem-solving namely understanding the problem, planning a solution, solving the problem, and rechecking all the steps that have been done [10, 11]. The highest level of learning objectives in mathematics is problem-solving, one of the indicators is to develop a problem-solving strategy, for that, students must be able to submit guesses and manipulate [12, 13].

Based on the results of tests conducted on observation, it can be said that only about 25% of students can reach the first indicator that is understanding the problem. Likewise with the indicators of planning, implementing plans, and checking back or drawing conclusions, only about 30% of students can plan and solve problems properly. Other problems that arise in schools include students still too dependent on the teacher. Students can only do the same practice questions as the teacher exemplified, but after being given other questions that are slightly altered, students tend to be confused and unable to solve them [14]. This happens because teachers still tend to use traditional methods such as lecture and question and answer. Like in calculating operation learning, the teacher explains the definition then gives an example, and then gives the practice questions as exemplified earlier.

The approach that can stimulate students to model problems in the form of mathematical models is Model-Eliciting Activities (MEAs) [15, 16]. Several principles use the MEAs model, including: principles of meaningful learning, principles of construct models, self-evaluation, documentation models, the simple prototype, and generalizations [17, 18]. The MEAs learning model is based on real-life student problems, works in small groups, and presents a mathematical model as a solution, the model created by students, then measured for accuracy in their presentation activities [19]. The application of MEAs in learning mathematics in the classroom has a good impact on improving student learning outcomes, especially the creative thinking skills and self-confidence for high school students [20].

MEAs model is also able to train and help students to understand and solve problems [21]. So the application of the MEAs learning model is considered can increase the students' mathematical problem-solving skills [22]. The research on MEAs and its relationship to problem-solving skills show that mathematical problem-solving skills of students who use MEAs in learning are better when compared to using the Problem Based Learning (PBL) model [23]. In addition, the application of the MEAs approach has a positive effect on students' mathematical problem-solving skills [24] and there is a significant increase in problem-solving skills and mathematical disposition on the repeated application of MEAs [25].

Other studies have shown that MEAs have a positive effect on communication skills [26, 27] reasoning abilities [28], connection skills, and mathematical disposition [29]. One study also stated that if the MEAs model was combined with 4C Skills it could increase creativity, communication skills, collaboration skills, and could improve problem-solving abilities [30]. Problem-solving abilities also can improve several capabilities, including; visualization, association, reasoning, abstraction, analysis, synthesis, and generalization, which are high-level thinking skills [31]. So the effect of MEAs on mathematical skills indirectly implies that MEAs can positively influence more complex abilities, namely problem-solving skills. The results of the study inspired researchers to conduct semi-experimental research to find out the difference in the mathematical problem-solving skills of junior high school students who use MEAs and the other students who use ordinary or conventional learning.

2. Method

This research was an experimental study with a randomized control group only. The experimental group was given treatment as Model-Eliciting Activities (MEAs) and the control group did not apply the same treatment. When the learning activities were finished, the students in the experimental and control group are given a test to measure their problem-solving skills in the relations and functions material. The

population in this study were all eighth-grade students of a junior high school in Sungai Penuh. VIII B and VIII A were selected as experimental and control groups through random sampling techniques.

Table 1. Research design

Group	Treatment	Post-test
Experiment	X ^a	T ^b
Control		T ^b

^a The treatment is given to the experimental group by applying the Model-Eliciting Activities (MEAs)

^b Problem solving skills test

The students' mathematical problem-solving skills scores are obtained from the results of tests of mathematical problem solving skills that are given to both groups. The problem-solving skills test used consisted of 4 items. The test has been assessed its validity and reliability before it is given to students. The content validity was assessed by two experts while the construct validity was obtained from the analysis of the trial results. The data analyzed by using a hypothesis test or t-test.

3. Result and Discussion

The MEAs learning model is applied in the experimental group to conduct students' understanding and encourage students to solve any problem. At the first meeting, students still look confused and rigid in the learning process. Students still need more guidance and direction about the learning model, even before the learning process, it has been explained. After several meetings the students seem to understand, the students were able to position themselves independently, as if they were already sitting in their respective groups. When the teacher gives any questions related to the material, students are more enthusiastic about receiving questions and solve the problem together in their groups. Then the teacher asks each group delegate to present their problem-solving results in front of the class.

After the subject of relation and function has been taught using the MEAs learning model, the researcher gives 4 questions about problem-solving skills. The results of mathematical problem-solving ability tests of students in the experimental and control group can be seen in Table 2.

Table 2. Descriptive statistics of mathematical problem-solving ability test

	Group	Mean	Std. Dev	Std. Error Mean
Problem Solving Skills Test	Experiment	73.31	8.22	2.05
	Control	65.19	9.76	2.44

Based on Table 2, the scoring average of the problem-solving test results for the experiment group is 73.31 and the control group is 65.19. It means the scoring average of the experiment group is 11.07% higher than the control group. Furthermore, based on Table 3 it is known that the value of sig. Levene's Test for Equality Variances is 0.468 that larger than Sign (0.05). It can be interpreted that the data variance between the experiment group and the control group are homogeneously or equal variances assumed.

Table 3. Results of the problem-solving test

	Levene's Test for Equality Variances		t-test for Equality of Means		
	Sig.	t	Sign. (2-tailed)	Mean Diff.	Std. Error Diff
Equal Variances Assumed	0.468	2.546	0,016	8.12	3.19

Equal Variances not Assumed	2.546	0.016	8.12	3.19
-----------------------------	-------	-------	------	------

From the test results obtained Sig. (2-tailed) is 0.016 which is less than sign (0.05), so it means there is a significant difference in the students' mathematical problem-solving skills that applied the MEAs learning model and another group that does not apply the MEAs learning model in 95% level of confidence. The comparison of students' mathematical problem-solving skills test results in both groups presented as the box plot in Figure 1.

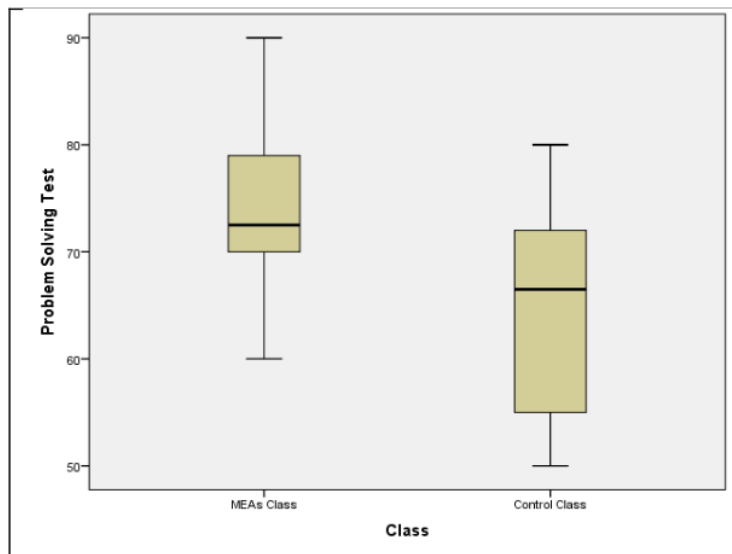


Figure 1. Box plot of comparison of test results

Based on the sig. (2-tailed) value 0.016 as a positive value, it can be understood that the average MEA group is higher than the control group with a difference of 8.12. This difference occurs as a result of differences in the treatment received by students. By applying the MEAs model, students are required to be more active to understand and formulate the problems [32]. If students lack understanding in solving the problem, the students can exchange their opinions with classmates to solve the problem.

These findings are following the previous research results about the MEAs learning model and the mathematical problem-solving skills. The results of this study also conclude the same thing done by other studies, where it said that the average problem-solving ability of students who learn by using MEAs is better than students who are taught with other models, both conventional models and other models like PBL [23]. The positive influence of MEAs on students' mathematical problem-solving skills was confirmed by other research [17] and was proven to improve students' mathematical problem-solving skills and mathematics dispositions significantly if applied continuously [19].

4. Conclusion

Based on the results, it can be concluded that there are differences in students' mathematical problem-solving skills who apply the MEAs learning model and other students who did not apply the MEAs learning model. Based on a comparison of the students' average score in problem-solving skills, the test

results of students who took the MEAs learning model were higher than other students who did not apply it. So, the MEAs learning model is recommended for teachers to use as an alternative to improving students' problem-solving skills. Other researchers can conduct further research to confirm these findings or conduct any research on the effect of the MEAs learning model to enhance other higher-order thinking skills.

Acknowledgment

The authors wish to thank the Mathematics Education Department, Faculty of Education and Teacher Training, State Islamic Institute of Kerinci for giving support in this research.

References

- [1] Anjani I 2019 Pendekatan problem solving dengan strategi metakognitif untuk meningkatkan kemampuan pemecahan masalah matematika siswa *Edumatika: Jurnal Riset Pendidikan Matematika* **2** 63–8
- [2] Wardhani S 2008 Analisis SI dan SKL mata pelajaran Matematika SMP/MTs untuk optimalisasi tujuan mata pelajaran matematika (Yogyakarta: PPPPTK)
- [3] Hadi S and Radiyatul R 2014 Metode pemecahan masalah menurut Polya untuk mengembangkan kemampuan siswa dalam pemecahan masalah matematis di Sekolah Menengah Pertama *EDU-MAT* **2** 53–61
- [4] Gunawan R G and Putra A 2019 Pengaruh strategi belajar aktif sortir kartu terhadap kemampuan pemecahan masalah matematis *Jurnal Cendekia: Jurnal Pendidikan Matematika* **3** 362–70
- [5] Suherman E 2001 *Common textbook: Strategi pembelajaran matematika kontemporer* (Bandung: JICA UPI Bandung)
- [6] Habibi M, Darhim and Turmudi 2018 Self-determination in mathematics learning process by using generative multi-representation learning (GMRL) model *Journal of Physics: Conference Series* **1097** 012155
- [7] Wulansari T, Putra A, Rusliah N, and Habibi M 2019 Pengaruh model pembelajaran berbasis masalah pada materi statistika terhadap kemampuan penalaran statistik siswa *AKSIOMA: Jurnal Matematika dan Pendidikan Matematika* **10** 35–47
- [8] Branca N A 1980 Problem solving as a goal, process, and basic skills *Problem Solving in School Mathematics* **1** 3–8
- [9] Ruseffendi 2006 *Pengantar kepada membantu guru mengembangkan kompetensinya dalam pengajaran matematika* (Bandung: Tarsito)
- [10] Polya G 1985 *How to solve it. 2nd Edition* (New Jersey: Princeton University Press)
- [11] Nurmutia H 2019 Pengaruh gaya kognitif terhadap kemampuan pemecahan masalah matematis siswa *Edumatika: Jurnal Riset Pendidikan Matematika* **2** p 98-103
- [12] Putra R, Fauzan A, and Habibi M 2019 The impact of cognitive conflict based learning tools on students mathematical problem solving ability *International Journal of Educational Dynamics* **2** 209–18
- [13] Delyana H 2015 Peningkatan kemampuan pemecahan masalah matematika siswa kelas VII melalui penerapan pendekatan open ended *Lemma* **2** 26–34
- [14] Laswadi 2015 Pendekatan problem solving berbantuan komputer dalam pembelajaran matematika *Al-Jabar: Jurnal Pendidikan Matematika* **6** p 33-42
- [15] Gilat T, and Amit M 2013 Exploring young students creativity: The effect of model eliciting activities *PNA* **8** 51–9
- [16] Yildirim T P, Shuman L, and Besterfield-Sacre M 2010 Model eliciting activities: assessing engineering student problem solving and skill integration processes *International Journal of Engineering Education* **26** 831–45
- [17] Lesh R and Doerr H 2003 *Beyond constructivism: A models & modelling perspective on mathematics teaching, learning, and problems solving* (Lawrence Erlbaum Associates)

Publishers)

- [18] Yu S Y, and Chang C K 2011 What did Taiwan mathematics teachers think of model-eliciting activities and modelling teaching? *Trends in teaching and learning of mathematical modelling* 147–56
- [19] Jumadi J 2017 Penerapan pendekatan Model-eliciting activities (Meas) dalam meningkatkan kemampuan pemecahan masalah siswa kelas XII SMA N 2 Yogyakarta *AKSIOMA: Jurnal Matematika dan Pendidikan Matematika* **8** 43–9
- [20] Pane N, Syahputra E, and Mulyono 2017 Model-eliciting activities approach as a tool to improve creative thinking skills and self confidence *Advance in Social Science, Education and Humanities Research* **104** 399
- [21] Wulandari A Y R, Agustina N, Hidayati Y, and Tsulutsya F B 2019 Increasing students' problem-solving ability on the pressure concept through model-eliciting activities (MEAs) *AIP Conference Proceedings* **2202** 020058
- [22] Hamilton E, Lesh R, Lester F, and Brilleslyper M 2008 Model-eliciting activities (MEAs) as a bridge between engineering education research and mathematics education research *Advances in Engineering Education* **1** 1–25
- [23] Risma 2016 Perbandingan kemampuan pemecahan masalah matematika dengan menggunakan model pembelajaran berbasis masalah dan model eliciting activities (MEA) pada peserta didik kelas VIII SMP negeri 3 Patalassang kab. Gowa *Unpublihsed thesis* (Makassar: UIN Alauddin Makassar)
- [24] Andriani D 2013 Pengaruh pendekatan Model-eliciting activities (MEAs) terhadap kemampuan pemecahan masalah matematika siswa (Penelitian Quasi Eksperimen Di SMP Bhinneka Tunggal Ika) *Publihsed thesis* (Jakarta: UIN Syarif Hidayatullah Jakarta)
- [25] Sholikhah U 2014 Penerapan model eliciting activities (MEA) sebagai upaya meningkatkan kemampuan pemecahan masalah dan disposisi matematis siswa kelas IX B MTS Taris Lengkong Batangan Pati materi pokok bangun ruang sisi lengkung tahun pelajaran 2014/2015 *Publihsed dissertation* (Semarang: UIN Walisongo Semarang)
- [26] Afrilianto M 2015 Pengaruh pendekatan model-eliciting activities terhadap kemampuan komunikasi matematik siswa SMP *P2M STKIP Siliwangi* **2** 40–5
- [27] Anggralia R, Deswita R, Erita S, Habibi M., and Putra A 2019 Effect of model-eliciting activities (MEAs) approach on students' mathematical communication skills *Edumatica: Jurnal Pendidikan Matematika* **9** 41–9
- [28] Yulianti D E 2013 Keefektifan model-eliciting activities pada kemampuan penalaran dan disposisi matematis siswa kelas VIII dalam materi lingkaran *Published dissertation* (Semarang: Universitas Negeri Semarang)
- [29] Prasetyo A Dwidayati N K and Junaedi I 2017 Kemampuan koneksi dan disposisi matematis siswa ditinjau dari tipe kepribadian Keirsey pada pembelajaran matematika model eliciting activities *Unnes Journal of Mathematics Education* **6** 190–7
- [30] Handajani S Pratiwi H and Mardiyana M 2018 The 21st century skills with model eliciting activities on linear program *Journal of Physics: Conf. Series* **1008** 012059
- [31] Foshay R and Kirkley J 2003 *Principles for teaching problem solving: Technical paper 4* (Indiana: Plato Learning)
- [32] Sari D and Fiantika F 2018 The students algebraic thinking processed in mathematic problem solving at low mathematic ability student based on quantitative reasoning ability *Edumatica: Jurnal Riset Pendidikan Matematika* **1** 29-35

ORIGINALITY REPORT

12%

SIMILARITY INDEX

11%

INTERNET SOURCES

6%

PUBLICATIONS

%

STUDENT PAPERS

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

1%

★ www.ijsht-journals.org

Internet Source

Exclude quotes On

Exclude matches Off

Exclude bibliography On

22.J._Phys._Conf._Ser._2021

GRADEMARK REPORT

FINAL GRADE

/0

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7
