Jurnal Elementaria Edukasia
Volume 7, No. 2, Juni 2041, 2558-2569
DOI: 10.31949/jee.v7i2.9328

p-ISSN 2615-4625
e-ISSN 2655-0857

The Impact Of Open-Ended Based Learnıng Modıfıed By Realıstıc Mathematıc Educatıon On Computatıonal Thınkıng Skılls In Terms Of Mathematıcs Anxıety

Maryam Aunurrahim *
* Pendidikan Dasar, Fakultas Ilmu Pendidikan, Universitas Negeri Jakarta
aunurrahimmaryam@gmail.com

Yurniwati Yurniwati **
** Pendidikan Dasar, Fakultas Ilmu Pendidikan, Universitas Negeri Jakarta
yurniwati@unj.ac.id

Faisal Madani **
** Pendidikan Dasar, Fakultas Ilmu Pendidikan, Universitas Negeri Jakarta
fais_madani@unj.ac.id

Submitted: 2024-05-06
Revised: 2024-05-23
Accepted: 2021-06-04

ABSTRACT
This research was based on the problem of students' computational thinking skills that are still low, especially in elementary school mathematics subjects in term of students' mathematics anxiety. The purpose of this study is to determine the impact of the Open-Ended Based Learning Modified by Realistic Mathematics Education (OEBL-RME) method on computational thinking skills in terms of mathematics anxiety in elementary school students. This research used a quasi-experimental method of post-test only control group design using a design treatment by level 2x2. Data were collected using computational thinking skills tests and mathematics anxiety questionnaires and analyzed with the 2-way ANOVA test using SPSS 27. The sample used was 108 Grade V elementary school students consisting of 54 students in the experimental class and 54 students in the control class. The results showed that there is an impact of the OEBL-RME method on students' computational thinking skills in learning mathematics. In addition, it is proven that there is an interaction between learning methods and mathematical anxiety towards computational thinking skills
***Keywords**: Computational Thinking Ability; Mathematical anxiety; Open-Ended Based Learning; Realistic Mathematic Education.*

ABSTRAK
Penelitian ini dilandasi permasalahan kemampuan berpikir komputasi siswa yang masih rendah terutama dalam mata pelajaran matematika sekolah dasar dengan mempertimbangkan tingkat kecemasan matematika siswa. Tujuan dari penelitian ini adalah mengetahui pengaruh penerapan metode *Open-Ended Based Learning* Modifikasi *Realistic Mathematic Education* (OEBL-RME). terhadap kemampuan berpikir komputasi ditinjau dari kecemasan matematika pada siswa sekolah dasar. Metode penelitian yang digunakan adalah metode kuasi eksperimen rancangan *posttest only control group design* menggunakan desain *treatment by level* 2x2. Data dikumpulkan menggunakan tes kemampuan berpikir komputasi dan angket kecemasan matematika. Data dianalisis dengan uji ANAVA 2 jalur menggunakan aplikasi SPSS 27. Sampel yang digunakan dalam penelitian ini adalah 108 siswa kelas V sekolah dasar yang terdiri dari 54 siswa di kelas eksperimen dan 54 siswa di kelas

kontrol. Hasil yang didapat menunjukkan bahwa terdapat pengaruh penerapan metode OEBL-RME terhadap kemampuan berpikir komputasi siswa dalam pembelajaran matematika. Selain itu, terbukti bahwa terdapat interaksi antara metode pembelajaran dan kecemasan matematika terhadap kemampuan berpikir komputasi.
Kata Kunci: Kecemasan Matematika; Kemampuan Berpikir Komputasi; *Open-Ended Based Learning; Realistic Mathematic Education*.

INTRODUCTION

Mathematic learning in elementary school must equip the students to think logically, analytically, systematically, critically, and to cooperate with others (Turgut & Turgut, 2020). Student's ability to understand concepts in a structured manner and explain them sequentially is essential for developing computational thinking skills (Jiang & Li, 2021). Computational thinking skills, akin to basic abilities in reading, counting, and writing, are crucial for elementary school students (Monalisa, 2023).

Several studies on the development of computational thinking skills through various methods have been conducted. Jun et al. (2017) proved that DBL is more effective than direct teaching methods for improving students' computational thinking skills by stimulating their abstract thinking. Research by Kwon et al. (2021) shows the positive influence of media use and the level of understanding of concepts on students' cognitive abilities, especially computational thinking skills through the application of PBL methods. Munawarah et al. (2021) developed computational thinking ability test instruments with the RME approach, finding that students who learn with the RME approach have higher computational thinking skills compared to those who do not. Other studies have successfully used open-ended problem approaches to develop computational thinking skills in elementary school students (Abidin, 2020).

Observations and interviews at school reveal that students still have difficulty sorting out information in problems (abstractions) to formulate problems and solutions (algorithm design). Moreover, students lack the ability to break down large problems into smaller, more manageable parts (decomposition) and to find similarities and patterns within and between problems (pattern recognition). Based on the description above, it can be concluded that the computational thinking ability of elementary school students is still relatively low. Students with low computational thinking skills struggle to solve mathematical problems in everyday life in order and thoroughly (Shute et al., 2017). Therefore, efforts are needed to improve students' computational thinking skills, one of which involves applying learning methods and approaches that focus on students' ability to use the four indicators of computational thinking (abstraction, decomposition, algorithm design, and pattern recognition) to be able to solve given problems (Kurino, 2017).

This research develops computational thinking through PBL modified by Open-Ended and Realistic Mathematics Education, hereinafter referred to as the Open-Ended Based Learning modified by Realistic Mathematics Education (OEBL-RME) method. The application of open-ended problems in the PBL method can train and foster originality of ideas, creativity, high cognitive skills, critical thinking, communication-interaction, sharing, openness, and socialization among students (Murni, 2013). Moreover, Soraya et al. (2018) stated that the application of the RME approach to elementary school mathematics learning can improve students' cognitive abilities in general. Various studies on the PBL method and students' computational abilities have not widely examined one of the mathematical affective factors, namely math anxiety. According to Jameson (2014), high math anxiety reduces students' learning performance and cognitive abilities.

The novelty in this study is the application of the Open-Ended Based Learning method modified by Realistic Mathematisc Education (OEBL-RME). Open-ended problems are a flexible, learner-centered methodological approach where students are expected to apply their unique methodologies to solve a problem (Nohda, 2000). The application of the RME approach to the PBL method involves using contextual problems as the main characteristic of the process of understanding mathematics (Özkaya & Yetim Karaca, 2017).

The urgency of this study is based on the following conditions: 1) Students at the elementary school level still have low computational thinking skills; 2) Students are still faced with learning that does not develop computational thinking skills; and 3) There is a lack of consideration of the influence of students' level of mathematical anxiety in the learning process on improving students' computational thinking skills .

Based on the description above, this study was conducted to determine the impact of the Open-Ended Based Learning modified by Realistic Mathematics Education (OEBL-RME) method on computational thinking skills in terms of math anxiety. The purpose of this study is to find out: 1) Whether there are differences in students' computational thinking skills using the OEBL-RME method compared to students who use expository methods; 2) Whether there are interaction differences between learning methods and mathematical anxiety regarding computational thinking skills; 3) Whether there are differences in computational thinking skills between students who learn with OEBL-RME and expository learning methods among students who have low math anxiety; and 4) Whether there are differences in computational thinking skills between students who learn with OEBL-RME and expository learning methods among students who have high math anxiety.

METHODS

Type and Design

The experimental research design used was a post-test only control group design. The data were only taken after treatment was carried out in the experimental group. This research used a 2x2 treatment-by-level design, which can be seen in the following table:

Table 1. Treatment by Level 2 x 2 Design

Learning Methods (A) / Math Anxiety (B)	OEBL-RME method (A_1)	Expository method (A_2)
Low (B_1)	A_1B_1	A_2B_1
High (B_2)	A_1B_2	A_2B_2

The population used in this study was fifth-grade students of MI schools in Bekasi City. The target population in this study consists of fifth-grade students from 14 MI schools in Pondokgede District, Bekasi City. After an equivalence test was carried out using interview techniques to equalize the characteristics of teachers and students in the population, sampling was carried out using the Cluster Random Sampling technique. The result was a sample of 108 students from MI Yahya and MI Tarbiyatul Iman in Bekasi. The period for this research is from September 2023 to May 2024. The experimental class will be treated by applying the OEBL-RME method, while the other classes will serve as a control group, using the expository method.

Data and Data Sources

The first data source was the level of students' mathematics anxiety obtained through a mathematics anxiety questionnaire. The indicators of mathematical anxiety were somatic, cognitive, attitude, and emotional. The grouping of math anxiety in this study was divided into two groups: high and low.

The second data source collected was the students' computational thinking abilities obtained through a computational thinking ability test given to both groups (experimental and control). The indicators of computational thinking used in this study were: 1) Decomposition; 2) Abstraction; 3) Algorithm Design; and 4) Pattern Recognition. The test consisted of 8 essay questions regarding geometry in grade 5 mathematics subjects.

The instruments were tested for validity and reliability first. The trial was carried out for one day, guided by the teacher who taught mathematics in the class. Based on the results of the validity test of the computational thinking ability test instrument, of the 10 questions tested, 8 questions were declared valid and reliable, so they could be used to test computational thinking skills.

Data collection technique

The treatment in this study was carried out by applying the OEBL-RME method to the experimental class, which was then compared with the control class that received the expository method instead. Before giving the treatment, the students' mathematics anxiety levels were first measured. This was done to identify groups of students with low math anxiety (the lowest 33%) and high math anxiety (the highest 33%). After the treatment was completed, subjects were given a post-test in the form of a computational thinking ability test. The results obtained were then used in data analysis.

Data analysis

To analyze test result data, descriptive statistical analysis and inferential statistics are used. The inferential procedure begins by going through prerequisite tests: normality and homogeneity test. The normality test was performed using the Kolmogorov-Smirnov test. Based on the normality test, the value of Asymp. Sig (0.200) > 0.05, indicating that the data are normally distributed. Data homogeneity tests were performed using the Levene's test. Based on the homogeneity test, the value of Asymp. Sig (0.200) > 0.05, indicating that the data are already homogeneous. To prove the formulated hypothesis and determine the conclusion, a t-test is used.

RESULTS AND DISCUSSION

Based on research data obtained through post-test, the normality test was carried out using the Kolmogorov-Smirnov test because the sample data exceeded 50. The result of the level of significance of students' post-test scores in both experimental and control classes was

(0.200) ≥ 0.05. So it can be concluded that there are no significant differences in the characteristics of the data compared to the population (the data are normally distributed).

Table 2. Result of Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for Computational Thinking Ability Score	.085	72	**.200***	.976	72	.196

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Then a homogeneity test was carried out to find out whether the research data obtained were homogeneous or not. Based on the results of the homogeneity test, the level of significance of post-test scores in control and experimental classes was (0.372) ≥ 0.05. Therefore, it can be concluded that there are no significant differences in variance (the data are homogeneous).

Table 3. Levene's Test of Equality of Error Variance

		Levene Statistic	df1	df2	Sig.
Computational Thinking Ability	Based on Mean	1.059	3	68	**.372**
	Based on Median	1.066	3	68	.369
	Based on Median and with adjusted df	1.066	3	59.078	.371
	Based on trimmed mean	1.058	3	68	.373

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: Computational Thinking Ability

b. Design: Intercept + A + B + A * B

After the prerequisite test was conducted with the conclusion that the data were normally distributed and homogeneous, the analysis was continued by testing the hypothesis with an independent sample t-test to determine whether there was an influence of the OEBL-RME method on students' computational thinking skills.

Table 4. Tests of Between-Subjects Effects

Dependent Variable: Computational Thinking Ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	6751.889[a]	3	2250.630	37.996	.000	.626
Intercept	151984.222	1	151984.222	2565.842	.000	.974

A	1740.500	1	1740.500	29.384	**.000**	.302
B	840.500	1	840.500	14.190	.000	.173
A * B	4170.889	1	4170.889	70.414	.000	.509
Error	4027.889	68	59.234			
Total	162764.000	72				
Corrected Total	10779.778	71				
a. R Squared = .626 (Adjusted R Squared = .610)						

From the table above, the level of significance of students' post-test results between experimental and control classes was 0.000 < 0.05 so it can be concluded that there was an influence of the OEBL-RME method on students' computational thinking skills.

Table 5. Descriptive Statistics

Dependent Variable: Computational Thinking Ability				
Learning Method	Mathematics Anxiety	Mean	Std. Deviation	N
OEBL-RME	Low	**61.89**	8.560	18
	High	**39.83**	5.894	18
	Total	50.86	13.325	36
Expository	Low	**36.83**	9.076	18
	High	**45.22**	6.822	18
	Total	41.03	8.984	36
Total	Low	49.36	15.396	36
	High	42.53	6.851	36
	Total	45.94	12.322	72

The data above showed that after being given treatment, the average score of the experimental class post-test (61.89) was higher than that of the control class (36.83) in the group of students with low anxiety. As for the group of students with high anxiety, the average score of the control group was higher (45.22) than that of the experimental class (39.83). Therefore, it can be concluded that there is an influence of learning methods and mathematical anxiety on computational thinking skills. To find out the magnitude of the influence, proceed with the effect size test using a post-hoc test using the Tukey test.

Table 6. Multiple Comparisons

Dependent Variable: Computational Thinking Ability Tukey HSD						
(I) Interaction	(J) Interaction	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
A1B1	A1B2	22.06*	2.565	.000	15.30	28.81
	A2B1	**25.06***	2.565	**.000**	18.30	31.81
	A2B2	16.67*	2.565	.000	9.91	23.42
A1B2	A1B1	-22.06*	2.565	.000	-28.81	-15.30

A2B1	3.00	2.565	.648	-3.76	9.76
A2B2	**-5.39**	2.565	**.000**	-12.15	1.37

Based on observed means.
The error term is Mean Square(Error) = 59.234.

From the table above, in the low math anxiety group (A1B1 X A2B1), the average difference between the experimental class and the control class was 25.06 with a Significance value of Sig. 0.000. This means that the computational thinking ability of students who learn using the OEBL-RME method is higher than that of the students who learn using expository methods in groups of students with low mathematical anxiety. While in the high math anxiety group (A1B2 X A2B2), the average difference between the experimental class and the control class was -5.39 with a Significance value of Sig. 0.000. This means that the computational thinking ability of students who learn using expository methods is higher than that of students who learn using OEBL-RME methods in groups of students who have high mathematical anxiety.

In the OEBL-RME method, students were trained in the ability to design logical and orderly instructions to provide solutions to a problem. This ability is one of the indicators of computational thinking, namely algorithms. The selection of open-ended problems in the OEBL-RME method also trained students to apply their own unique methodologies to solve problems and to extract important points from a problem to then analyze and understand the relationship between these points. This ability is one component of computational thinking, namely abstraction (Kwon et al., 2021).

In addition to the use of open-ended problems, the use of the RME approach has also improved students' computational thinking skills. This occurred because one of the characteristics of learning with the RME approach is that it involves procedural methods, where students must be able to create their own methods when solving problems (Khatimah & Fatimah, 2023). This process was called the method transition process. After this transition, the method can be used as a formal mathematical method. Generalization is one of the indicators of computational thinking (Palts & Pedaste, 2020).

In expository method, at the application phase, students were taught how to work on sample questions by the teacher. Students may gain the ability to analyse problems and formulate logical solutions based on examples given by the teacher. This is some of computational thinking components, namely abstractions and algorithms. Only in this phase, the preparation of problem solutions depends on the way taught by the teacher alone, not the result of the thinking process in students. Therefore, learning with expository methods did not develop the potential of students' computational thinking skills (Shute et al., 2017). Based on the description above, it can be concluded that there are differences in the computational thinking skills of students who learn using the OEBL-RME learning method with expository methods.

Math anxiety is based on fear of everything related to mathematics, which is influenced by the methods used in the classroom. In certain learning processes, the class activities can be greatly influenced by their anxiety levels (Lyons & Beilock, 2020). Increased anxiety affected their learning performance, so it had directly affected their learning performance, including computational thinking skills (Vinson, 2021).

In the OEBL-RME method, there was a problem orientation phase where learning begins with activities that trigger students to explore their understanding of the real problems given. At that phase, students were exposed to new material that they have never been familiar with. This certainly was greatly influenced by the level of students' math anxiety, where students who had high levels of anxiety had difficulty in dealing with new things they have not tried (Hanum & Amini, 2023).

The use of open-ended problems had an affect on the phase of developing and presenting the results of discussions on the OEBL-RME method, so there would be many different opinions from other students. This has triggered the fear of students who might give different answers to others. As for students with low levels of math anxiety, they tend to be calm in doing activities that involve many others because they are not overshadowed by fear of other people's opinions (Ramirez et al., 2018).

In the expository method, students tend to feel more comfortable because they are not required to do many things. Students with high levels of mathematical anxiety are more in line with the phases of expository learning, because there are not many required activities to carry out problem orientation activities and group discussions that trigger responses to high anxiety (Lyons & Beilock, 2020). In contrast to this, students with low mathematical anxiety felt bored because it tends to be monotonous and passive. As a result, the condition of students who were no longer interested in the learning process disrupted the process so that it had negatively affected students' computational thinking skills (Mutlu, 2019).

Students who have low math anxiety have a calm characteristic when facing a new process, and tend to be interested and enthusiastic in facing challenges in the learning process. At the investigation guidance phase, students were required to actively participate in group discussions. Before that, students had to carry out the process of finding learning resources independently. This process helped students to select and filter the necessary information as discussion material. This is one of the computational thinking skills, namely abstraction (Fajri & Yurniwati, 2021).

In the OEBL-RME method, students were given more activities that encourage active student participation, such as during the discussion phase and presenting the results of the discussion. By following each phase of learning in this method, the components of computational thinking skills developed at each phase were also well executed (Mrizkidirmansyah & Febriandi, 2023).

The use of open-ended problems at the problem orientation phase was also well welcomed by students with low math anxiety. In the absence of these anxiety feelings, they were able to explore the possibilities of solving problems in the open problems presented without fear of giving inappropriate answers. In this activity, students developed some components of computational thinking skills, namely debugging and iteration, where students were able to detect, identify, and then correct errors when solutions do not work as they should (Almulla, 2020).

In contrast to that, in the expository method, students tend to be passive in receiving teaching material. At the presentation phase, students were asked to sit and listen to the explanation of the material and take notes if they were given the opportunity to take notes. Students with low math anxiety were easily bored in these situations because they tend to be more interested in challenging activities. Such boredom led to a tendency to ignore the teachers, take initiative to do other activities, and even annoy their classmates. This of course affected the learning process by decreasing engagement, thus negatively affecting students' computational thinking skills (Kong et al., 2022).

Students who have high math anxiety are characterized by anxiety and fear of facing anything related to mathematics. Especially when in the process the student is faced with unfavorable conditions, such as being required to speak in front of the class, participate in discussions, or complete challenging assignments. Students tend to have better learning performance in conditions that do not require them to be active in learning (Gunderson et al., 2018).

In the expository method, students were not required to do many things on their own. Students with high math anxiety tend to be reluctant to participate, refuse to work on tasks they have not mastered, and are not interested in challenges. At the application phase, students will be given sample questions by the teacher and directed to apply the methods of solving questions that have been taught to other questions. This is one of the computational thinking skills, namely pattern recognition. By following each phase of learning in the expository method well, it also affected the components of students' computational thinking skills (Nasution, 2020).

In contrast to this, in the OEBL-RME method, students were faced with new challenges that could trigger an anxiety response because one of the factors causing high anxiety is fear of the unknown. At this phase, students were able to practice one of the processes of breaking down the problem into several important parts so that it is easier for students to manage problem solving in a smaller scope. Students with high math anxiety found it difficult to do the problem orientation phase, so the process of training the computational thinking component of decomposition at this phase was disrupted (Zhang et al., 2019).

The use of open-ended problems at every phase of the OEBL-RME method also affected students with high math anxiety. By providing questions that have many answer options, students experienced fear of differences of opinion when discussing and presenting problems. Disagreements made students with high anxiety worry about getting comments that blamed their own opinions. This has caused the difficulty of developing computational thinking skills in students with high math anxiety, where students are asked to propose various open-ended problem-solving options and test repeatedly to find the best solution. This ability is one of the components of computational thinking skills, namely iteration and debugging (Tekdal, 2021).

Based on the comprehension above, it can be stated that the application of the OEBL-RME method has a significant effect on students' computational thinking skills in elementary school mathematics lessons in terms of mathematics anxiety. This is because the steps in the PBL method have been modified with an open-ended problem approach and RME which improves students' ability to abstract, decomposition, algorithm design, and pattern recognition.

CONCLUSION

Based on the results and discussion, it can be concluded that there is an impact of the Open-Ended Based Learning modified by Realistic Mathematics Education (OEBL-RME) method on students' computational thinking skills in terms of mathematics anxiety. It was also concluded that the computational thinking ability of students who learned using the OEBL-RME method was higher than that of the students who learned using expository methods among the group of students with low mathematical anxiety. In addition, the computational thinking ability of students who learn using expository learning methods is higher than students who learn using OEBL-RME methods in the groups of students with high mathematical anxiety.

Researchers recommend the OEBL-RME method as an alternative learning method that can be used to improve computational thinking skills. We also suggest analysis of the application of the OEBL-RME method to assess its effect on computational thinking skills by reviewing other mathematical affectives such as self-confidence and self-efficacy. Further research can also maintain the method and affective variables by replacing the dependent variables with other thinking skills, such as creative thinking and critical thinking.

REFERENCES

Abidin, Z. (2020). Universitas Bhayangkara Jakarta 3) Mathematical Reasoning Abilities In Elementary Schools. *Dkk JMIE : Journal of Madrasah Ibtidaiyah Education*, *4*(1), 2020. http://e-journal.adpgmiindonesia.com/index.php/jmie

Almulla, M. A. (2020). The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning. *SAGE Open*, *10*(3). https://doi.org/10.1177/2158244020938702

Fajri, M., & Yurniwati. (2021). *COMPUTATIONAL THINKING , MATHEMATICAL THINKING BERORIENTASI COMPUTATIONAL THINKING , MATHEMATICAL THINKING BERORIENTASI GAYA KOGNITIF PADA PEMBELAJARAN MATEMATIKA DI SEKOLAH DASAR*. *March 2019*.

Gunderson, E. A., Park, D., Maloney, E. A., Beilock, S. L., & Levine, S. C. (2018). Reciprocal relations among motivational frameworks, math anxiety, and math achievement in early elementary school. *Journal of Cognition and Development*, *19*(1), 21–46. https://doi.org/10.1080/15248372.2017.1421538

Hanum, L., & Amini, R. (2023). Pengembangan E-LKPD Berbasis Problem Based Learning Menggunakan Aplikasi Book Creator di Kelas III Sekolah Dasar. *Jurnal Elementaria Edukasia*, *6*(4), 2183–2194. https://doi.org/10.31949/jee.v6i4.7963

Jameson, M. M. (2014). Contextual factors related to math anxiety in second-grade children. *Journal of Experimental Education*, *82*(4), 518–536. https://doi.org/10.1080/00220973.2013.813367

Jiang, B., & Li, Z. (2021). Effect of Scratch on computational thinking skills of Chinese primary school students. *Journal of Computers in Education*, *8*(4), 505–525. https://doi.org/10.1007/s40692-021-00190-z

Jun, S. J., Han, S. K., & Kim, S. H. (2017). Effect of design-based learning on improving computational thinking. *Behaviour and Information Technology*, *36*(1), 43–53. https://doi.org/10.1080/0144929X.2016.1188415

Khatimah, H., & Fatimah, N. (2023). Pengembangan LKPD Etnomatematıka Berbasıs Rme Untuk Menıngkatkan Lıterası Matematıka Sıswa. *Jurnal Elementaria Edukasia*, *6*(4), 1680–1686. https://doi.org/10.31949/jee.v6i4.7115

Kong, S.-C., Abelson, H., & Kwok, W.-Y. (2022). Introduction to Computational Thinking Education in K–12. In *Computational Thinking Education in K–12*. https://doi.org/10.7551/mitpress/13375.003.0002

Kwon, K., Ottenbreit-Leftwich, A. T., Brush, T. A., Jeon, M., & Yan, G. (2021). Integration of problem-based learning in elementary computer science education: effects on computational thinking and attitudes. *Educational Technology Research and Development*, *69*(5), 2761–2787. https://doi.org/10.1007/s11423-021-10034-3

Lyons, I. M., & Beilock, S. L. (2020). Mathematics anxiety: Separating the math from the anxiety. *Cerebral Cortex*, *22*(9), 2102–2110. https://doi.org/10.1093/cercor/bhr289

Monalisa, M. (2023). Analisis Berpikir Komputasional Siswa SMP pada Kurikulum Merdeka Mata Pelajaran Informatika. *DIAJAR: Jurnal Pendidikan Dan Pembelajaran*, *2*(3), 298–304. https://doi.org/10.54259/diajar.v2i3.1596

Mrizkidirmansyah, & Febriandi, R. (2023). Meningkatkan Kemampuan Problem Solving Matematika Siswa Sd Melalui Implementasi Model Problem Based Learning. *Jurnal Elementaria Edukasia*, *6*(4), 2135–2144. https://doi.org/10.31949/jee.v6i4.7591

Munawarah, Thalhah, S. Z., Angriani, A. D., Nur, F., & Kusumayanti, A. (2021). Development of Instrument Test Computational Thinking Skills IJHS/JHS Based RME Approach. *Mathematics Teaching-Research Journal*, *13*(4), 202–220.

Murni. (2013). Open-Ended Approach in Learning to Improve Students Thinking Skills in Banda Aceh. *International Journal of Independent Research and Studies*, *2*(2), 95–101.

Mutlu, Y. (2019). Math anxiety in students with and without math learning difficulties. *International Electronic Journal of Elementary Education*, *11*(5), 471–475. https://doi.org/10.26822/iejee.2019553343

Nasution, W. N. (2020). Expository Learning Strategy: Definition, Goal, Profit and Procedure. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS*, *25*(5), 7–10. https://doi.org/10.9790/0837-2505080710

Nohda, N. (2000). Teaching by open-approach method in Japanese mathematics classroom. *Proceedings of the 24th Conference of the International Group for the Psychology of Mathematics Education*, *1*, 39–53.

Özkaya, A., & Yetim Karaca, S. (2017). The effects of Realistic Mathematics Education on students' achievements and attitudes in fifth grades mathematics courses. *International Online Journal of Education and Teaching (IOJET)*, *2017*(2), 185–197. http://iojet.org/index.php/IOJET/article/view/187/162

Palts, T., & Pedaste, M. (2020). A model for developing computational thinking skills. *Informatics in Education*, *19*(1), 113–128. https://doi.org/10.15388/INFEDU.2020.06

Ramirez, G., Shaw, S. T., & Maloney, E. A. (2018). Math Anxiety: Past Research, Promising Interventions, and a New Interpretation Framework. *Educational Psychologist*, *53*(3), 145–164. https://doi.org/10.1080/00461520.2018.1447384

Shute, V. J., Sun, C., & Asbell-Clarke, J. (2017). Demystifying computational thinking. *Educational Research Review*, *22*, 142–158. https://doi.org/10.1016/j.edurev.2017.09.003

Soraya, F., Yurniwati, Y., Cahyana, U., & Syarif Sumantri, M. (2018). The Application of Realistic Mathematics Education (RME) Approach to Increase the Creative Thinking Ability of Fraction

Subject Matter for Fourth-Graders of SDN Rawajati 06 Pagi. *American Journal of Educational Research*, *6*(7), 1016–1020. https://doi.org/10.12691/education-6-7-19

Tekdal, M. (2021). Trends and development in research on computational thinking. In *Education and Information Technologies* (Vol. 26, Issue 5). Springer US. https://doi.org/10.1007/s10639-021-10617-w

Turgut, S., & Turgut, İ. G. (2020). Me while i am learning mathematics: Reflections to elementary school students' drawings. *International Electronic Journal of Elementary Education*, *13*(1), 139–154. https://doi.org/10.26822/iejee.2020.179

Vinson, B. M. C. (2021). A comparison of preservice teachers' mathematics anxiety before and after a methods class emphasizing manipulatives. *Early Childhood Education Journal*, *29*(2), 89–94. https://doi.org/10.1023/A:1012568711257

Kurino, Y. (2017). Penerapan Realistic Mathematic Education Dalam Meningkatkan Hasil Belajar Siswa Kelas V Pada Materi Volume Bangun Ruang Di Sekolah Dasar. *Cakrawala Pendas*, *3*(2).

Zhang, J., Zhao, N., & Kong, Q. P. (2019). The relationship between math anxiety and math performance: a meta-analytic investigation. *Frontiers in Psychology*, *10*(AUG), 1–17. https://doi.org/10.3389/fpsyg.2019.01613