

ANALYSIS OF MATHEMATICS PROBLEM-SOLVING SKILLS THROUGH PROBLEM-SOLVING MODEL IN ELEMENTARY SCHOOL STUDENTS

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Abstrak

Keterampilan dalam menyelesaikan masalah matematika merupakan kemampuan yang sangat penting bagi siswa di tingkat sekolah dasar, tetapi banyak siswa menghadapi kesulitan dalam mengembangkan keterampilan tersebut. Tujuan dari penelitian ini adalah untuk menilai efek penggunaan Model *Problem Solving* terhadap kemampuan siswa dalam memecahkan masalah matematika di tingkat sekolah dasar. Metode yang diterapkan ialah *Systematic Literature Review* (SLR), dengan menelaah 10 artikel yang dipublikasikan dalam rentang waktu 6 tahun terakhir. Penelitian ini membuktikan bahwa kemampuan pemecahan masalah berdampak positif terhadap keterampilan siswa dalam menyelesaikan problem matematika dengan menstimulasi mereka untuk mengidentifikasi problem, merancang strategi, menerapkan konsep matematika, dan mengevaluasi jawaban. Model ini memberikan struktur kerja yang teratur agar siswa dapat meningkatkan kemampuan dalam memecahkan masalah dengan efisien.

Kata kunci: Matematika, Kemampuan Pemecahan Masalah, Model *Problem Solving*.

Abstract

Skills in solving mathematical problems are a very important ability for students at the elementary school level, but many students face difficulties in developing these skills. The aim of this research is to assess the effect of using the Problem Solving Model on students' ability to solve mathematical problems at the elementary school level. The method applied is Systematic Literature Review (SLR), by reviewing 10 articles published in the last 6 years. This research proves that problem solving has a positive impact on students' skills in solving mathematical problems by stimulating them to identify problems, design strategies, apply mathematical concepts, and evaluate answers. This model provides an organized work structure for students to improve their problem-solving skills efficiently.

Keywords: Mathematics, Problem-Solving Ability, Problem-Solving Model.

INTRODUCTION

Learning mathematics has an important role in meeting the needs of students' lives, so it is an interesting topic because of the different characteristics of children and students, and the characteristics of mathematics. (Arrahim & Sabrina, 2019). According to Sudayana stated in (Fatona, Hartono, & Surmilasari, 2019, p. 114), Maths plays a vital role in the education curriculum. Maths is studied from primary school level to higher education. With its learning system, mathematics can help individuals prepare themselves well by utilising the thinking and knowledge gained while studying this discipline. (Wiwin Nafiatul Fatikhah, Nora Surmilasari, 2023).

According to Permendikbud No. 21 (2016), the purpose of learning mathematics is to improve skills in understanding problems, making mathematical models, solving problems, and interpreting the solutions obtained. (Ndiung, 2021). According to Permendikbud No. 58 of 2014, mathematics learning objectives include developing an understanding of mathematical concepts, improving problem-solving skills, strengthening mathematical reasoning, communicating systematically, and aligning with internal values. This is in line with the five mathematics learning objectives set out by the National Council of Teachers of Mathematics, namely problem solving, reasoning and proof, communication, connection, and representation. (Risma & Kafuji, 2023).

Prastiwi (2018) stated that the ability to solve problems is one of the key abilities essential in dealing with changes in science and technology. It is an integral part of the educational objectives that aim to develop critical thinking, logical, and effective problem-solving skills. (Mekarsariningtyas & Rizqi, 2024).

According to Charles dan O'Daffer (1997), Teaching mathematical problem solving aims to: (1) train students' thinking, (2) improve the ability to choose and apply strategies, (3) build a positive attitude in solving problems, (4) develop the ability to connect knowledge, (5) improve the ability to monitor and evaluate the problem solving process, (6) strengthen cooperation skills, and (7) train students to find accurate answers. (Kania & Fitriyani, 2022).

Meanwhile, the indicators that must be achieved by students in solving problems according to Polya & Conway include: (1) understanding the problem, where students must identify relevant information and answer the question at hand; (2) planning, where students develop a formula or strategy to solve the problem; (3) implementing the plan, where

students apply the strategy or formula that has been designed; and (4) reassessing, where students check their work to ensure accuracy. Providing problems related to problem solving is important to train students in gathering and analysing information, as well as understanding the importance of reviewing the final result to make the right decision (Sundari et al., 2022).

One of the problems encountered is that students often face difficulties in developing problem-solving skills, especially in the context of solving mathematics problems. This is important because problem-solving skills are considered important because they are not only the core of learning mathematics, but also affect students' ability to think critically and find effective solutions to problems in everyday life as well as in the future.

According to Rosneli (2019), one of the main causes of students' low ability to solve mathematical problems is a lack of interest or belief that the problem can be solved, which causes them to be reluctant to try. In addition, students who have difficulty conducting experiments and collecting information tend to face more obstacles, and it is possible that some students are not active during the learning process. (Ar Ridha et al., 2024).

Factors that hinder the development of mathematical problem-solving skills can reduce students' ability to think creatively, critically, and at a higher level, and make it difficult for them to apply the material they have learnt. Therefore, the development of these skills should be based on a learning process that links students' direct experience with new or unfamiliar information. (Maesari et al., 2020).

Based on several scientific articles found, students' ability to solve problems is considered very low. So, courage and creativity are needed in teaching mathematics by applying appropriate learning methods. This model should be centred on learning that encourages the ability to solve problems. One example of a learning model that applies this concept is the Problem-Solving model.

The problem-solving learning model is an approach that focuses on teaching and developing problem-solving skills and reinforcing them. It can improve students' abilities by engaging them in a thinking process that includes data collection, analysis of information, generation of alternative solutions, and selection of the most effective solution. (Azidah et al., 2024).

According to Asfar dan Nur (2018: 11) argues that the problem-solving model is a learning approach that allows each student to have the opportunity to solve their problems. On the contrary, Ristiasari, Priyono, dkk (2012: 35) added that this model is designed to improve students' critical thinking skills and encourage collaboration in groups (Kusumaningrum, 2020).

The objectives of the Problem Solving learning model are: 1) Train students to think and draw conclusions through exploration, experimentation, and analysis of differences and similarities; 2) Improve problem solving skills; 3) Sharpen students' skills in conveying information; and 4) Make learning more relevant, interesting, and trigger students' creativity. (Ar Ridha et al., 2024).

According to some of these opinions, it can be concluded that the Problem-Solving model is a model that prioritises teaching and improving problem-solving skills. This method encourages students to do critical and analytical thinking from the data collection stage to the selection of suitable solutions. According to some researchers, such as Azidah et al. (2024), Shoimin (2014), Djamarah (2010), and Ngalimun (2017), the model encourages students to think critically, analyse information, and improve their ability to solve problems systematically.

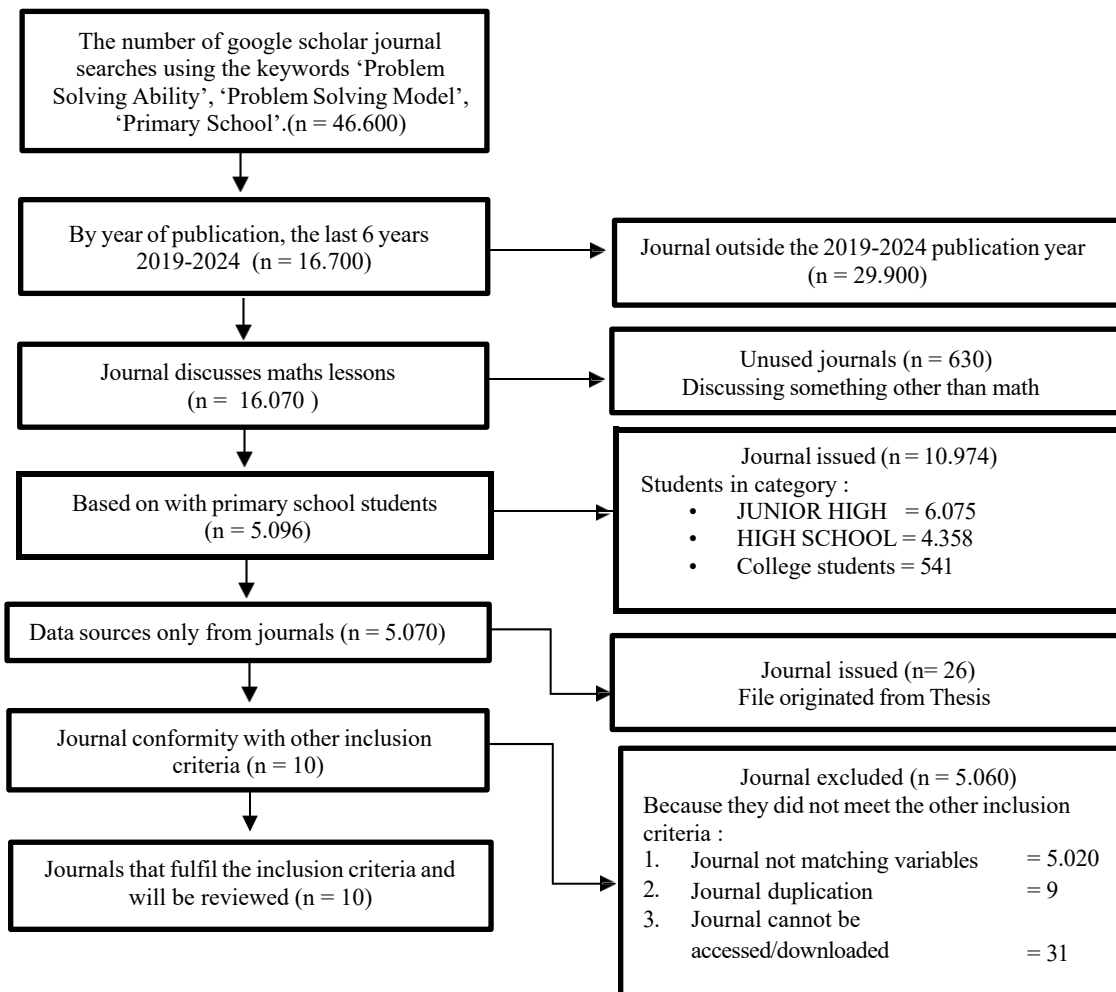
According to Djamarah dan Zain (2013:92), the advantages of the Problem Solving learning model include: (1) making education at school by real life, (2) training students in solving problems skilfully, and (3) increasing students' creative and comprehensive mindset. (Mardiyana, 2020). Meanwhile, Hosnan (2016: 288) points out some of the shortcomings of this model, namely: 1) Requires considerable time to implement; 2) Not all students are involved in the process of searching or finding solutions; 3) This model is only effective for certain problem-solving situations. (Kusumaningrum, 2020).

Based on the description above, research was conducted with the title 'Analysis of Mathematical Problem-Solving Ability through Problem-Solving of Elementary School Students'. The purpose of this research is to find out the effect of the Problem-Solving learning model on the mathematical problem-solving ability of elementary school students.

RESEARCH METHOD

The research method applied in this study is a Systematic Literature Review (SLR). This method aims to identify, evaluate, and interpret all findings related to the research topic to answer the pre-defined research questions by analysing relevant scientific articles from Google Scholar.

Systematic Literature Review (SLR) is a scientific study that focuses on a specific question and uses a predetermined, explicit scientific method to identify, select, review, assess, and summarize similar research findings/results in scientific articles.



RESULTS AND DISCUSSION

In this study, using the Systematic Literature Review (SLR) approach through Google Scholar using the keywords set to obtain study material, namely 10 journals that have met the criteria, as well as data collected through an overview of 'Analysis of Mathematical Problem-Solving Ability Through Problem-Solving in Elementary School Students'. The following are journal articles that meet the criteria:

Table 1. Grouping of data and sources used

Research Title	Researcher Name	Journal and Year of Publication	Source
Differences between Problem-Solving and Problem-Based Learning Models	1. Yunita Berliana Nurul Hidayah	Journal on Education Volume (2023)	https://jonedu.org/index.php/joe/article/view/3093
Learning Model Assisted by Diagram Board on Problem-Solving Ability of Elementary School Students	2. Lisa Virdinarti Putra		
The Effectiveness of Discovery Learning and Problem-Solving Learning Models on Mathematics Problem-Solving Ability in Grade IV Elementary	1. Yuniarti Kusumaningrum um 2. Endang Indarini	Jurnal PAJAR (Pendidikan dan Pengajaran) (2020)	http://dx.doi.org/10.33578/pjr.v4i2.7969

School

The Effect of Problem-Solving Learning Model on Problem-Solving Ability of Data Collection and Presentation Material in Grade V Elementary School

1. Wiwin Nafiatul Fatikhah
2. Nora Surmilasari
3. Dian Nuzulia Armariena

Pendas : Jurnal Ilmiah Pendidikan Dasar (2023)

<https://journal.unpas.ac.id/index.php/pendas/article/view/8627>

The Effect of Problem-solving Learning Model Assisted by Canva On the Problem-Solving Ability of State Elementary Students

1. Dwi Puji Mekarsarinin gtyas
2. Hesti Yunitiara Rizqi

Media Penelitian Pendidikan: Jurnal Penelitian dalam Bidang Pendidikan dan Pengajaran (2024)

<https://journal.upgris.ac.id/index.php/me-diapenelitianpendidikan/article/view/18124>

Ungaran 01 Effectiveness of Problem-Based Learning and Problem Solving Viewed from the Mathematics Problem-Solving Ability Grade IV Primary School Learners

1. Ulva Amalia Putri
2. Wahyudi

JEMS (Jurnal Edukasi Matematika dan Sains) (2020)

<https://ejournal.unipma.ac.id/index.php/JEMS/article/view/6088>

The Effectiveness of Problem-Solving Learning Model Assisted

1. Mahfudotul Azidah
2. Zulmi

Jurnal DIDIKA : Wahana Ilmiah Pendidikan Dasar

<https://ejournal.hamzanwadi.ac.id/index.php/didika>

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| by Media
Comics to
Improve Problem-
Solving Ability
Class II Maths at
SDN Wonoyoso | Roestika
Rini | (2024) | a/article/view/25193 |
| Improving
Problem-Solving
Ability
In Mathematics
Learning
Using Problem
Problem-Solving
Model in
Elementary
School | 1. Ar Ridha,
Fadhilaturrah
mi
2. Moh
Fauziddin
3. Rusdial
Marta
4. Iis
Aprinawati | PEDADIDAKTIKA :
Jurnal Ilmiah
Pendidikan Guru
Sekolah Dasar (2024) | https://ejournal.upi.edu/index.php/pedadidaktika/article/view/69198 |
| Efforts to
Improve Problem-
Solving Ability
Mathematics
Problem-Solving
Model in
Elementary
School | 1. Arrahim
2. Rika Sabrina | Jurnal Pendidikan
Sekolah Dasar (2019) | https://journal.uny.ac.id/index.php/didaktika/article/view/28092 |
| Application of
Problem-Solving
Learning Model
to Improve
Mathematics
Problem-Solving
Ability
Mathematics
Problem-Solving
Ability of
Elementary | 1. Citra
Maesari
2. Rusdial
Marta
3. Yusnira | JPdK (Jurnal
Pendidikan dan
konseling) (2020) | https://journal.universitaspahlawan.ac.id/index.php/jpdk/article/view/531 |

School Students

Application of the
Problem-Solving
Learning Model
to Improve
Maths Problem
Solving

1. Tina

Mardiyana

Kalam Cendekia: Jurnal
Ilmiah Kependidikan
(2020)

<https://jurnal.uns.ac.id/jkc/article/view/42539>

This research aims to review and analyse how problem-solving skills through the Problem-Solving model are applied to elementary school students. The method used is Systematic Literature Review (SLR), where the researcher identifies, evaluates, and interprets all established studies from various journals that focus on problem-solving skills through problem-solving in primary school students from 2019-2024.

Based on a review of 10 journals that have been described, the Problem-Solving model is proven to be very effective in improving the mathematical problem-solving skills of elementary school students. Research by Mahfudotul Azidah and Zulmi Roestika Rini (2024) also supports these findings, showing that the application of the Problem-Solving model successfully improved the mathematics problem-solving skills of grade II students at SDN Woyonos. The advantages of this model, according to Tina Mardiyana (2020), the focus is on the way students receive material from the teacher, discuss with friends, and through direct experience in designing structured problem-solving strategies. This model motivates students to be more active in learning and improves their interaction in the learning process of mathematics.

Based on Table 1 of the research results in the 10 journals above, there are 8 journals of research results in upper grades, namely classes IV and V, and 2 journals of research results in lower grades, namely classes II and III. From the results of these studies, it is stated that the Problem-Solving learning model can improve problem-solving skills, especially in mathematics problem-solving skills, both in upper grades and in lower grades. The research results from several journals mentioned in Table 4.1 use different types of research methods, namely, PTK (Classroom Action Research) and Experiments.

1. Based on Research Method Analysis

Based on the 10 journals presented in the table above, there are 4 journals that apply the Classroom Action Research (PTK) method and 6 journals that use the Experiment method.

a. Classroom Action Research (PTK)

Based on the analysis of journal articles, 4 journals use the type of Classroom Action Research (PTK) as the research method used by previous researchers. This can be seen from the increase in the percentage of completeness of students' problem-solving skills in Mathematics subjects, as follows:

Table 2. Classroom Action Research Methods

No	Researcher	Researcher Subject	KKM	Percentage of Completion				Improvement
				Pre Cycle	Cycle I	Cycle II	Cycle III	
1.	Citra Maesari, Rusdial Marta, dan Yusrina (2020)	12 Class IV students	70	25 %	33,33%	83,33%	-	58,33%
2.	Tina Mardiyana (2020)	14 Class V students	72	14,29%	64,29%	92,86%	-	78,57%
3.	Ar Ridha, Fadhilaturrahmi, Moh Fauziddin, Rusdial Marta dan Iis Aprinawati (2024)	23 Class V students	70	-	22%	83%	-	61%
4.	Arrahim dan Rika Sabrina (2019)	28 Class V students	-	-	47%	69%	88%	41%
Average Improvement								59,72%

Based on the table above, two journals use classroom action research methods with pre-cycle, cycle I, and cycle II, namely researchers Citra Maesari, Rusdial Marta, and Yusnira (2020) with subjects consisting of fourth-grade students of SDN 004 Bangkinang Kota. The result is that, based on what is obtained, each student has an increase in mathematics learning, which shows good results. This can be seen from the increase in the percentage of student completeness on mathematics learning materials. In mathematics learning material, Citra Maesari, Rusdial Marta, and Yusnira (2020) obtained a percentage of learning completeness in the pre-cycle of 25%, in the first cycle 33.33%, and in the second cycle 83.33%. And researchers Tina Mardiyana (2020) with subjects consisting of fifth-grade students of SDN 4 Pulutan Kulon. The result is that, based on what is obtained, each student has an increase in mathematics learning, which shows good results. This can be seen from the increase in the percentage of student completeness of mathematics learning materials. Tina Mardiyana (2020) obtained a percentage of learning completeness in the pre- cycle of 14.29%, in the first cycle 64.29%, and in the second cycle 92.86%.

b. Experimental Research

Based on the analysis of journal articles, 6 journals were found that applied quasi-experimental research methods with a pre-test and post-test design. This research focuses on students' problem-solving abilities by using a problem- solving model to improve problem-solving skills at the primary school level. The following table shows the increase in the initial and final mean scores of the various experimental methods that have been used:

Table 3. Experimental Research Methods

No	Research	Research Subject	Pre-test		Post-test		Comparison
			Control class average	Experiment class average	Control class average	Experiment class average	
1.	Mahfudot	Classroom	-	-	88,43	89,43	1

	ul Azidah dan Zulmi Roestika Rini (2024)	s II A and II B					
2.	Dwi Puji Mekarsari ningtyas dan Hesti Yunitiara Rizqi (2024)	Class III studen ts	-	-	-	-	-
3.	Wiwin Nafiatul Fatikhah, Nora Surmilasar i dan Dian Nuzulia Armariena (2023)	50 class V studen ts	-	-	18,4	76	57,6
4.	Yunita Berliana Nurul Hidayah dan Lisa Virdinarti Putra (2023)	28 class V studen ts	-	-	-	89,08	-
5.	Ulva Amalia Putri dan	21 Class IV	61,05	-	73,43	-	-

	Wahyudi (2020)	studen ts					
6.	Yuniarti Kusumani ngrum dan Endang Indarini (2020)	54 class IV studen ts	62,5	-	72,4		-
Average Comparison							9,76

2 journals use experimental and control methods at the end of the study (post-test), 2 journals use the average value of the control class (pre-test and post- test), 1 journal uses the average value of the experimental class at the end of the study (post-test), 1 journal does not have the average value of the class (pre-test and post-test).

2. By Year of Publication

When viewed in Table 1, there is a graph that discusses the author's search year on Google Scholar. The author sets the search for the last 6 years of the analysed journal, which shows an up-and-down diagram every year. In the year (2019) the results of journal searches analysed were 1, journal search results year (2020) 4, the results of journal searches in (2021) were 0, the results of journal searches in (2022) were 0, the results of journal searches in (2023) were 2, and in (2024) the results of journal searches were 3. The journals analysed were Classroom Action Research (PTK) and Experiments. In relevant research by the journal, the inclusion of journal searches for the last 6 years is described in the graph below.

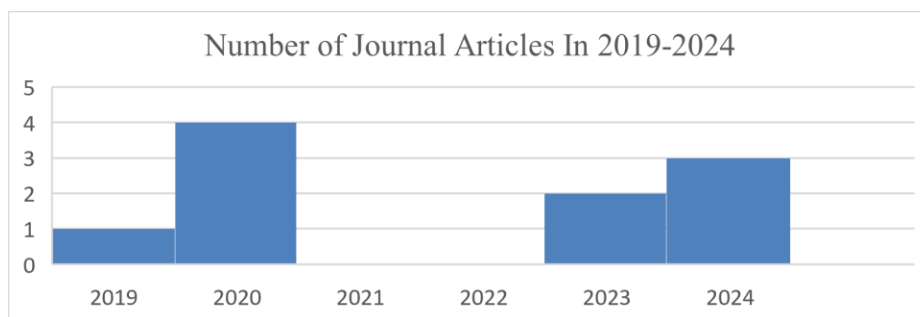


Figure 1. Graph of Journal Article Search Results (Last 6 Years) on Google Scholar

After analysing various journal articles on the problem-solving model, the researcher recommends the application of this model in both lower and upper grades in primary schools. The recommendations include the following steps: The teacher provides a problem for students to solve, students identify the proposed problem, solve the problem independently, verify the correctness of the answer, and draw conclusions from the solution obtained. The use of the problem-solving model is expected to make the learning process more effective and optimal. Here are the steps in the problem-solving learning model:

a) Problems and Materials are Given

Students are presented with a problem to solve, along with relevant materials from the teacher that will help them solve the problem.

b) Discussion and Group Work

Students work together in groups to solve problems through discussion, with the teacher providing guidance and ensuring the effectiveness of group work.

c) Problem Given by the Teacher.

Students do not look for problems on their own, but solve problems provided by the teacher, ensuring relevance to the material and students' abilities.

d) Evaluation by Students

Students are required to evaluate solutions and problem-solving processes, develop critical skills, and learn from mistakes.

e) Conclusion of Results

Students summarise the results of problem solving, including solutions found and steps taken.

f) Deployment and Verification

Students apply the developed solution and verify its correctness to conclude.

CONCLUSIONS

Based on the analysis of the 10 journal articles reviewed, it can be concluded that the application of the Problem-Solving learning model is very effective in improving the mathematical problem-solving skills of primary school students. From the review materials, the average research subjects were elementary school students, with 8 studies focusing on high grades (grades IV and V) and 2 studies on low grades (grades II and III). The results show that the Problem-Solving model has a more significant impact on mathematics problem solving in the high grades. The use of this model is proven to be effective and efficient in improving mathematics problem-solving skills, both in high and low grades.

REFERENCES

- Ar Ridha, Fadhilaturrahmi, Fauziddin, M., Marta, R., & Aprinawati, I. (2024). Peningkatan Kemampuan Berpikir Kritis pada Pembelajaran Matematika dengan menggunakan Model Problem Solving. *Pedadidaktika : Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, 11(1), 69–88. <http://ejournal.upi.edu/index.php/pedadidaktika/index>
- Arrahim, A., & Sabrina, R. (2019). Upaya Meningkatkan Kemampuan Pemecahan Masalah Matematika dengan Menggunakan Model Problem Solving di Sekolah Dasar. *DIDAKTIKA: Jurnal Pendidikan Sekolah Dasar*, 2(1), 9–14. <https://doi.org/10.21831/didaktika.v2i1.28092>
- Azidah, M., Rini, Z. R., & Masalah, P. (2024). Keefektifan Model Pembelajaran Problem Solving Berbantuan Media Komik Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Kelas II SDN Wonoyoso. 10(1), 517–526.
- Berliana Nurul Hidayah, Y., Virdinarti Putra, L., Kunci, K., Masalah, P., Berbasis Masalah, P., & Pemecahan Masalah, K. (2023). Perbedaan Model Pembelajaran Problem Solving dan Problem Based Learning Berbantuan Papan Diagram terhadap Kemampuan Pemecahan Masalah Siswa Sekolah Dasar. *Journal on Education*, 06(01), 1390–1396.

- Kania, N., & Fitriyani, D. (2022). Implementasi Teori Pemecahan Masalah Polya dalam Pembelajaran Matematika. *Progressive of Cognitive and Ability*, 1(1), 42–49. <https://doi.org/10.56855/jpr.v1i1.5>
- Kusumaningrum, Y. (2020). Efektivitas Model Pembelajaran Discovery Learning Dan Problem Solving Terhadap Kemampuan Pemecahan Masalah Matematika Kelas Iv Sekolah Dasar. *JURNAL PAJAR (Pendidikan Dan Pengajaran)*, 4(2), 435–444. <https://doi.org/10.33578/pjr.v4i2.7969>
- Maesari, C., Marta, R., & Yusnira, Y. (2020). Penerapan Model Pembelajaran Problem Solving Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa Sekolah Dasar. *Jurnal Pendidikan Dan Konseling (JPDK)*, 2(1), 12–20. <https://doi.org/10.31004/jpdk.v1i2.531>
- Mardiyana, T. (2020). Penerapan Model Problem Solving Learning untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika. *Kalam Cendekia: Jurnal Ilmiah Kependidikan*, 8(2). <https://doi.org/10.20961/jkc.v8i2.42539>
- Mekarsariningtyas, D. P., & Rizqi, H. Y. (2024). *Pengaruh Model Pembelajaran Problem solving Berbantuan Canva Terhadap Kemampuan Pemecahan Masalah Siswa SD Negeri*. 18(1), 15–20.
- Ndiung, S. dkk. (2021). *(The Effectiveness of the Problem-Solving Approach in Developing Students ' Mathematics Problem-Solving Ability At Elementary*. 2(1), 1–11.
- Risma, D., & Kafuji, I. (2023). *Jurnal Pendidikan Matematika*. 2(1), 30–34.
- Sundari, N., Kuswidyanarko, A., & Lubis, P. H. M. (2022). Analisis Kemampuan Pemecahan Masalah Matematis Pada Siswa Kelas II Di SD Negeri 66 Palembang. *Jurnal Pendidikan Dan Konseling*, 4, 924–929.
- Wiwin Nafiatul Fatikhah, Nora Surmilasari, D. N. A. (2023). *PENGARUH MODEL PEMBELAJARAN PROBLEM SOLVING TERHADAP KEMAMPUAN PEMECAHAN MASALAH MATERI PENGUMPULAN DAN PENYAJIAN DATA KELAS V SD*. 2(1), 19–29.