



Make A Match Model: An Effort to Enhance Problem-Solving and Mathematical Representation Skills

Bambang Sri Anggoro¹, Fredi Ganda Putra^{1*}, Ika Pupiyan¹

¹Mathematics Education Department, Universitas Islam Negeri Raden Intan Lampung, Bandar Lampung, Indonesia

**Correspondence: fredigpsw@radenintan.ac.id*

Abstract

This study aims to assess the impact of the "Make a Match " learning model on improving problem-solving abilities and mathematical representation among middle school students. Conducted at Mesuji Raya State Junior High School, this quasi-experimental study focused on the entire eighth-grade student body. A sample of 42 students was selected via cluster random sampling. Data analysis was performed using the Manova test with a significance level of 5%. The findings indicate a rejection of H_{0AB} , suggesting a significant influence of the "Make a Match " learning model on enhancing students' problem-solving and mathematical representation abilities. These findings suggest that the "Make a Match " model can be an effective tool in aiding middle school students to improve their mathematical skills. This provides valuable insights for educators in developing learning strategies.

Keywords: Make a Match Learning; Mathematical Representation; Problem Solving

Abstrak

Kemampuan pemecahan masalah dan representasi matematis adalah keterampilan kunci bagi siswa di tingkat sekolah menengah pertama. Meskipun penting, menemukan metode pembelajaran yang efektif untuk meningkatkan keterampilan ini sering kali menantang. Penelitian ini bertujuan untuk mengevaluasi efektivitas model pembelajaran *Make a Match* dalam meningkatkan kemampuan pemecahan masalah dan representasi matematis di kalangan siswa SMP. Menggunakan metode quasi eksperimen, penelitian ini dilaksanakan di SMP Negeri 1 Mesuji Raya. Target populasi adalah seluruh siswa kelas VIII, dengan sampel sejumlah 42 siswa yang dipilih melalui cluster random sampling. Analisis data dilakukan menggunakan Uji Manova dengan tingkat signifikansi 5%. Hasil penelitian menunjukkan bahwa H_{0AB} ditolak, mengindikasikan bahwa model pembelajaran *Make a Match* berpengaruh signifikan terhadap peningkatan kemampuan pemecahan masalah dan representasi matematis siswa. Temuan ini menyarankan bahwa model *Make a Match* dapat menjadi alat yang efektif untuk membantu siswa SMP dalam meningkatkan

keterampilan matematika mereka, memberikan wawasan berharga bagi para pendidik dalam pengembangan strategi pembelajaran.

Kata Kunci: Pembelajaran *Make a Match*; Pemecahan Masalah; Representasi Matematis

Introduction

Problem-solving ability is an inherent potential that can be harnessed to address challenges and is applicable in daily life scenarios (Afriansyah, 2016; Elita et al., 2019; Gunantara et al., 2014). The capability of students to tackle issues is a part of the educational process, enabling them to take an active role (Hartinah et al., 2019; Prasetyo et al., 2021; Putri et al., 2019; Siagan et al., 2019). A diminished proficiency in mathematical problem-solving can often be attributed to the teaching and learning process (Muslihah & Suryaningrat, 2021; Mutia & Mega, 2021; Szabo et al., 2020). Furthermore, there's the concept of mathematical representation, an interpretative framework that students should be emphasized on, to arrive at solutions (Goldin, 2020; Lisarani & Qohar, 2021; Sabirin, 2014).

In Indonesia, numerous studies have delved into the abilities of mathematical problem-solving and representation. As evidenced in a research conducted on high school students by Sari, the representation skills were found to be suboptimal due to various factors including independence, motivation, listening skills, and hesitancy in presenting their results (Sani, 2019). A study by Narohita highlighted the classroom mathematics learning process as being predominantly teacher-centered, with teachers chasing curriculum goals and sidelining student participation (Novitasari & Wilujeng, 2018). Challenges in problem-solving and mathematical representation were similarly observed at SMP Negeri 1 Mesuji Raya. Preliminary research and interviews with subject teachers revealed that students displayed a lack of systematic approach in addressing problems and often failed to summarize their answers. Furthermore, students struggled with accurate mathematical representation, misinterpreting problems, or inaccurately executing them. Many were confused about the strategies or techniques to employ in problem-solving. Often, students would only comprehend problems if they resembled examples showcased during lessons, but found it challenging to tackle distinct problems, resulting in inaccurate problem resolution and representation.

The *Make a Match* instructional model incorporates several key elements that directly contribute to enhancing students' mathematical problem-solving and representation abilities. Firstly, its open-ended approach, which allows for multiple correct responses, not only encourages creative thinking but also fosters a deeper understanding of mathematical concepts (Hidayat & Sariningsih, 2018; Muksar,

2018). This flexibility in thinking is critical in problem-solving. Secondly, the contextual strategy employed in the model bridges the gap between theoretical mathematics and real-world applications, thereby enhancing students' ability to apply mathematical concepts in various contexts (Arafani et al., 2019). Thirdly, the model's structure, which emphasizes collaboration and peer learning, has been shown to improve both proficiency in mathematics and student engagement (Anggraeni & Veryliana, 2019; Kusmanto, 2017; Maisari et al., 2013; Nufiati et al., 2020; Rahmawati & Suprihatiningrum, 2014).

Several empirical studies further validate the effectiveness of the Make a Match model in improving mathematical learning outcomes. Perdana's research, for example, highlights a notable improvement in learning outcomes in experimental classes following the implementation of this model, demonstrating its positive impact on students' mathematical communication skills (Putra, 2019; Sirait & Noer, 2013; Sundari, 2017). Furthermore, the model fosters a structured learning environment that cultivates discipline and organizational skills, empowering students to confidently present and discuss their mathematical reasoning (Savitri & Amalina, 2023). Consistent with these findings, Putra's study also indicates that the Make a Match approach effectively elevates students' problem-solving capabilities by encouraging analytical thinking and collaborative problem-solving strategies (Putra et al., 2021).

While previous research, such as the study by Putra et al. (2021), has substantiated the efficacy of the Make a Match learning model in improving students' problem-solving abilities, a comprehensive dissection of the model's procedural steps remains underexplored. This gap in the literature has left many educators and researchers with a limited understanding of the specific stages within the model that most significantly influence the development of problem-solving and mathematical representation skills. Addressing this gap, the current study not only builds upon the existing body of knowledge but also introduces a novel perspective by providing an in-depth analysis of each step in the Make a Match learning process. This approach is particularly pertinent for the context of SMP Negeri 1 Mesuji Raya, where specific challenges in problem-solving and mathematical representation have been observed. By delineating the individual components of the model and their direct impact on student learning, this study offers new insights and practical guidance for educators seeking to optimize their teaching strategies in mathematics.

Method

This study adopted a quasi-experimental research design with a posttest-only control group setup. The purpose was to measure the impact of the Make a

Match learning model on students' problem-solving and mathematical representation abilities, eliminating the influence of pre-existing differences. The study spanned five weeks, with the first week devoted to instructional activities and subsequent weeks to implementing different learning models in the experimental and control groups. The study involved eighth-grade students from Mesuji Raya Public Middle School 1. The participants comprised 22 students from Class VIII 2 as the experimental group and 20 students from Class VIII 3 as the control group. Both classes were taught by the same mathematics teacher, and they were chosen for the study because they showed no significant differences in initial assessments.

A descriptive test was used to assess problem-solving capabilities and mathematical representation. This instrument was subjected to a preliminary trial to evaluate its validity, reliability, difficulty level, and discriminating power. The validity and reliability assessments confirmed that the instrument was both valid and reliable. Data analysis involved conducting normality and homogeneity tests using SPSS 26 software at a 5% significance level. Both the experimental and control groups displayed normal distribution in the normality test. The homogeneity test showed that the samples were from a homogenous population. The MANOVA test was employed for hypothesis testing to observe the effects on problem-solving and mathematical representation skills. The detailed steps are depicted in Figure 1.

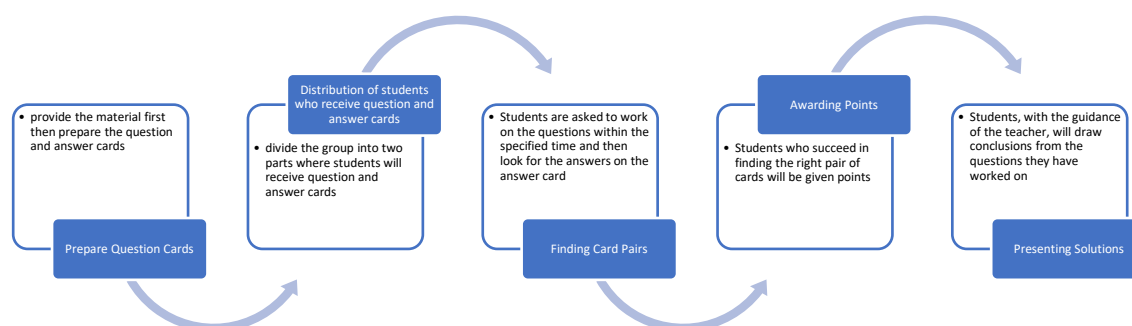


Figure 1. Steps in the Make a Match Learning Model

Results

Data assessment of problem-solving abilities after the learning session (post-assessment). The post-assessment data on problem-solving capabilities can be seen in Table 1, considering the average scores of the experimental and control groups. From the post-assessment results, the experimental group achieved an average score of 83.27 in their problem-solving abilities. Meanwhile, the control group recorded an average score of 65 in the same domain. A comparison of the

enhancement in post-assessment scores between both groups is illustrated in Figure 2.

Table 1. Problem Solving (PS) and Representations Mathematics (RM)

Data	Experiment Class		Control Class	
	PS	RM	PS	RM
Average	83,27	79,27	65	59,4
Minimum Score	56	53	40	40
Maximum Score	98	97	92	75

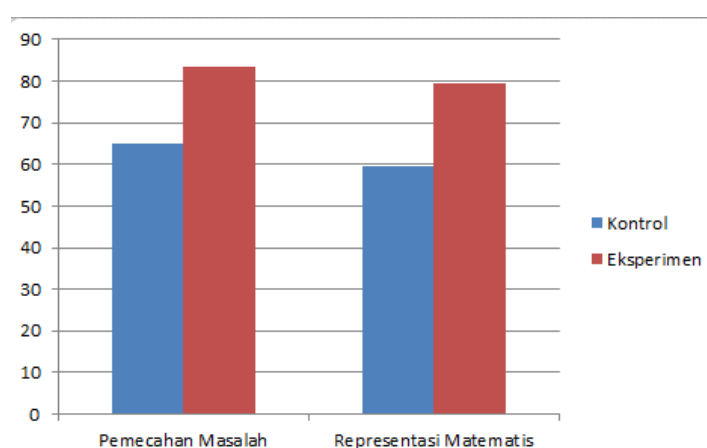


Figure 2. Result of Post-Test Problem Solving Ability and Mathematical Representation

In Figure 2, it is evident that the average score of the post-test for problem-solving abilities in the experimental group surpasses that of the control group. The experimental group achieved an average score of 83.27, while the control group had an average of 65. This clearly indicates a disparity in problem-solving abilities between the two groups, with the experimental group outperforming the control group. Similarly, Chart 1 also demonstrates that the average post-test score for mathematical representation skills in the experimental group is higher than in the control group. The experimental group scored an average of 79,27, in contrast to the control group's average of 59,4. This highlights a distinct difference in mathematical representation skills between the groups, with the experimental group taking the lead.



Examination of mathematical representation skills after the instructional process (post-instruction assessment). The post-instruction assessment data for problem-solving capabilities is presented in Table 2, drawing on average scores from both the experimental and control groups. Following the assessment, the experimental group scored an average of 79,27 in mathematical representation skills, while the control group averaged 59,4.




The 'Make a Match ' teaching model proves effective when learners demonstrate enhanced skills in solving problems and accurate representation using this approach. This method's effectiveness in improving problem-solving and mathematical representation capabilities is evident in the Manova test results, as displayed in Table 3. Table 3 suggests that the 'Make a Match ' teaching method has a highly significant influence on problem-solving and mathematical representation, underscoring its profound impact in aiding students to grasp the subject matter and address mathematical challenges. This is attributed to the method's use of question cards, breaking the monotony of traditional instruction, and producing a positive learning outcome.

Table 3. Results of Problem-Solving Ability and Mathematical Representation

Variable	Sig.
Problem Solving	0,87
Mathematical Representation	0,392

Tabel 4. Make a Match Learning Model

Make a Match Learning	Problem Solving Indicator	Mathematical Representation Indicator
Providing material and question cards 	Understanding the Problem Students can understand the meaning of the problem in the question so they can determine a plan to solve the problem correctly.	Visual Representation Students will represent answers to questions which can be expressed using graphs, tables, or pictures and so on
Group division 	Develop a resolution plan After understanding the problem, students must then develop a plan or strategy to use.	Representation of Mathematical Expressions Students will create a mathematical model to solve a problem by involving

<p>Find pairs of cards</p> 	<p>Resolve problems according to plan</p> <p>After thinking about a suitable strategy, then start solving with the strategy that has been used to get results or solutions</p>	<p>Text Representation</p> <p>Students will write situations based on data results that have solved the problem using mathematical models.</p>
<p>Awarding points</p> 	<p>Check</p> <p>After carrying out the appropriate stages, then carrying out the next plan, students must check again that the strategy used has obtained the correct solution.</p>	
<p>Presenting Solutions</p> 		

Problem-solving skills are essential for students to tackle challenges systematically within both academic settings and daily life (Septiani & Nurhayati, 2019). As evidenced in Table 3, hypothesis testing using the Manova test revealed a significant influence of the Make a Match model on problem-solving and mathematical representation capabilities. The rationale is that when learners are exposed to the Make a Match approach, they find it engaging due to its dynamic nature, prompting them to compete for points. Throughout the learning journey, students grasp the content by closely following explanations, thus comprehending issues and applying suitable strategies for the existing challenges, while also crafting accurate representations necessary for resolution. This learning method provides them with experiences and insights that mathematics can be straightforward when tackled with the right tactics. Additionally, implementing this model energizes students and diminishes their hesitancy in showcasing their work (Muksar, 2018).

Based on prior studies regarding the Make a Match learning model to enhance students' learning outcomes (Anggraeni et al., 2017), aimed at boosting motivation and academic achievement in mathematics (Seasfaot et al., 2020), and

for advancing mathematical communication (Rahmadiansyah, 2022), students are highly engaged during this learning process. They actively search for solutions, placing them at the center stage. This provides them with a unique experience in math learning which promotes a joyful learning environment. Consequently, it instills a mindset where students do not solely rely on peers for answers to questions. Table 5 indicates the post-test results from two sample classes, highlighting the differences in how students respond to questions.

Table 5. Results of Post-Test Answers for the Experimental Class and Control Class

Class	Post-test
Experiment	<p>Diket: Sisi berhadapan persegi panjang $x + 3y = 7$ Dit: nilai x dan y? $2x + y = 9$ Jawab: $x + 3y = 7$ $\times 2$ $2x + 6y = 14$ $2x + y = 9$ $\times 3$ $6x + 3y = 27$ $-5x = -20$ $x = \frac{-20}{-5} = 4$ Substitusi: $x + 3y = 7$ jadi nilai $x = 4$ dan $4 + 3y = 7$ $y = 1$ $3y = 7 - 4$ $3y = 3$ $y = \frac{3}{3} = 1$</p>
Control	<p>2.) Diket: $2x + y = 9$ $x + 3y = 7$ Nilai x: $2x + y = 9$ $\times 3$ $6x + 3y = 27$ $x + 3y = 7$ $\times 1$ $x + 3y = 7$ $5x = 20$ $x = \frac{20}{5} = 4$ Nilai y: $2x + y = 9$ $\times 1$ $2x + y = 9$ $x + 3y = 7$ $\times 2$ $2x + 6y = 14$ $-5y = -8$ $y = \frac{-8}{-5} = 1$</p>

Discussion

In Table 5, one can observe the contrast in answer methodologies between students in the experimental group and the control group. Upon employing the 'Make a Match' learning model, students in the experimental group approached questions in a systematic and comprehensive manner, which led them to achieve optimal results due to their attentive engagement with the content during lessons. This was unlike the control group, where the learning environment wasn't as conducive for optimal learning.

When students tackled the post-test questions, there were noticeable differences among the samples in terms of accuracy and precision in their answers

(Aakre et al., 2021; Bufasi et al., 2022). Those educated under the 'Make a Match' learning model typically provided more coherent responses compared to those who weren't exposed to the model. This distinction is evident when analyzing how students comprehend the given problems, their methodological approach, and their ability to draw well-informed conclusions based on the presented questions (Andrade et al., 2021; Ngereja et al., 2020). Even though both groups had correct explanations, the students in the experimental class answered in a systematic and detailed manner, while those in the control class responded correctly but not comprehensively. This indicates that the experimental class effectively hones problem-solving and systematic mathematical representation skills compared to the control class.

Utilizing the 'Make a Match' model in mathematics education provides students with experience and knowledge, helping them understand, listen to, and implement the lessons conveyed. Matching question cards to their respective answers motivates students to work and earn points. Observations during the study showed that this instructional approach enhances abilities in tackling problems and illustrating them. This aligns with a study by Anggraeni & Veryliana (2019) which found an improvement in mathematics learning outcomes. During the material presentation and card distribution stages, students paid keen attention to the educator's explanations. In the group division phase, some students received question and answer cards. In the card-matching phase, students worked on problems within a set timeframe to hone their problem-solving abilities. During the point allocation, students were eager to earn points, pushing them to do their best. The final step involves presenting solutions where both educators and students derive conclusions together. The findings of this study are corroborated by hypothesis test results, showing that the 'Make a Match' model positively influences problem-solving and mathematical representation skills. Before the instructional process commenced, the teacher prepared benefits relatable to daily life scenarios.

The findings of this research contribute to an expanding body of work regarding the Make a Match model in educational settings, reinforcing the model's versatility and effectiveness across various subjects. For instance, the study by Rusnilawati et al. (2020) echoes these results by demonstrating the model's capacity to enhance cognitive abilities. This aspect is crucial in the realm of education, as cognitive skills form the foundation for critical thinking and understanding complex concepts. Furthermore, the adaptability of the Make a Match model is highlighted in Arisanty & Riyah (2019) research, which observed significant improvements in geography learning outcomes. This suggests that the model's interactive and

engaging nature can be effectively applied to subjects requiring spatial understanding and environmental awareness.

Additionally, the scope of the Make a Match model extends beyond traditional subjects, as seen in the study by Utami & Sulisworo (2016), which revealed its efficacy in enhancing narrative text comprehension. This implies that the model's application can be beneficial in developing language skills, particularly in understanding and constructing narratives. Such versatility underscores the model's potential as a comprehensive tool in diverse educational contexts. Overall, these studies collectively affirm that the Make a Match model is not only effective in improving mathematical skills, as shown in the current research, but also in fostering a broad range of academic abilities, thus validating its widespread applicability in the educational sphere.

Conclusion

From the research findings, it can be deduced that the Make a Match learning model is effective in elevating students' problem-solving and mathematical representation capabilities. This assertion is backed by the results from the Manova test, which indicates a significant value of 0.000, meaning it is below the 5% or 0.05 threshold. Thus, the Make a Match model significantly influences students' problem-solving and mathematical representation in their math subjects.

This study's results underscore the potential of the Make a Match model as a pivotal tool in enhancing mathematical problem-solving and representation skills, suggesting its integration into educational curricula. By advocating for its adoption in classroom settings, these findings could lead to more engaging and effective teaching methodologies. Furthermore, this research opens avenues for exploring the model's applicability across various academic disciplines, potentially revolutionizing teaching and learning strategies in broader educational contexts. In addition to its significant findings, this research acknowledges certain limitations. The study's focus on a specific educational setting and a relatively small sample size may limit the generalizability of the results to wider populations or different educational contexts. Additionally, the exclusive use of the posttest-only design without a pretest assessment could restrict the ability to fully understand the initial competency levels of the participants, impacting the depth of the comparative analysis between the experimental and control groups.

References

- Aakre, I. G., Persson, J., Lein, H. L., & Eggen, P.-O. (2021). First-year university students' perception of chemical bonding and bond energy. *Nordic Journal of STEM Education*, 4(2). <https://doi.org/10.5324/njsteme.v4i2.3300>
- Afriansyah, E. A. (2016). The Use of Realistic Approach to Enhance Students' Mathematical Problem Solving Skills. In *International Conference on Elementary and Teacher Education ICETE*.
- Andrade, T. L. de, Rigo, S. J., & Barbosa, J. L. V. (2021). Active Methodology, Educational Data Mining and Learning Analytics: A Systematic Mapping Study. *Informatics in Education*. <https://doi.org/10.15388/infedu.2021.09>
- Anggraeni, A. A. A., & Veryliana, P. (2019). Pengaruh Model Pembelajaran Kooperatif Tipe Make a Match Terhadap Motivasi dan Hasil Belajar Matematika. *International Journal of Elementary Education*, 3(2), 218–225.
- Anggraeni, A. S., Budiyo, B., & Pramesti, G. (2017). Penggunaan Model Pembelajaran Make a Match Untuk Meningkatkan Keaktifan dan Hasil Belajar Siswa Kompetensi Segitiga dan Segiempat Bagi Siswa Kelas VII B SMPN 14 Surakarta Tahun Ajaran 2015/2016. *Jurnal Pendidikan Matematika Dan Matematika SOLUSI*, 1(5), 85–103.
- Arafani, E. L., Herlina, E., & Zanthi, L. S. (2019). Peningkatan Kemampuan Memecahkan Masalah Matematik Siswa SMP dengan Pendekatan Kontekstual. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 3(2), 323–332.
- Arisanty, D. & Riyah. (2019). Application of Make a Match model to improve geography learning outcomes. *Journal of Technology and Science Education*, 9(1), 32–40. Scopus. <https://doi.org/10.3926/jotse.547>
- Bufasi, E., Hoxha, M., Cuka, K., & Vrtagic, S. (2022). Developing Student's Comprehensive Knowledge of Physics Concepts by Using Computational Thinking Activities: Effects of a 6-Week Intervention. *International Journal of Emerging Technologies in Learning (IJET)*, 17(18). <https://doi.org/10.3991/ijet.v17i18.31743>
- Elita, G. S., Habibi, M., Putra, A., & Ulandari, N. (2019). Pengaruh Pembelajaran Problem Based Learning Dengan Pendekatan Metakognisi Terhadap Kemampuan Pemecahan Masalah Matematis. *Mosharafa: Jurnal Pendidikan Matematika*, 8(3), 447–458.
- Goldin, G. A. (2020). Mathematical representations. *Encyclopedia of Mathematics Education*, 566–572.
- Gunantara, G., Suarjana, I. M., & Ristiani, P. N. (2014). Penerapan Model Pembelajaran Problem Based Learning Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa Kelas V. *Mimbar PGSD Undiksha*, 2(1).
- Hartinah, S., Suherman, S., Syazali, M., Efendi, H., Junaidi, R., Jermisittiparsert, K., & Umam, R. (2019). Probing-Prompting Based on Ethnomathematics Learning Model: The Effect on Mathematical Communication Skills. *Journal of Education of Gifted Young Scientists*, 7(4), 799–814.

- Hidayat, W., & Sariningsih, R. (2018). Kemampuan pemecahan Masalah Matematis Dan Adversity Quotient Siswa SMP Melalui Pembelajaran Open-ended. *JNPM: Jurnal Nasional Pendidikan Matematika*, 2(1), 109–118.
- Kusmanto, H. (2017). Pengaruh Penerapan Model Pembelajaran Kooperatif Tipe Make a Match Terhadap Kreativitas Siswa Dalam Pembelajaran Matematika. *Eduma: Mathematics Education Learning and Teaching*, 6(1), 32–42.
- Lisarani, V., & Qohar, A. (2021). Representasi Matematis Siswa SMP Kelas 8 dan Siswa SMA kelas 10 Dalam Mengerjakan Soal Cerita. *Jurnal Magister Pendidikan Matematika (JUMADIKA)*, 3(1).
- Maisari, D., Suyadi, G., & Asnawati, R. (2013). Pengaruh Model Pembelajaran Kooperatif Tipe Make a Match terhadap Pemahaman Konsep Matematis. *Jurnal Pendidikan Matematika Universitas Lampung*, 1(1).
- Muksar, M. (2018). Kemampuan Berpikir Kreatif Siswa SMP Dalam Memecahkan Masalah Open-ended Pada Materi Bangun Datar. *Jurnal Math Educator Nusantara: Wahana Publikasi Karya Tulis Ilmiah Di Bidang Pendidikan Matematika*, 4(2), 157–167.
- Muslihah, N. N., & Suryaningrat, E. F. (2021). Model Pembelajaran Contextual Teaching and Learning terhadap Kemampuan Pemecahan Masalah Matematis. *Plusminus: Jurnal Pendidikan Matematika*, 1(3), 553–564.
- Mutia, N. A., & Mega, A. N. (2021). Kemampuan Pemecahan Masalah Ditinjau dari Kemandirian Belajar Siswa pada materi Lingkaran di Kelurahan Muarasanding. *Plusminus: Jurnal Pendidikan Matematika*, 1(3), 421–434.
- Ngereja, B. J., Hussein, B., & Andersen, B. (2020). Does Project-Based Learning (PBL) Promote Student Learning? A Performance Evaluation. *Education Sciences*, 10(11). <https://doi.org/10.3390/educsci10110330>
- Novitasari, N., & Wilujeng, H. (2018). Analisis Kemampuan Pemecahan Masalah Matematika Siswa SMP Negeri 10 Tangerang. *Prima: Jurnal Pendidikan Matematika*, 2(2), 137–147.
- Nufiati, N., Mandalina, V., Mashup, M., Syahrudin, S., Abdillah, & Fitriani, E. (2020). Effect of Make a Match Learning Model on Student Learning Outcomes on Statistical Materials. *Justek: Jurnal Sains Dan Teknologi*, 3(1), 1–8.
- Prasetyo, T., Rachmadtullah, R., Samsudin, A., & Aliyyah, R. R. (2021). General Teachers' Experience of the Brains' Nayural Learning Systems-Based Instructional Approach in Inclusive Classroom. *International Journal of Instruction*, 14(3), 95–116.
- Putra, K. A. Y. D., Sariyasa, & Mertasari, N. M. S. (2021). Pengaruh Model Pembelajaran Make a Match Terhadap Kemampuan Pemecahan Masalah Matematika Siswa Kelas VII SMP Negeri 4 Tejakula TA 2018/2019. *Jurnal Pendidikan Dan Pembelajaran Matematika Indonesia*, 10(1).
- Putra, N. T. E. (2019). Pengaruh Model Pembelajaran Kooperatif Teknik Make a Match Terhadap Motivasi Belajar Dan Hasil Belajar. *Purwadita*, 3(1), 94–100.
- Putri, R. S., Suryani, M., & Jufri, L. H. (2019). Pengaruh Penerapan Model Problem Based Learning Terhadap Kemampuan Pemecahan Masalah Matematika. *Mosharafa: Jurnal Pendidikan Matematika*, 8(2), 331–340.

- Rahmadiansyah, R. (2022). Pengaruh Model Pembelajaran Make a Match Terhadap Kemampuan Komunikasi Matematis Siswa Kelas VII Pada Materi Himpunan. *DESANTA (Indonesian of Interdisciplinary Journal)*, 2(2), 310–322.
- Rahmawati, G., & Suprihatiningrum, J. (2014). Pengaruh Model Pembelajaran Kooperatif Tipe Make a Match Terhadap Nilai Kerjasama dan Hasil Belajar Kognitif Kimia Siswa Kelas X SMAN 1 Bambanglipuro Bantul. *Jurnal Kaunia*, 10(2), 128–140.
- Rusnilawati, Nuraeni, Z., & Ariska, D. (2020). The combination of the quantum learning model and the make-a-match method to improve the cognitive ability of elementary students in mathematics. *International Journal of Innovation, Creativity and Change*, 12(2), 309–321. Scopus.
- Sabirin, M. (2014). Representasi dalam Pembelajaran Matematika. *Jurnal Pendidikan Matematika*, 1(2), 33–44.
- Sani, L. D. Y. (2019). Analisis Representasi Matematis Siswa SMA Melalui Model Pembelajaran Problem Based Learning Materi Fungsi Trigonometri. *Jurnal LEMMA*, 5(2), 148–156.
- Savitri, A. Y., & Amalina, S. N. (2023). Pengaruh Model Pembelajaran Kooperatif Make a Match Terhadap Keaktifan dan Hasil Belajar. *Dinamika Sosial: Jurnal Pendidikan Ilmu Pengetahuan Sosial*, 2(2), 166–177.
- Seasfaat, L., Bien, Y. I., & M.Abi, A. (2020). Penerapan Model Pembelajaran Make a Match untuk Meningkatkan Motivasi Belajar dan Prestasi Belajar Matematika Siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 4(2), 454–460. <https://doi.org/10.31004/cendekia.v4i2.236>
- Septiani, E. S., & Nurhayati, E. (2019). Analisis Kemampuan Pemecahan Masalah Matematis Ditinjau Dari Adversity Quotient (AQ) Peserta Didik Melalui Model Problem Based Learning (PBL). *Prosiding Seminar Nasional & Call For Papers*.
- Siagan, M. V, Saragih, S., & Sinaga, B. (2019). Development of Learning Materials Oriented on Problem-based Learning Model to Improve Students' Mathematical Problem Solving Ability and Metacognition Ability. *International Electronic Journal of Mathematics Education*, 14(2), 331–340.
- Sirait, M., & Noer, P. A. (2013). Pengaruh Model Pembelajaran Kooperatif Tipe Make a Match Terhadap Hasil Belajar Siswa. *INPAFI (Inovasi Pembelajaran Fisika)*, 1(3).
- Szabo, Z. K., Peter, K., Guncaga, J., & Szabo, Dalma, Neag, R. (2020). Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. *Sustainability*, 12(23), 6–28.
- Utami, S. N., & Sulisworo, D. (2016). The effect of creative reading instruction: A comparison of technique between number head together (NHT) and Make a Match in narrative text at the seventh grade of Junior Level. *Asian EFL Journal*, 2016(SpecialEdition), 69–76.

This page is intentionally left blank