

LEARNING MODELS TO IMPROVE HIGHER-ORDER THINKING SKILLS IN MATHEMATICS: A SYSTEMATIC LITERATURE REVIEW

Gida Kadarisma¹, Jagad Aditya Dewantara²

¹ IKIP Siliwangi, ² Universitas Tanjungpura, Indonesia

gidakadarisma@ikipsiliwangi.ac.id

ABSTRACT Higher-Order Thinking Skills (HOTS) are essential abilities that students must possess in order to face complex problems and think critically. The role of learning models is crucial in developing students' HOTS, as they provide structured and meaningful learning experiences. Numerous learning models have been applied to facilitate and improve students' higher-order thinking, particularly in mathematics. This study employed a Systematic Literature Review (SLR) approach, which involved collecting and analyzing previously published articles indexed by Google Scholar. The articles were gathered using the Publish or Perish software, with keywords such as "learning model," "HOTS," and "mathematics." A total of 25 relevant articles were reviewed. The findings revealed that several learning models have proven effective in enhancing students' HOTS, including Problem-Based Learning, Project-Based Learning, Discovery Learning, Creative Problem Solving, CORE, and Missouri Mathematics Program. The specific HOTS skills improved through these models include critical thinking, creative thinking, reasoning, and problem-solving abilities. The implication of this study is that educators are encouraged to design instructional activities using learning models with proven effectiveness in fostering students' higher-order thinking skills.

Keywords: high order thinking skills, instructional model, sistematic literature review

ABSTRAK Higher-Order Thinking Skills (HOTS) atau keterampilan berpikir tingkat tinggi merupakan kemampuan penting yang harus dimiliki siswa untuk menghadapi permasalahan kompleks dan berpikir secara kritis. Peran model pembelajaran sangat krusial dalam mengembangkan HOTS siswa karena memberikan pengalaman belajar yang terstruktur dan bermakna. Berbagai model pembelajaran telah diterapkan untuk memfasilitasi dan meningkatkan kemampuan berpikir tingkat tinggi siswa, khususnya dalam mata pelajaran matematika. Penelitian ini menggunakan metode Systematic Literature Review (SLR) yang dilakukan dengan mengumpulkan dan menganalisis artikel-artikel yang telah dipublikasikan dan terindeks di Google Scholar. Pengumpulan artikel dilakukan menggunakan perangkat lunak *Publish or Perish* dengan kata kunci: "model pembelajaran", "HOTS", dan "matematika". Sebanyak 25 artikel yang relevan berhasil dikaji dalam penelitian ini. Hasil penelitian

menunjukkan bahwa beberapa model pembelajaran efektif dalam meningkatkan HOTS siswa, antara lain *Problem-Based Learning*, *Project-Based Learning*, *Discovery Learning*, *Creative Problem Solving*, CORE, dan Missouri Mathematics Program. Kemampuan HOTS yang meningkat melalui model-model ini mencakup berpikir kritis, berpikir kreatif, penalaran, dan kemampuan pemecahan masalah. Implikasi dari penelitian ini adalah pendidik diharapkan dapat merancang kegiatan pembelajaran dengan menggunakan model pembelajaran yang telah terbukti efektif dalam mengembangkan kemampuan berpikir tingkat tinggi siswa.

Kata-kata kunci: model pembelajaran, kemampuan berpikir tingkat tinggi, matematika, SLR

INTRODUCTION

High-level thinking skills or commonly called HOTS are one of the skills that must be improved by students, this is because HOTS is an important skill for students to have. Moreover, in the era of the industrial revolution 4.0, students are required to think critically and creatively in dealing with a problem. Someone who has high HOTS can definitely solve problems well (Kadarisma et al., 2020). High order Thinking Skills are thinking skills that are at the highest level of Bloom's taxonomy, namely the ability to analyze, evaluate and create. This is in line with (Ernawati, 2016), High-level thinking skills are thinking skills that involve complex thinking processes such as critical, creative, analytical, reflective, and evaluative thinking in solving a problem for which there is no algorithm that has been taught to solve the problem. HOTS is a broad thinking process to find new challenges. HOTS aims for students to be able to apply new information or knowledge they have and be able to manipulate information to find answers to problems in new situations. However, the importance of HOTS is not in line with the reality in the field, HOTS students in Indonesia, especially in mathematics, are relatively low (Hafshoh et al., 2024; Kadarisma et al., 2019; Suryapuspitarini et al., 2018; Susanto & Retnawati, 2016) Therefore, learning carried out by teachers should be able to develop HOTS.

Teachers innovate learning so that students' HOTS increases. Innovations made by teachers range from designing teaching materials, learning media to learning models. Teachers' pedagogical abilities are essential in designing HOTS-based learning. In the 21st century, various innovative learning models are increasingly emerging, as are learning models to improve students' HOTS. However, teachers should be able to consider the selection of learning models based on several criteria, namely according to the characteristics of students, according to the teaching materials, and the efficiency of the learning model itself. Some HOTS-based learning models that are often used are Problem Based Learning (PBL), Creative Problem Solving (CPS), Project Based Learning (PJBL), contextual learning models, and Discovery Learning. Some studies on the effectiveness of these learning models in improving HOTS in mathematics subjects are Puadi & Habibie (2018) found that students who learn with the Problem Based Learning model have better mathematical problem-solving abilities than those who use the conventional model, as we understand that problem-solving abilities are one of the indicators of HOTS.

Research on learning models that can improve HOTS other than PBL, namely the Creative Problem Solving (CPS) model research by Faturohman & Afriansyah (2020) involving class X students in the function material, the results of the study found that students' creative thinking skills increased with the CPS model. The Discovery Learning model is also a favorite because it is often used in research to improve students' HOTS, one of which is research from (Kadarisma, 2016) which found that logical thinking skills which are part of HOTS can be improved with the discovery learning model, Research

regarding the effectiveness of other Discovery Learning models in improving HOTS by Boham & Domu (2021) who found that the Discovery Learning learning model can improve students' ability to solve HOTS questions, in line with (Alita, Khintan Ustino et al., 2019) who found that after elementary school students studied using the Discovery Learning model, their critical thinking skills and learning outcomes increased. Another learning model that is widely used to improve students' HOTS is the PjBL model, one of the studies is (students' HOTS abilities using direct or conventional learning.

Mathematics learning in the 21st century because of its crucial role in shaping critical and creative thinking competencies. Various studies have examined learning models that can improve HOTS, such as problem-based learning, project-based learning, and flipped classroom, but these findings are still scattered, varied, and have not been systematically synthesized. Most previous studies are narrative in nature and have not adopted the Systematic Literature Review (SLR) approach that is capable of producing a comprehensive, transparent, and replicable knowledge map. In addition, there has been no comprehensive review that identifies learning models based on their effectiveness at various levels of education and types of HOTS targeted. Therefore, this SLR is important to fill this gap by systematically compiling and analyzing empirical evidence on learning models that are effective in improving HOTS in mathematics.

METHODS

The research method used in this study is a systematic literature review approach, researchers searched for articles related to HOTS-based learning models in mathematics subjects, using the help of Publish and Perish software with the keywords: Learning Models, HOTS, Mathematics published in 2015-2021 and indexed in Google Scholar researchers obtained several articles then selected the articles with several inclusion and exclusion criteria, namely (a) articles are the results of empirical research, (b) focus on learning models to improve HOTS in mathematics learning, (c) available in Indonesian or English, and (d) full access is available for analysis. The exclusion criteria include: (a) articles in the form of theoretical or non-empirical studies, (b) not relevant to the context of HOTS or mathematics, and (c) duplicate articles or cannot be accessed in full. which have been obtained and finally

got 25 articles that are relevant to this study after that the analysis was carried out and synthesized the results of previous research from the articles that had been obtained. After that the researcher compiled the metadata of the article summary results in a table containing the author, journal name and research results. Next, the researcher describes the synthesis results of each article in depth in the discussion section.

FINDING AND DISCUSSION

Innovative learning models have been widely utilized as solutions to enhance students' mathematical abilities, particularly in developing higher-order thinking skills (HOTS). Numerous articles have been published focusing on learning models based on HOTS. In this study, relevant articles were selected using the keywords *learning models*, *HOTS*, and *mathematics*, limited to publications between 2011 and 2021 and indexed in Google Scholar. From the initial search results, the researchers filtered and selected 25 articles that met the inclusion criteria and aligned with the research objectives.

The first part of the discussion presents a review of articles that examine the learning models most frequently used to improve students' HOTS in mathematics, as summarized in the following table.

Table 1. HOTS Based Learning Articles

No	Author/Year	Journal	Model	Result
1	Masduriah (2020)	Prosiding Konferensi Dasar	PBL	This research is a classroom action research. The results of the study show that PBL has a positive effect on the HOTS skills of elementary school students.
2	Sasmi et al. (2020)	UNION: Jurnal Pendidikan Matematika	CPS	This research is an experimental research. The results of the study show that CPS has a positive and significant effect on students' high-level thinking skills.
3	Rachmi (2020)	Prosiding Seminar Nasional Pascasarjana Universitas Negeri Jakarta	DL	This research is the result of a best practice writing. The results of this study are that the DL model can be used as a best practice because it can improve critical thinking and problem-solving skills.
4	Widiasari et al. (2019)	Prosiding Seminar Matematika dan Sains FKIP Universitas Wiralodra	Missouri Mathematics Project	This study is an experimental study. The results of this study indicate that the high-level mathematical thinking skills of students whose learning uses the Missouri Mathematics Project learning model are better than students whose learning uses the conventional model.

No	Author/Year	Journal	Model	Result
5	Kezia Londa & Domu (2020)	Marisekola: Jurnal Matematika Riset Edukasi dan Kolaborasi	PjBL	This study is an experimental study. The results of this study are that the use of the Project-Based Learning model has an effect on the Higher-Order Thinking Skills (HOTS) of high school students. The mathematical problem-solving skills taught using the PjBL model are better than those taught using the expository model.
6	Nurfitriyanti (2016)	Jurnal Formatif	PjBL	This study is an experimental study. The results of this study are that the mathematical problem-solving skills taught using the Project-Based Learning model are better than those taught using the expository learning model.
7	Rasmita et al. (2020)	Edu-Mat: Jurnal Pendidikan Matematika	CORE	This study is a quasi-experimental study. The results of this study show that the CORE learning model has an effect on student learning outcomes in solving HOTS problems on the topic of function derivative applications.
8	Lestari et al. (2021)	Jurnal Elementary	PBL	This study is an experimental study comparing two classes. The results of the study indicate that there is a positive and significant effect of the PBL learning model assisted by HOTS questions on students' mathematics learning outcomes.
9	Suwarsi et al. (2018)	Prisma: Prosiding Seminar Nasional Matematika	PBL	This study is a classroom action research. The results of this study indicate that PBL combined with question card games can improve students' HOTS.
10	Jailani et al. (2017)	JRPM	PBL	This study is a mixed-method study. The results of this study show that the implementation of PBL is more effective in improving HOTS than expository learning.
11	Hidayati et al. (2018)	Jurnal Pendidikan Matematika dan Sains	PBL	This research is a quasi-experimental study in two classes. The results showed that PBL is effective in terms of HOTS, student achievement, and character development.
12	Imelda & Anzelina (2019)	MES: Journal of Mathematics Education and Science	PBL	This study is a descriptive study. The results indicate that students' responses to PBL learning in improving HOTS are positive.

No	Author/Year	Journal	Model	Result
13	Faturohman & Afriansyah (2020)	Moshrafa: Jurnal Pendidikan Matematika	CPS	This research involved grade X students on function material. The results showed that students' creative thinking skills increased with the CPS model.
14	Apino & Retnawati (2019)	Book Chapter: Character Education for 21st Century Global Citizens	CPS	This study is a design study. The results show that students' HOTS abilities increased after CPS was implemented in learning.
15	Prasasti et al. (2019)	Jurnal BasicEdu	DL	This study is a classroom action research. The results show that the application of Discovery Learning steps can improve critical thinking skills and student learning outcomes through activities such as providing stimulus, formulating problems, collecting and processing data, proving, and drawing conclusions.
16	Zubainur et al. (2020)	Jurnal Serambi Ilmu	DL	This is a mixed-method study. Students' mathematical reasoning abilities developed in various ways through the Discovery Learning model.
17	Kurniawan & Arnellis (2019)	Jurnal Edukasi dan Penelitian Matematika	DL	This is an experimental research. The results show that the HOTS abilities of students taught using the Discovery Learning model were better than those taught using conventional models.
18	Nugraha et al. (2020)	Jurnal PJME	DL	This is an experimental study comparing two classes. The results show that students' critical mathematical thinking abilities improved more with the Discovery Learning model than with conventional learning.
19	Haeruman et al. (2017)	Jurnal Penelitian dan Pembelajaran Matematika	DL	This is an experimental research. The results show that the increase in students' critical mathematical thinking skills using the Discovery Learning model is better than students who received conventional learning.
20	Lieung (2019)	Musamus: Journal of Primary Education	DL	This is an experimental research. The results show a significant positive effect of the Discovery Learning model on critical mathematical thinking skills.

No	Author/Year	Journal	Model	Result
21	Mawaddah et al. (2015)	Unnes Journal of Mathematics Education Research	DL	This is a development research study. The results show the DL learning tools developed can enhance students' creative mathematical thinking skills.
22	Novitasari (2015)	Jurnal Pendidikan Matematika dan Matematika	CPS	The increase in students' mathematical critical thinking skills with the Creative Problem Solving approach was better than students who received conventional learning.
23	Maharani et al. (2021)	Jurnal Riset Pendidikan Matematika Jakarta	CPS	The results of this study indicate that there is an influence of the Creative Problem Solving (CPS) model in Distance Learning on students' critical mathematical thinking skills.
24	Ridha & Syaban (2016)	Sosio Humanitas Journal	CPS	This research is both classroom action research and quasi-experimental. The results found an increase from cycle 1 to cycle 2 due to CPS implementation. CPS led to higher creative mathematical thinking skills than regular learning.
25	Septian et al. (2019)	Jurnal Prisma	CPS	This research is a classroom action and quasi-experimental study. The results found that the implementation of CPS improved students' creative mathematical thinking skills compared to conventional methods.

In Table 1 above, we can see several learning models used to improve students' high-level thinking skills, namely the Problem Based Learning (PBL) model, Discovery Learning (DL), Project Based Learning (PjBL), Creative Problem Solving (CPS), Core and Missouri. The high-level thinking skills that are focused on are critical thinking skills, creative thinking, mathematical reasoning and problem-solving skills, some articles do not mention the main points of high-level thinking skills.

Problem Based Learning Model, is widely used to improve high-level thinking skills because the characteristic of PBL which presents problems at the beginning of learning can trigger students to develop high-level thinking skills presented through contextual problems. These contextual problems stimulate students' high-level thinking skills (Lestari, 2021) The advantages of PBL itself are building life skills, metacognitive thinking, self-control and communication skills (Masduriah, 2020).

The following is a summary of learning models with the number of articles that examine the model.

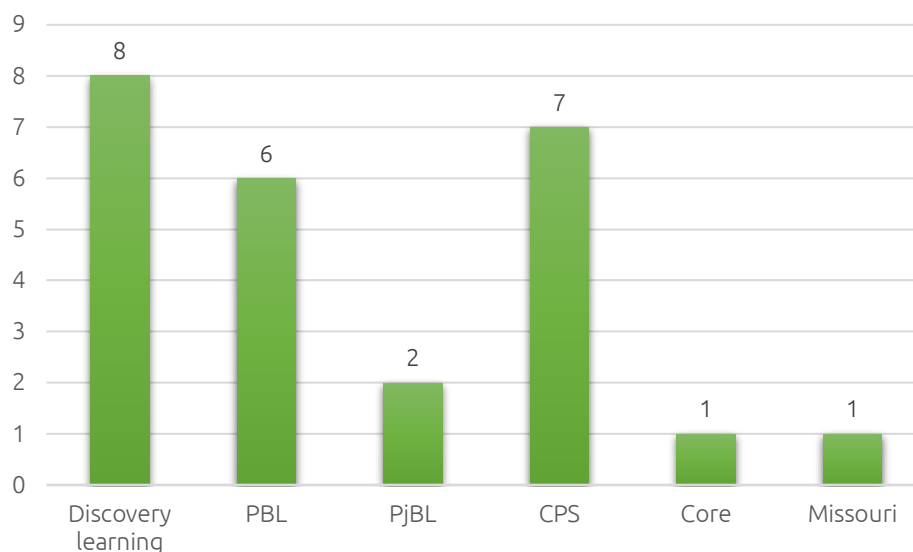


Figure 1. Diagram of the number of articles that examine HOTS-based learning models

The Project Based Learning (PjBL) model in several studies is used to facilitate students' problem-solving abilities. PjBL is a learning approach that confronts students with practical problems through learning stimuli, Linda (Niswara et al., 2019). So that the PjBL stages can encourage students to think analytically about problems, so that they are able to solve problems (Nurfitriyanti, 2016).

Another model that is commonly used to improve high-level thinking skills is the Discovery Learning model. In this model, students are required to be able to construct their own knowledge and provide students with opportunities to learn. The basic idea of the Discovery Learning model is because students can design their own experiments and conclude their own rules/concepts, so they really build their knowledge (Mawaddah et al., 2015). The stages in this Discovery Learning model are stimulation, problem statement, data collection, data processing, verification and generalization. Through these stages, high-level thinking skills can be trained.

In addition to the Discovery Learning Model, the Creative Problem Solving (CPS) model is widely used to improve students' HOTS, more specifically this model is related to students' creative thinking skills, according to (pepkin, 2004) the CPS model can train students to think creatively. The steps in this CPS are clarifying problems, expressing ideas, evaluating and selecting, and implementing them. With these stages, students can be trained to reason, construct their knowledge and be able to think creatively in solving problems (Faturohman & Afriansyah, 2020).

Effectiveness of Models at School Level

The research subjects for the application of learning models that can improve HOTS should be adjusted to the students' thinking process, as related to the research subjects in the article in Table 1. The following is the researcher's description: The research subjects in elementary schools are for PBL research (Lestari, 2021;

Masduriah, 2020) and Discovery Learning research (Lieung, 2019; Prasasti et al., 2019; Ramadhani & Fitri, 2020), this shows that even though HOTS-based learning is applied in elementary schools, it will be effective even though students at that age are not yet able to think formally. Meanwhile, for junior high school/equivalent research subjects, the PBL model was applied by research (Hidayati et al., 2018; Imelda & Anazelina, 2019; Jailani et al., 2017; Suwarsi et al., 2018). The effectiveness of implementing PBL seems to be more successful in improving critical thinking skills, with the highest impact, especially for high school students (Juandi & Tamur, 2021) for the Discovery Learning model by research (Zubainur et al., 2020) (and Creative Problem Solving by (Ridha & Syaban, 2016) from these studies it can be concluded that the PBL and CPS learning models can facilitate high-level thinking skills of junior high school students. For the subject of high school students/equivalent, research was conducted with the PjBL model by (Londa & Domu, 2020; Nurfitriyanti, 2016), the CPS learning model in high school students can also improve students' HOTS (Apino & Retnawati, 2019; Faturrohman & Afriansyah, 2020; Maharani et al., 2021; Septian et al., 2019), besides CPS, another model used in improving HOTS of high school students is the Discovery Learning model (Haeruman et al., 2017; Kurniawan & Arnellis, 2019; Nugraha et al., 2020), the CORE model (Rasmita et al., 2020) and the Missouri model (Widiasari et al., 2019).

In addition to the research subjects, teaching materials are one of the important elements in analyzing HOTS-based learning models because each material has its own character and the way of delivering each material will certainly be different, the following is a breakdown of the materials studied in Table 1. above, high-level thinking skills in flat building material can be improved with the DL and CPS models (Prasasti et al., 2019; Sasmi et al., 2020). For HOTS skills in comparison material, the DL model can be used (Rachmi, 2020) while students' HOTS, especially in function material, can use the Core, CPS and DL models (Faturrohman & Afriansyah, 2020; Rasmita et al., 2020; Zubainur et al., 2020) HOTS skills in other materials that can be improved with PjBL and CPS are in trigonometry materials (K Londa & Domu, 2020; Maharani et al., 2021). In the material on Number Patterns, HOTS can be developed with the PBL model (Imelda & Anazelina, 2019; Suwarsi et al., 2018), while in the material on Circles, CPS can be used as an alternative to improve students' HOTS (Novitasari, 2015; Ridha & Syaban, 2016)

The description above provides information related to the effectiveness of learning models to improve students' high-level thinking skills on certain materials. It is appropriate that as a teacher who has pedagogical competence, it is required to design learning with a choice of learning models based on the character of the material and the character of the students to be able to improve students' high-level thinking skills which are now a demand in the 21st century.

CONCLUSIONS AND RECOMMENDATIONS

Based on the description of the Results and discussion, the conclusion of this SLR study is that the Problem Based Learning, Project Based Learning, Discovery Learning, Creative Problem Solving, Core and Missouri models, while the HOTS abilities that are improved are Critical Thinking, creative thinking, reasoning, and problem solving abilities.

The suggestion from this study is to enrich and expand the results of the study, it is recommended that further research use a more diverse and inclusive database, and expand the range of publication years so that the scope of the literature analyzed becomes more representative and up-to-date. In addition, future research also needs to examine learning models from a quantitative effectiveness perspective, for example by calculating the effect size, in order to obtain a more measurable and objective understanding of the impact of each model on improving HOTS. Thus, the results of the study will be more useful in supporting evidence-based decision making in the field of mathematics education.

REFERENCES

- Alita, K. U., Koeswanti, H. D., & Giarti, S. (2019). *Jurnal Basicedu*, 3(1), 169–173. <https://jbasic.org/index.php/basicedu>
- Apino, E., & Retnawati, H. (2019). Creative problem solving for improving students' higher order thinking skills (HOTS) and characters. In *Character education for 21st century global citizens* (pp. 249–256). Routledge.
- Boham, M. W., & Domu, I. (2021). Penerapan model discovery learning untuk meningkatkan kemampuan siswa menyelesaikan soal-soal matematika berkategori HOTS. *Marisekola: Jurnal Matematika Riset Edukasi dan Kolaborasi*, 2(1), 5–8. <https://doi.org/10.53682/marisekola.v2i1.1083>
- Ernawati, E. (2016). Pengembangan perangkat pembelajaran matematika berbasis open-ended approach untuk mengembangkan HOTS siswa SMA. *Jurnal Riset Pendidikan Matematika*, 3(2), 209. <https://doi.org/10.21831/jrpm.v3i2.10632>
- Faturohman, I., & Afriansyah, E. A. (2020). Peningkatan kemampuan berpikir kreatif matematis siswa melalui creative problem solving. *Moshrafa: Jurnal Pendidikan Matematika*, 9, 107–118.
- Haeruman, L. D., Rahayu, W., & Ambarwati, L. (2017). Pengaruh model discovery learning terhadap peningkatan kemampuan berpikir kritis matematis dan self-confidence ditinjau dari kemampuan awal matematis siswa SMA di Bogor Timur. *Jurnal Penelitian dan Pembelajaran Matematika*, 10(2), 157–168. <https://doi.org/10.30870/jppm.v10i2.2040>
- Hafshoh, Elfis, S., & Armis. (2024). Development of discovery learning-based student worksheets to facilitate critical. *Absis*, 7(2), 186–197.

- Juandi, D., & Tamur, M. (2021). The impact of problem-based learning toward enhancing mathematical thinking: A meta-analysis study. *Journal of Engineering Science and Technology*, 16(4), 3548–3561.
- Kadarisma, G. (2016). Improving students' logical thinking mathematic skill through learning cycle 5E and discovery learning. *Proceeding of 3rd International Conference on Research Implementation Education of Mathematics and Science*.
- Kadarisma, G., Rosyana, T., & Nurjaman, A. (2019). Pengaruh minat belajar terhadap kemampuan penalaran matematik siswa SMP. *Jurnal Absis*, 2(1), 121–128.
- Kadarisma, G., Sari, I. P., & Senjayawati, E. (2020). Pengembangan lembar kerja siswa berbasis inkuiri untuk meningkatkan HOTS siswa SMA pada materi trigonometri. *Teorema: Teori dan Riset Matematika*, 5(2), 239. <https://doi.org/10.25157/teorema.v5i2.3725>
- Kurniawan, I., & Arnellis, A. (2019). Pengaruh penerapan model pembelajaran discovery learning terhadap kemampuan HOTS (high order thinking skill) siswa kelas X MIPA SMAN 3 Padang. *Edukasi dan Penelitian Matematika*, 8(4). <http://repository.unp.ac.id/id/eprint/24016>
- Lestari, B. (2021). Implementasi model pembelajaran PBL berbasis HOTS pada pembelajaran IPA. *Elementa: Jurnal Pendidikan Guru Sekolah Dasar*. <https://www.jurnal.stkipbjm.ac.id/index.php/pgsd/article/view/1446>
- Londa, K., & Domu, I. (2020). Pengaruh model pembelajaran project-based learning berbasis web pada kemampuan higher order thinking skills (HOTS). *Marisekola: Jurnal Matematika Riset Edukasi dan Kolaborasi*, 1(2), 25–28. <https://doi.org/10.53682/marisekola.v1i2.1029>
- Maharani, N., Hadiyan, A., & Murdiyanto, T. (2021). Pengaruh model pembelajaran creative problem solving (CPS) dalam pembelajaran jarak jauh (PJJ) terhadap kemampuan berpikir kritis matematis siswa. *Jurnal Riset Pendidikan Matematika Jakarta*, 3(1), 48–57. <https://doi.org/10.21009/jrpmj.v3i1.20110>
- Masduriah, H. (2020). Pengaruh penggunaan model pembelajaran PBL terhadap keterampilan HOTS siswa SD. *Prosiding Konferensi Ilmiah Dasar*. <http://prosiding.unipma.ac.id/index.php/KID/article/view/1576>
- Mawaddah, N., Kartono, K., & Suyitno, H. (2015). Model pembelajaran discovery learning dengan pendekatan metakognitif untuk meningkatkan metakognisi dan kemampuan berpikir kreatif matematis. *Unnes Journal of Research Mathematics Education*, 4(1), 10–17.
- Nugraha, G., Sarkani, & Supianti, I. I. (2020). Penerapan model discovery learning untuk meningkatkan kemampuan berpikir kreatif siswa. *Jurnal PJME*, 10(1), 78–87. <https://doi.org/10.5035/pjme.v10i1.2439>
- Nurfitriyanti, M. (2016). Model pembelajaran project-based learning terhadap kemampuan pemecahan masalah matematika. *Jurnal Formatif*, 6(2), 149–160.

- Puadi, E. F. W., & Habibie, M. I. (2018). Implementasi PBL berbantuan GSP software terhadap peningkatan kemampuan pemecahan masalah matematik siswa. *IndoMath: Indonesia Mathematics Education*, 1(1), 19. <https://doi.org/10.30738/indomath.v1i1.2091>
- Rasmita, R., Ansori, H., & Suryaningsih, Y. (2020). Pengaruh model pembelajaran CORE terhadap hasil belajar siswa dalam menyelesaikan soal HOTS pada materi aplikasi turunan fungsi. *Edu-Mat: Jurnal Pendidikan Matematika*, 8(2). <https://ppjp.ulm.ac.id/journal/index.php/edumat/article/view/9854/0>
- Ridha, M. R., & Syaban, M. (2016). Peningkatan kemampuan berpikir kritis matematis siswa dalam pembelajaran matematika melalui pendekatan creative problem solving (CPS). *Sosiohumanitas*, 1–17. <http://journal.unla.ac.id/index.php/sosiohumanitas/article/view/62>
- Septian, A., Komala, E., & Komara, K. A. (2019). Pembelajaran dengan model creative problem solving (CPS) untuk meningkatkan kemampuan berpikir kreatif matematis siswa. *Jurnal Prisma Universitas Suryakencana*, 8(2), 182–190.
- Suryapuspitarini, B. K., Wardono, & Kartono. (2018). Analisis soal-soal matematika tipe higher order thinking skill (HOTS) pada Kurikulum 2013 untuk mendukung kemampuan literasi siswa. *Prisma: Prosiding Seminar Nasional Matematika*, 1, 876–884. <https://journal.unnes.ac.id/sju/index.php/prisma/article/view/20393>
- Susanto, E., & Retnawati, H. (2016). Perangkat pembelajaran matematika bercirikan PBL untuk mengembangkan HOTS siswa SMA. *Jurnal Riset Pendidikan Matematika*, 3(2), 189. <https://doi.org/10.21831/jrpm.v3i2.10631>
- Widiasari, R., Hidayat, R., & Lusiyana, D. (2019). Penerapan model pembelajaran Missouri Mathematics Project untuk meningkatkan kemampuan HOTS matematis siswa SMA. *Prosiding Seminar Nasional Matematika dan Sains*. <https://prosiding.biounwir.ac.id/article/download/28/71>
- Zubainur, C. M., Jannah, R., Syahjuzar, & Vello, A. (2020). Kemampuan penalaran matematis siswa melalui model discovery learning di sekolah menengah Aceh. *Jurnal Serambi Ilmu*, 21(1).