

Critical thinking ability reviewed from self efficacy in the problem based learning model based on differentiation

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ABSTRACT

This study aims to analyze quality of learning models Problem Based Learning based on learning differentiate to think critical studentsz, analyzing influence self efficacy to think critical students , describe ability think critical student towards learning models Problem Based Learning based on learning differentiate reviewed from self efficacy. Research methods this is mixed methods using sequential explanatory design . Study quantitative with population participant educate class VIII of Muhammadiyah 5 Kandangan Middle School take class experiments in class VIII B and class control Class VIII A. Research qualitative used to describe ability think critical student towards learning models Problem Based Learning based on learning differentiate reviewed from self efficacy low , medium and high . The results of the study show that 1) the quality of the problem based learning model is based on learning differentiate meet valid criteria at stage planning , fulfilling Very good criteria at stage implementation , and fulfillment effectiveness learning at the stage evaluation results, 2) there are influence self efficacy to think critical students, 3) description ability think critical student towards the Problem Based Learning learning model based on learning differentiate reviewed from self efficacy produced as the following : a) self-efficacy tall capable interpret , analyze , evaluate and create conclusion, b) self efficacy currently capable interpret, analyze, evaluate will but need guidance from the teacher to make conclusion, c) self efficacy low teacher guidance with learning methods that support students to develop critical thinking.

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Introduction

Mathematics education is one of the foundation from ability science and technology . Understanding towards mathematics, from abilities that are characteristic skill until to understanding that is appreciative will succeed develop ability sufficient science and technology tall (Farida et al., 2019). Implementation mathematics education is carried out in various level to train student in solve the problem through learning that is done (Wittmann, 2021) . Mathematics learning will interesting If learning carried out by teachers is innovative and can accepted by students with enjoyable learning(Papadakis et al., 2017). With thus fun learning can realized with grow think critical mathematics in students with which exercise

various questions given by the teacher. Students own diverse thoughts in face mathematics learning, ability think students can't equalized in every student (Izzati et al., 2022). In line with objective the ability mathematical reasoning has a great influence on the process of learning mathematics. The ability understanding mathematical material someone cannot released from ability reasoning, in other words the mathematical material will easy understood with existence ability good sense (Khairunnisa et al., 2022). With thus accepted understanding every student will different – different there is students who directly understand when explained once and maybe must with explanation extra as well as need attention specifically to achieve objective desired learning.

The results of the 2013 PISA analysis by Scherer and Beckmann (2014) stated that mathematical competence plays a role in breakdown problem in matter whatever. While PISA 2022 results provide description about various aspect including inside it think critical and creative. The results of PISA 2022, the assessment of which conducted by the OECD shows that there is decline results Study in a way international consequence pandemic. This is why Indonesia rose 5-6 positions compared to with 2018. Indonesian mathematics literacy scores experience 13 point drop, more Good from the international average (Yusmar & Fadilah, 2023). Thinking results critical of mathematics learning in fact Still low with observations made on objects research. Causal factors low think critical is student Still difficulty in understand the questions given, students Not yet capable analyze commands and information contained in the matter of what to do breakdown problem, there is student Not yet difficulty understand information contained in question. In line with study Nuryanti (2018) stated that that a person who thinks critical shown with ability to analyze and evaluate the information he got (Purnaningsih & Zulkarnaen, 2022).

Build creativity think critical student can developed through mathematics learning. Basically must capable create pattern critical, systematic, logical and objective thinking to study mathematics. To solve problem in life in society somebody must consider in a way critical. In line with research by Riyanto and Ishartono (2022) that students who have skills critical driven to solve problems and evaluate solution (Cahyo & Murtiyasa, 2023). With so teachers must also push students to grow think critical with give problem for students break to get solution from results discussion student. Ability think critical can increase intelligence, help carry out tasks and look for solution to the problem at hand faced (Fitriana et al., 2022). In line with matter In this regard, Ennis (2015) revealed that criteria think critical is competent in identify problem, create argument logical, convey reasoning deductive, revealing reasoning inductive, evaluating, creating and implementing decision in a way right. There are indicator in ability think critical There are five categories that is convey explanation simple, forming skills basis, conclude, form explanation more continue and set strategies (Sari et al., 2021). In addition, believe self student in solve the problem still remains low according to Astuti & Pratama's (2020) research states that that fact moment activity mathematics learning is still low level of trust self, thing the Lots found when student given assignments by the teacher to complete problem in mathematics still cheat work friends, give up and feel incapable finish A the problems he faced with thus is lack of believe self owned by students (Wida Ismayanti et al., 2022).

Growing think critical mathematical and believe self student can also use learning models use breakdown problem for fishing student in face problem mentioned. Learning based on problem or Can called Problem Based Learning accordingly with measure understanding gained participant educate in the learning process (Arif et al., 2019). Problem based learning is wrong one learning model that can develop ability breakdown mathematical problems. This PBL model can increase ability breakdown problem student through the work process group or a systematic team, so that student can empower, sharpen, test and develop ability think about it in a way continuous (Naimnule et al., 2018). Based on results observation at Muhammadiyah 5 Kandungan Middle School Temanggung learning that is currently being carried out is still teacher centered (Teacher centered) and learning models Still done in a way contextual. In line with matter the (Papadakis et al., 2017) to put forward that learning currently using curriculum independence to improve think Christian

student with collaboration and not only centered on teachers only but student must involved active in the learning process . This is so then the learning model Problem Based Learning can applied to learning so that participants educate try to solve related issues with the material . One of them factor important in current mathematics learning is importance leading to growth think critical . This shows that student not enough active in Study so that ability think critical student less than optimal. One of the efforts to develop creativity in mathematics learning is with method integrate a development model Creativity is in the learning process teaching mathematics (Alan & Afriansyah, 2017). With thus the need interesting learning so that the level think student increased. The model used must also be diverse with existence diagnostic the beginning of the teacher will know need students to understand the material given. Implementation learning differentiate to make it easier for teachers to grouping participant educate in accordance with need learning . With thus learning will in accordance with planning that has been made.

Based on the results of observations of students of SMP Muhammadiyah 5 Kandangan when working on math problems with algebraic material contained in the material of relations and functions as a prerequisite for studying the material of exponents and root forms. Students are still confused about answering questions and do not believe in the results of their work. Students continue to ask the teacher how to do it and how to write the answers. Even though examples, explanations and practice questions have been given by the teacher. The need for an initial diagnostic assessment to determine the initial abilities and learning needs of students and teachers can identify the characteristics, learning models and learning methods used in the learning. Differentiated learning is applied so that students can develop their thinking skills and the needs of each student can be met. Differentiated learning is learning that tends to motor thinking skills . This learning is also known as differential learning. In line with Ki Hajar Dewantara's thinking that education provides guidance for all the natures possessed by these students. Students can freely develop their thoughts but must also be supervised by educators or teachers as guides for the learning activities. Differentiated learning is an effort to adjust the learning process in the classroom to meet the learning needs of each individual. The adjustments in question are related to interests, learning profiles and student readiness in order to achieve increased learning outcomes (Maydilla et al., 2023) . Thus, differentiated learning is learning that frees students to think and explore their knowledge according to the learning needs of students with teacher guidance so that their learning outcomes increase. The world of education today must have new challenges, educational units must be able to develop various creative ideas because the role in the future of routine work with repetitive patterns will be taken over by robots and other automatic processes(Firdaus, 2023). In addition, learning today requires innovation in the development of developing technological science. One of them is that learning must be reviewed from the role of teachers who facilitate their students to develop ideas and ways to solve the problems they give (Bhati & Sethy, 2022) .

In addition, other aspects that support mathematics learning are through affective aspects. Affective aspects include behavior that arises from students' feelings and emotions, such as interest in learning, attitudes, appreciation of the surrounding environment, and self-adjustment. One of the affective aspects that influences student learning outcomes is self-efficacy . Self Efficacy itself is defined as self-confidence in one's ability to organize and implement needs to achieve desired goals (Fitriani & Pujiastuti, 2021). This is based on the results of interviews with teachers at SMP Muhammadiyah 5 Kandangan, students are currently less confident in the results they get. Every time they are given an assignment, students still rely on the teacher and ask whether this is true or not. It should be discussed first with their group members for evaluation to be discussed during the presentation of group representatives. Evaluation of learning objectives is at the end of the learning steps by utilizing technology in the form of educational games designed according to the material that has been studied.

This study was conducted to determine the critical thinking of students with a differentiated approach by meeting the learning needs of students. Learning with the

material of relations and functions, the results obtained are still very lacking, 30% of students are still below average from the results of working on the questions. Critical thinking skills are reviewed from Self efficacy in students with differentiated learning models is learning that follows the needs of students. In the initial observation, differentiation learning was carried out with the readiness of students to learn. In this study, if the teacher is the main source of learning, students will feel bored and unchallenged, therefore this study tries to apply it with power point interactive and using LKPD on the material to analyze their thinking skills about the material with the initial step of explaining the material and then testing it by providing problems that they will solve. Thus the title of this study is Mathematical Critical Thinking Skills Reviewed from Self Efficacy Through Problem Based Models Learning Based on Differentiated Learning .

Method

This research is a combination research (Mixed) method). Mixed method is a research that combines qualitative and quantitative methods that are used together in a research activity (Sugiyono, 2018). This research method complements the data to be studied in order to produce valid research (Almeida, 2018). The research design used in This research is sequential explanatory design . This method is merge method study quantitative and qualitative in a way sequentially . This design can also characterized as a method strategy mixture that applies quantitative and qualitative data collection in One time (Sugiyono, 2018). Research model with sequential This explanatory method is the first stage using a quantitative method to measure the quality of learning with a problem- based learning model. learning towards critical mathematical thinking skills, namely with the hypothesis (1) critical mathematical thinking skills using the PBL learning model based on a differentiated approach achieve 75% completion, (2) the average critical mathematical thinking skills in PBL learning with a differentiated approach are more than the actual completion limit (BTA), (3) the average critical mathematical thinking skills in the PBL learning model with a differentiated approach are more than the average critical mathematical thinking skills in the PBL learning model, (4) the proportion of completion of critical mathematical thinking skills in the PBL learning model based on a differentiated approach is higher than the proportion of completion of critical mathematical thinking skills in the PBL learning model, (5) there is an increase in critical thinking skills in terms of self students' mathematical efficacy through PBL learning model based on differentiated learning , and the influence of self-efficacy. efficacy towards critical thinking. Then in the next study with qualitative methods to describe mathematical critical thinking skills with a problem- based model learning with a differentiated learning approach viewed from the perspective of self efficacy . This study combines two methods to strengthen the research results .

The subjects used in this study were class VIII students of Muhammadiyah 5 Kandangan Middle School with the technique used in election subject study is a Purposive sampling technique. Purposive sampling is technique determination sample with consideration certain (Sugiyono, 2020). This study uses class VIII B as the experimental class and class VIII A as the control class. This research was conducted on February 4 until February 28, 2025. Data analysis for learning quality is divided into three stages, namely (1) planning which is measured through sheet validation that contains device learning used along with research instruments validated by experts , (2) implementation measured learning with sheet teacher observation based on results observation learning with criteria terminal good , (3) evaluation results learning with a problem based learning model reviewed from Self efficacy based on learning differentiate prerequisite tests , completeness tests are carried out classical , average completeness test, average difference test, difference test proportion , improvement test and regression test . Analysis of research data qualitative conducted on subjects in class Experiment . Qualitative data results is description critical mathematical thinking skills with problem based models learning with a differentiated learning approach viewed from the perspective of self efficacy .

Result and Discussion

Model Quality in *Problem Based Learning Models Based on Learning Differentiate*

1. Stage Planning

Devices learning consisting of from teaching module , flow objective learning , effective hours, semester programs and annual programs along with learning media arranged in accordance with learning models problem based learning based on learning differentiated . The material taught in This research is number form rank and form roots in even semester year 2024/2025. Instruments in research has validated and revised in accordance with conclusions , comments and suggestions for improvement from the validator. Instrument study has validated by 2 lecturers and 1 mathematics teacher of Muhammadiyah 5 Kandungan Middle School Temanggung . The average result of the validation of the Teaching Module was 88 with very good category , LKPD with an average of 88 with Very good category , Regarding ability think critical with an average of 87 with very good category , guidelines interview with an average of 89 with very good category and questionnaire response student with an average of 86.6 with very good category .

The instrument trial was conducted in the trial class, namely class VIII C. The critical thinking ability trial instrument consisted of 8 questions, then validity, reliability , difficulty level and discriminatory power of the questions were analyzed to determine which questions could be used in the study. The results of the trial test showed that out of 8 questions, 5 questions could be used in the study. Based on Table 1 results reliability of test questions ability think critical mathematical student get 0.54 with the average value obtained which is 48.68. The result is show that There are 5 questions that are significant and can be used in study that is number 1,3,4,7,8.

2. Stage Implementation

This research was conducted in class VIII B of SMP Muhammadiyah 5 Kandungan on February 4 – February 28 , 2025. Activities learning held 4 meetings with a problem based learning model based on learning differentiated . The assessment results for each meeting obtained an overall average value of 92.25%. These results indicate that learning activities were carried out very well and increased at each meeting. The student responses filled in by students with an overall average of 85.75% with very good criteria. Thus, learning with the problem- based model learning based on differentiated learning carried out in the classroom can be accepted by students very well. This is in line with research conducted (Abdillah & Astuti, 2021)learning with problem based learning can be used well and can improve critical thinking skills.

The implementation of learning in the classroom, students have obstacles, but learning can run according to the learning steps and needs adjustments because learning is usually done contextually. The results of the LKPD work are grouped based on the results of students' initial abilities with 3 categories, namely developing, proficient and very proficient. The grouping of these categories gets different treatment in each group. The very proficient group consists of 2 groups that can solve problems and occasionally get guidance from the teacher. In the proficient category, students still depend on the teacher, but an explanation is given once. Then in the developing category, students need more specific guidance and direction with the teacher because in this category, students are in the lower category of ability.

Learning is carried out based on differentiated learning , teachers can focus on guiding groups that do not yet understand the material being studied. However, some students need to be guided specifically because they are accustomed to contextual learning, but the response of students shows an average of 85.75% with a very good category. In line with research (Kamal, 2021)that learning with a differentiated learning approach makes learning focus on students and makes students increase their learning motivation . Research conducted by (Fanani et al., 2024)that critical thinking skills with a problem- based learning model Learning is able to develop students' abilities by being given a problem contained in the question.

3. Evaluation Stage

Based on the research results, the results of the experimental class and control class can be obtained in Table 2 as follows.

Table 2: Summary of Critical Thinking Ability Test Results Data

Class	Experimental Class		Control Class	
	Pretest	Posttest	Pretest	Posttest
Average	36.8	76.56	43.76	53.44
Maximum Value	66	96	74	88
Minimum Value	10	54	16	22

Table 3: Quantitative Results Analysis

Test Name	Hypothesis	Sig Value .	Conclusion
Normality Test	H_0 : Normally distributed H_1 : Not normally distributed	Experimental Class Sig. = 0,2 Control Class Sig. = 0,2	H_0 accepted
Homogeneity Test	H_0 : homogeneous data H_1 : data is not homogeneous	Sig. = 0,063	H_0 accepted
Classical Completion Test	H_0 : proportion of completion of experimental class $\leq 75\%$ H_1 : proportion of completion of experimental class $>75\%$	$Z_{hitung} = 1,9767$	H_1 accepted
Average Completion Test	H_0 : the value in the experimental class only reached BTA H_1 : the value in the experimental class is more than BTA	Sig. = 0,840	H_0 accepted
Mean Difference Test	H_0 : average of experimental class $\leq$ average of control class H_1 : average of experimental class $>$ average of control class	$t_{hitung} = 5,363$ Sig. = 0,63	H_1 accepted

Test Name	Hypothesis	Sig Value .	Conclusion
Proportion Difference Test	H_0 : proportion of experimental class $\leq$ proportion of control class H_1 : proportion of experimental class $>$ proportion of control class	$Z_{hitung} = 1,2$	H_1 accepted
Improvement Test	H_0 : there is no difference before and after the experimental class H_1 : there is a difference before and after the experimental class	$Sig. = 0,00$	H_1 accepted
Regression Test	H_0 : no effect H_1 : there is an influence	$F_{hitung} = 28,844$	H_1 accepted

Based on the test results, the implementation of learning with a problem- based model learning has fulfilled all indicators of learning quality at the learning planning stage , learning implementation and evaluation. Thus, the problem based learning model learning based on a differentiated approach is of very good quality to improve students' critical thinking skills.

Critical Thinking Skills Description Mathematical reviewed with Self Efficacy

Subject study shared in three self-efficacy categories : high (S-1, S-2), medium (S-3, S-4), and low (S-5, S-6), based on results questionnaire . In the category height , subject capable fulfil almost all indicator ability think critical like interpretation , analysis , evaluation , and conclusion . However , S-2 has not fulfil indicator evaluation of the question number 3. Even though Thus , the interview show understanding good material and dominance in learning . This is in accordance with (Praiono et al., 2022) which states that student with self-efficacy tall own ability think critical very good.

In the category in progress , subject show ability interpretation and analysis , but Not yet consistent in evaluation and conclusion . Although answer No always right , subject can look for alternative completion and explanation material to friends . (Sukma & Priatna, 2021) stated that student with self-efficacy currently only capable analyze and evaluate question , whereas according to (Hari et al., 2018), students Still difficulty in a number of indicator think critical like inspect arguments and validity answer.

Low category show less than optimal results , especially in make conclusion . Although a number of indicator like interpretation and evaluation fulfilled , results overall Not yet maximum. Subject Not yet understand material with good and need guidance direct from the teacher. According to (Kintoko et al., 2024), increase ability think critical can done through mapping learning , discussion and approach learning that encourages think critical.

Student with self- efficacy low need guidance intensive , moderate need mentoring occasionally , and high show independence think . However , the pressure social like influence friends can also influence results work students . (Praiono et al., 2022) mention that student with self-efficacy currently capable think critical even though Not yet fully right . (Negara et al., 2023) confirm that learning based on problem can increase self- efficacy and ability think critical . This is in line with (Aziz et al., 2023) which states that student with self-efficacy tall capable analyze , identify problem , connecting concept, solve problem , and do evaluation , as well as importance teacher's attention to aspect self-efficacy student.

Conclusion

Based on results and Discussion can obtained conclusion that learning with a problem based learning model learning differentiate quality very good to improve ability think critical mathematical students . Assessment results from 3 stages learning (1) Stage planning learning with device learning used in the research is so valid that suitable for use , (2) Stage implementation learning , implementation of problem based learning model including in very good criteria based on results observation by observer on sheet observation activity learning and questionnaire response students . (3) Stage evaluation learning . Assessment results learning with a problem based learning model based on learning differentiate that is quality . Results learning after done study namely a) Ability think critical mathematical using PBL -based learning model approach differentiate reach completion and exceeds 75%, b) Average ability think critical mathematics in PBL -based learning approach differentiate only reach the finish line actual (BTA), c) Average ability think critical mathematics in the PBL learning model with approach differentiate more from average ability think critical mathematics in the PBL learning model, d) Proportion completeness ability think critical mathematics in the PBL learning model based on approach differentiate more tall from proportion completeness ability think critical mathematics in the PBL learning model, e) There is improvement ability think critical reviewed from self efficacy mathematical student through the PBL- based learning model learning differentiated . Participants educate with self efficacy tall capable fulfil indicator ability think critical mathematical with interpret , analyze , evaluate and create conclusion . While participant students who have self efficacy currently they capable interpret , analyze and evaluate . Participants students who have self efficacy low they capable analyze and evaluate as well as need guidance special from the teacher to make conclusion.

References

- Abdillah, D. M., & Astuti, D. (2021). Pengembangan lembar kerja peserta didik (LKPD) berbasis problem-based learning (PBL) pada topik sudut. *Pythagoras: Jurnal Pendidikan Matematika*, 15(2), 190–200. <https://doi.org/10.21831/pg.v15i2.36444>
- Alan, U. F., & Afriansyah, E. A. (2017). Kemampuan Pemahaman Matematis Siswa Melalui Model Pembelajaran Auditory Intellectually Repetition Dan Problem Based Learning. *Jurnal Pendidikan Matematika*, 11(1). <https://doi.org/10.22342/jpm.11.1.3890.67-78>
- Almeida, F. (2018). Strategies to Perform a Mixed Methods Study. *European Journal of Education Studies*, 5(1), 137–151. <https://doi.org/10.5281/zenodo.1406214>
- Arif, D. S. F., Zaenuri, & Cahyono, A. N. (2019). Analisis kemampuan berpikir kritis matematis pada Model Problem Based Learning (PBL) berbantu media pembelajaran interaktif dan Google Classroom. *Prosiding Seminar Nasional Pascasarjana UNNES, 2018*, 323–328.
- Aziz, A., Puspita, W., & Inayah, S. (2023). Analisis Kemampuan Berpikir Kritis Matematis Siswa SMP Ditinjau dari Self Efficacy Pada Materi Perbandingan. *Intellectual Mathematics Education (IME)*, 1(2), 79–93. <https://doi.org/10.59108/ime.v1i2.50>
- Bhati, K., & Sethy, T. P. (2022). Self-Efficacy: Theory to Educational Practice. *The International Journal of Indian Psychology*, 10(1), 1123–1128. <https://doi.org/10.25215/1001.112>
- Cahyo, T. S. S., & Murtiyasa, B. (2023). Analisis Kemampuan Berpikir Kritis Matematis Melalui Pendekatan Problem Based Learning dalam Pembelajaran Matematika di SMP. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 7(2), 1597–1610. <https://doi.org/10.31004/cendekia.v7i2.2329>

- Fanani, M. A., Wafiroh, Z., & Yaqin, M. H. (2024). Penerapan Model Problem Based Learning (PBL) dalam Pembelajaran Berdiferensiasi untuk Meningkatkan Keterampilan Berpikir Kritis Peserta Didik pada Pelajaran Matematika. *Proceeding International Conference on Lesson Study*, 1(1), 537. <https://doi.org/10.30587/icls.v1i1.7426>
- Farida, N., Sesanti, N. R., & Ferdiani, R. D. (2019). Tingkat Pemahaman Konsep dan Kemampuan Mengajar Mahasiswa pada Mata Kuliah Kajian dan Pengembangan Matematika Sekolah 2. *MUST: Journal of Mathematics Education, Science and Technology*, 4(2), 135. <https://doi.org/10.30651/must.v4i2.2897>
- Firdaus, A. (2023). Pemanfaatan Pembelajaran Open-Ended Berbantuan Game Edukasi Untuk Meningkatkan Berpikir Kreatif Peserta Didik Pada Materi Bilangan Cacah. *EDUCATOR: Jurnal Inovasi Tenaga Pendidik Dan Kependidikan*, 2(4), 435-444. <https://doi.org/10.51878/educator.v2i4.1928>
- Fitriana, I., Kosasih, U., Saputra, S., & Wahid, A. (2022). Analisis terhadap kemampuan berpikir kritis peserta didik pada pembelajaran trigonometri melalui papan permainan evaluasi. *Jurnal Dimensi Matematika*, 05(02), 422-434.
- Fitriani, R. N., & Pujiastuti, H. (2021). Pengaruh Self-Efficacy Terhadap Hasil Belajar Matematika. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 5(3), 2793-2801. <https://doi.org/10.31004/cendekia.v5i3.803>
- Hari, L. V., Zanthi, L. S., & Hendriana, H. (2018). Pengaruh Self Efficacy Terhadap Kemampuan Berpikir Kritis Matematik Siswa Smp. *JPMI (Jurnal Pembelajaran Matematika Inovatif)*, 1(3), 435. <https://doi.org/10.22460/jpmi.v1i3.p435-444>
- Izzati, G. N., Dwijanto, & Cahyono, A. N. (2022). Analisis kemampuan berpikir divergen berdasarkan math anxiety siswa: Tinjauan pada penggunaan model problem based learning berbantuan permainan ular tangga. *Delta-Pi: Jurnal Matematika Dan Pendidikan Matematika*, 11(2), 270-282.
- Kamal, S. (2021). Meta 10. *Jurnal Pembelajaran Dan Pendidik*, 1(September 2021), 89-100.
- Khairunnisa, A., Juandi, D., & Gozali, S. M. (2022). Systematic Literature Review: Kemampuan Pemahaman Matematis Siswa dalam Menyelesaikan Masalah Matematika. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 6(2), 1846-1856. <https://doi.org/10.31004/cendekia.v6i2.1405>
- Kintoko, Waluya, S. B., Junaedi, I., & Dewi, N. R. (2024). Teachers' perceptions of critical thinking and mathematical literacy in main school PISA 2022 regional survey Yogyakarta, Indonesia. *Edelweiss Applied Science and Technology*, 8(6), 2346-2353. <https://doi.org/10.55214/25768484.v8i6.2479>
- Maydilla, Harun, L., Pendidikan Matematika Pascasarjana Universitas PGRI Semarang, P., & SMA Negeri, P. (2023). 219 Maydilla Fadiarahma Vistara, Rasiman, Lukman Harun, Marnala Efektivitas Model Problem-Based Learning Dengan Pendekatan Stem Efektivitas Model Problem-Based Learning Dengan Pendekatan Stem Terhadap Kemampuan Berpikir Kreatif Matematis Siswa. *Jurnal Penelitian Pembelajaran Matematika Sekolah*, 7(JP2MS), 219-227. <https://doi.org/10.33369/jp2ms.7.2.219-227>
- Naimnule, M., Kartono, & Asikin, M. (2018). Peran Peer Feedback dalam Pembelajaran Model Problem Based Learning pada Pencapaian Kemampuan Pemecahan Masalah. *Seminar Nasional Pendidikan Matematika Ahmad Dahlan*, 6, 309-316. <http://seminar.uad.ac.id/index.php/sendikmad/article/view/487>

- Negara, F. P., Abidin, Z., & Faradiba, S. S. (2023). Meningkatkan Self-Efficacy Matematika Siswa Melalui Pembelajaran Berbasis Masalah. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 7(1), 455–466. <https://doi.org/10.31004/cendekia.v7i1.1943>
- Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2017). Improving Mathematics Teaching in Kindergarten with Realistic Mathematical Education. *Early Childhood Education Journal*, 45(3), 369–378. <https://doi.org/10.1007/s10643-015-0768-4>
- Prajono, R., Gunarti, D. Y., & Anggo, M. (2022). Analisis Kemampuan Berpikir Kritis Matematis Peserta Didik SMP Ditinjau dari Self Efficacy. *Mosharafa: Jurnal Pendidikan Matematika*, 11(1), 143–154. <https://doi.org/10.31980/mosharafa.v11i1.694>
- Purnaningsih, I., & Zulkarnaen, R. (2022). Identifikasi Faktor Penyebab Kemampuan Berpikir Kritis Matematis Pada Siswa Kelas Viii. *Teorema: Teori Dan Riset Matematika*, 7(2), 291. <https://doi.org/10.25157/teorema.v7i2.7185>
- Sari, Y. I., Sumarmi, Utomo, D. H., & Astina, I. K. (2021). The Effect of Problem Based Learning on Problem Solving and Scientific Writing Skills. *International Journal of Instruction*, 14(2), 11–26. <https://doi.org/10.29333/iji.2021.1422a>
- Sugiyono. (2018). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D*. Alfabeta.
- Sugiyono. (2020). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. CV. Alfabetha.
- Sukma, Y., & Priatna, N. (2021). Pengaruh Self-Efficacy terhadap Kemampuan Berpikir Kritis Siswa Pada Mata Pelajaran Matematika. *Jurnal Ilmiah Soulmath: Jurnal Edukasi Pendidikan Matematika*, 9(1), 75–88. <https://doi.org/10.25139/smj.v9i1.3461>
- Wida Ismayanti, Santosa, C. A. H. F., & Rafianti, I. (2022). Minat Belajar, Efikasi Diri, dan Kemampuan Berpikir Kritis Berpengaruh Terhadap Hasil Belajar Matematika Siswa. *Jurnal Educatio FKIP UNMA*, 8(3), 943–952. <https://doi.org/10.31949/educatio.v8i3.2847>
- Wittmann, E. C. (2021). Connecting Mathematics and Mathematics Education. In *Connecting Mathematics and Mathematics Education*. <https://doi.org/10.1007/978-3-030-61570-3>
- Yusmar, F., & Fadilah, R. E. (2023). Analisis Rendahnya Literasi Sains Peserta Didik Indonesia: Hasil Pisa Dan Faktor Penyebab. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, 13(1), 11–19. <https://doi.org/10.24929/lensa.v13i1.283>