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PROBLEM-BASED LEARNING: ALTERNATIVE LEARNING MODEL TO IMPROVE STUDENTS' CRITICAL THINKING ABILITY

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ABSTRACT

The goal of this study was to help fourth-grade children improve their critical thinking skills. This is a Classroom Action Research project. The study was divided into two cycles, each of which included planning, action, observation, and reflection. Muhammadiyah Notoprajan Elementary School fourth grade pupils were used as research subjects. The ability to think critically in mathematics is the focus of this study. The test was utilized as a means of gathering information. The descriptive analysis was employed in the data analysis. The findings of the study show that after learning with PBL, students' mathematics learning outcomes improve. From the first to the second cycle, the percentage of students who received the KKM grew from 42.85% to 78.57%. The findings also demonstrate that using the PBL paradigm in the classroom can help fourth-graders enhance their critical thinking skills. This can be observed in the percentage of pupils in the high group with weak critical thinking skills, which was 62.40% in the first cycle and increased to 77.40%in the second cycle. Because the student sheet given to students in this study was in accordance with the PBL syntax and provided ill-structured issues as a starting point at the beginning of learning, there was an increase. Students can use the PBL syntax in student sheet to address problems that aren't well-structured.

Key Words: critical thinking; learning methods; problem based learning

INTRODUCTION

Education occupies an important position in the order of life because education is part of the basic needs of everyone. This is also because education is an investment in the future and progress of the nation. The subject that must be studied in the education system at all levels in mathematics. This is because mathematics is a science that trains thinking skills (Rahmadani & Anugraheni, 2017). Critical thinking skills are skills that must be mastered by students. Critical thinking is very important to have to determine a decision that requires reasoning, understanding, analysis, and evaluation of the information obtained (Aizikovitsh-Udi & Cheng, 2015). The ability to critically analyze is the first step that needs to be taken in dealing with problems, reading information from problems, and using it to find solutions to these problems (As'ari, 2016). Critical thinking ability is a thinking procedure in analyzing and evaluating data, where the data is obtained from the results of observing, things experienced the results of thinking, or communication (Deswani, 2019). Collecting imformation as much as possible before making a decision or taking action.

Critical thinking in mathematics or called mathematical critical thinking is the ability to connect previous knowledge, reasoning abilities, and cognitive strategies to generalize, prove, or evaluate unusual mathematical situations (Ennis, 1996). Indicators of critical

thinking ability can be known from their characteristics so that it can be said that people with these characteristics have critical thinking abilities. There are 4 indicators identified by Facione (2011), namely: interpretation, analysis, evaluation, and inference. Interpretation is an activity to understand the meaning of various things that have been experienced, situations, data, and so on. The analysis is an activity to identify inferential relationships. Evaluation is an activity to measure the credibility of an expression which is an explanation from a person's point of view, things experienced, circumstances, judgments, beliefs, or opinions. The inference is the process of identifying and getting the parts needed to conclude, develop hypotheses, pay attention to similar information and make conclusions from the impact given from data, situations, questions, or other descriptions. Two other indicators proposed by Facione are explanation and self-regulation. The two indicators mean to explain what they have in mind and how they draw conclusions that have been obtained at the inference stage. In their research, Putra et al. explained that critical thinking indicators were simpler, namely being able to explain simply, develop the basis, make inferences, explain further, and develop plans and techniques (Putra et al., 2020).

The importance of critical thinking skills is not owned by all Indonesian students. The critical thinking of Indonesian students is lower than that of students from other countries. This can be seen from the Trends in International Mathematics and Science Study 2015 (TIMSS) score. The score shows that Indonesian students are in position 46 out of 51 participants (Mullis et al., 2016). The same result also occurred in the Program for International Student Assessment 2018 (PISA). The mathematical ability of Indonesian students is ranked 72 out of 78 countries. The mathematical ability score of Indonesian students is 379, below the overall average of 489 (OECD, 2019). The math problems presented in the TIMSS and PISA tests include problem-solving questions, while critical thinking skills are needed in solving problems.

In addition to the international level, the low mathematical ability of students also occurs at the regional level. The results of observations at SD Muhammadiyah Notoprajan illustrate that student learning outcomes still need to be improved. This is because it is still below the Minimum Completeness Criteria (KKM) determined by the school. Students find it difficult to solve story problems given by the teacher. Those difficulties are difficulty in understanding the problem, difficulty in writing information from the problem, and determining the plan that must be used to solve the problem.

These results illustrate that the critical thinking skills of Indonesian students need to be improved. This is proof that cultivating critical thinking is not an easy thing, but critical thinking can be trained. Efforts that can be taken to hone students' critical thinking are by carrying out a teaching and learning process that familiarizes students with being involved in solving problems. *Problem-based Learning* (PBL) is a model mentioned in the K-13 Curriculum to be applied in teaching and learning activities. This PBL model familiarizes students with constructing a concept from the problems given to students (Nofitasari et al., 2017).

PBL is a learning model that begins by presenting a problem designed in a context that is relevant to the material to be studied to encourage students: gain knowledge and understanding of concepts, achieve critical thinking, have independent learning, participate in group work skills, and problem-solving skills (Ibrahim & Fadzil, 2013). Arends provides 5 steps of learning using PBL, namely problem orientation, organizing students to learn, guiding investigative activities, presenting work results, and analyzing and evaluating problem-solving processes (Arends, 2012). Problem orientation at the beginning of learning provides opportunities for students to conduct investigations to find solutions (Umanailo et al., 2019).

Boell & Hovorka (2019) explains that curiosity, inner turmoil, and critical thinking are the perfect combination to learn to get all opportunities and solutions in a problem or problem. This makes the PBL learning model effective for developing problem-solving (Santoso et al., 2020). Research by Asriningtyas, et al (2018) also provides results that the use of the PBL model is able to develop critical thinking and mathematics learning outcomes. Several previous studies have shown the success of PBL in learning mathematics. Research by Malmia et al (2019) and Mulyanto et al (2018) shows the success of PBL in improving mathematical critical thinking skills. The research of Malmia et al (2019) examined junior high school students, Mulyanto et al (2018) examined students in fifth-grade elementary school, while this study examined fourth-grade elementary school students. The study was conducted on fourth-grade elementary school students because fourth-grade elementary school is the beginning of high grade in elementary school. So that it is expected that students can develop mathematical critical thinking skills from the beginning of high grade. Kaharuddin's research (2018) shows the success of PBL on the learning outcomes of sixth-grade elementary school students, while the research in this article examines PBL on learning outcomes and critical thinking skills. Amalia, Surya, & Syahputra's research (2017) shows the effectiveness of PBL in improving problem-solving abilities, while the research in this article examines critical thinking. The relationship between problem-solving abilities and critical thinking, namely critical thinking is the ability to obtain information and solve problems by digging up information about the problems at hand (Christina & Kristin, 2016).

Based on the problems and theories that have been explained, the purpose of this study is to explain the improvement of students' learning outcomes and critical thinking using the PBL learning model for fourth-grade students of SD Muhammadiyah Notoprajan. Learning through this PBL model students are conditioned to be involved in teaching and learning activities because PBL is a learning model by involves students in solving a problem so that students gain experience from the process of finding the concepts they are learning. As a result, students are expected to be able to think critically in solving a problem.

RESEARCH METHOD

This research is a Classroom Action Research (CAR) with a model *of Problem-based Learning (PBL)*. The Kemmis & Taggart model was chosen as the CAR cycle model. Each cycle contains four stages of activities, namely planning, action, observation and the last is reflection. The planning stage is carried out so that the research can achieve the research objectives. The action stage is the realization of what has been planned. The reflection stage is carried out to see the extent of the success of the research. CAR is carried out in 2 cycles, cycle 1 and cycle 2. Each cycle is carried out in 3 meetings. The research location is in SD Muhammadiyah Notoprajan. The subjects of PTK are fourth-grade students of SD Muhammadiyah Notoprajan, with a total of 14 students consisting of 7 boys and 7 girls. The object of research is learning outcomes and students' mathematical critical thinking skills. The research was carried out during the pandemic in January – March 2021. The

Learning process was carried out online using the application Whatsapp because there were problems with implementing the Learning From Home (BDR) rules. Before learning, the researcher coordinated with the parents of students regarding the technicalities of learning and asked parents for help to print the LKPD that had been sent through Whatsapp Group feature. The learning activity begins with a greeting, asking the condition and readiness of students to learn. Students are instructed to look at the problems on the LKPD that have been given for 5 minutes. Furthermore, the researcher explained voice notes and text messages through Whatsapp Group. Students are given time to work on problems on the LKPD for 10 minutes. Furthermore, some students were asked to show the results of their work by taking a photo and sending it to the Whatsapp Group. Other students respond to the results of their

friends' work. After the discussion activities were completed, the researcher explained/conclusion from the lesson.

The data collection technique is using a written test. The data collection instruments are learning outcomes test questions and critical thinking test questions. The instrument has been declared feasible by the validator to be used in research. The questions consist of 5 essay questions on fractions. The basic competencies used to develop questions are presented in Table 1.

Table 1. Basic Competencies

	KD
Cycle 1	3.1.1 Showing common fractions 3.1.2 Writing common examples of fractions common 4.1.1 Determining fractions by multiplying the numerator and denominator by the same number 4.1.2 Determining common fractions by dividing the numerator and denominator by unequal numbers
Cycle 2	3.2.1 Shows common and mixed fractions 3.2.2 Write examples of common and mixed fractions 4.2.1 Determine fractions by multiplying or dividing the numerator and denominator by the same number 4.2.2 Solving problems presented in story problems regarding the operation of adding two fractions from various fractions

The critical thinking ability test assessment grid is presented in Table 2.

Table 2. Critical Thinking Ability Test Assessment Grid

Aspects of	**Indicators**	**Score**
Interpretation	Not writing what is known and what is asked	0
	Writes what is known and what is asked incorrectly	1
	Writes down what is known correctly or only what is asked correctly	2
	Writes what is known and asked about the question correctly but is incomplete	3
	Writes what is known and asked about the question correctly and completely	4
Analysis	Does not make a mathematical model of the given problem	0
	Makes a mathematical model of the given problem with no	1
	Makes a mathematical model of the given problem correctly without giving an explanation	2
	Makes a mathematical model of the problem given correctly but there is an error in the explanation	3
	Makes a mathematical model from the given questions correctly and provide correct and complete explanations	4
Evaluation	Do not use strategies in solving problems	0
	Use inappropriate and incomplete in solving problems	1
	strategies use appropriate strategies in solving problems, but are incomplete or use strategies that are not correct but complete in solving problems	2

	Using the right strategy in solving problems, complete but making mistakes in calculations and explanations	3
	Using the right strategy in solving problems, complete and correct in doing calculations/explanations	4
Inference	Not making conclusions	0
	Making conclusions that are not fast and not according to the context of the question	1
	Makes conclusions that are not right even though they are adapted to the context of the questions	2
	Make conclusions correctly, according to the context of the questions but are not complete	3
	Make conclusions correctly, according to the context of the questions and complete	4

Analyze the test results in doing it quantitatively to measure learning outcomes and critical thinking skills after participating in learning by applying the learning model Problem-based Learning (PBL).
Calculation with the following formulas:

$$N = \frac{P}{SM} \times 100$$

Information: N = value
P = Score obtained
SM = Maximum Score

The results of the learning outcomes test are used as a reference for the percentage of students who have completed the KKM (value 70). The indicator of the success of this research is that at least 75% of students achieve the KKM for learning outcomes tests and 75% at least achieve good categories on critical thinking test results.

RESULTS AND DISCUSSION

Observations were made on the implementation of learning as well as initial interviews with teachers and students indicating that there were several problems in the process of implementing learning. These problems are learning outcomes and students' critical thinking in mathematics. The solution to these problems is to conduct teaching and learning activities based on Problem-Based Learning (PBL). The teaching and learning process is carried out online, so the PBL model is highlighted in the student worksheets (LKPD).

The planning stage carried out is making questions about learning outcomes and critical thinking skills, Learning Implementation Plans (RPP), learning observation sheets, and PBL-based Student Worksheets. Furthermore, the implementation of learning is carried out through the WhatsApp group. Parents of students are encouraged to supervise/accompany students in online learning. Descriptive data on learning outcomes and students' critical thinking skills in cycle I can be seen in Table 3.

Table 3. Data Description Cycle I

Description of	Learning Outcomes	Critical thinking ability
Average	71.57	60.19
Highest score	87	8.25
Lowest score	50	38, 75
Percentage of students who completed	42.85%	57.14%

Table 3 illustrates that the average learning outcome has exceeded the specified KKM, which is more than 70, but the percentage of students whose scores are more than 70 is only 42.85%. The same thing also happened to the results of critical thinking tests. The average score of students' critical thinking skills is 62.41. Furthermore, the results of the mathematical critical thinking ability scores were further categorized based on the normal curve in Table 4.

Table 4. Critical Thinking Category

Category	Information
80 < X	Very High
60 < X 80	High
40 < X 60	Medium
20 < X 40	Low
X 20	Very Low

Based on Table 4, this average is in the "high" category, but the percentage of students who get a minimum high score is only 57.14% of students. The average distribution of critical thinking skills for each aspect is presented in Table 5.

Table 5. Data Description of Cycle I

Aspect	**Mean**	**Category**
Interpretation	68.32	High
Analysis	55.25	Medium
Evaluation	59.01	Medium
Inference	58.21	Medium

Based on Table 5 it is known that the interpretation aspect is included in the "high" category, this means that students are able to understand the problem by writing down what is known and what is asked in the question. The other three aspects, namely analysis, evaluation, and inference, are in the medium category. This illustrates that students in seeing the relationship between questions and information about questions still need to be improved. Some students are able to use models and problem-solving strategies correctly, but some students have not been able to do it. Some students also have not written down the flow of problem-solving completely.

The score of learning outcomes and critical thinking skills in cycle I was not in line with the criteria determined in this classroom action research, so the research was continued to cycle II. The results of the reflection in the first cycle were used as material for evaluating the implementation of the second cycle. The results of the reflection cycle I showed that students were still lacking in aspects of analysis, evaluation, and inference, therefore, in the PBL LKPD developed in the second cycle, more emphasis was placed on solving problems in the PBL LKPD. The developed PBL LKPD is made more detailed so that students are trained to work on the questions in sequence and completely. Students are also encouraged to re-check the results of their work.

Comparison of descriptive data on students' mathematics learning outcomes in cycle I and cycle II is presented in Figure 1.

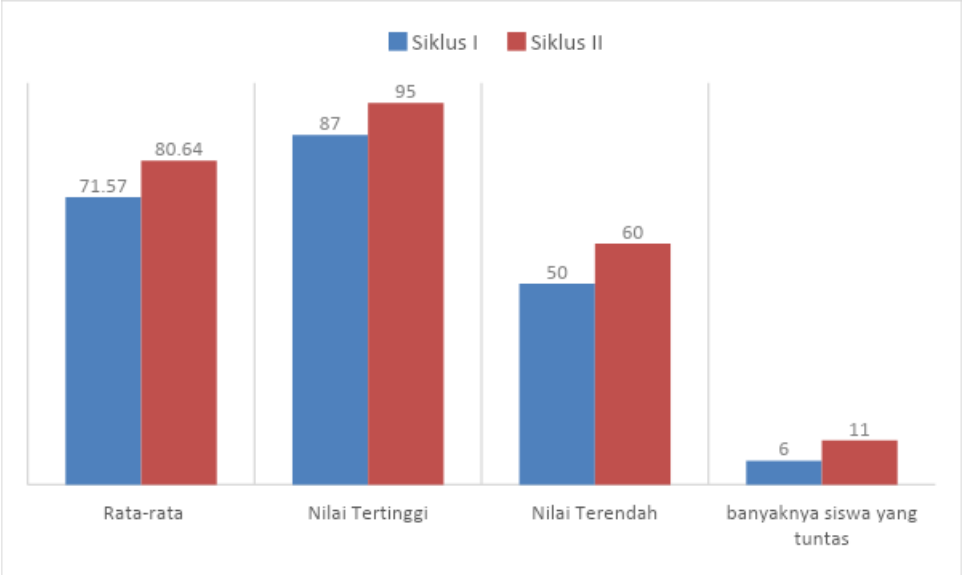

Figure 1. Comparison of learning outcomes data in cycle I and cycle II

Figure 1 illustrates the score of students' mathematics learning outcomes from cycle I to cycle II there is a change in value positive ones. The average result of student learning outcomes increased 9.07 points from 71.57 to 80.64. The number of students whose scores meet the KKM increased from 6 students to 11 students or from 42.85% to 78.57%. This increase also occurred in the critical thinking ability variable. Descriptive data on students' mathematical critical thinking skills in cycle I and cycle II are depicted in the bar chart in Figure 2.

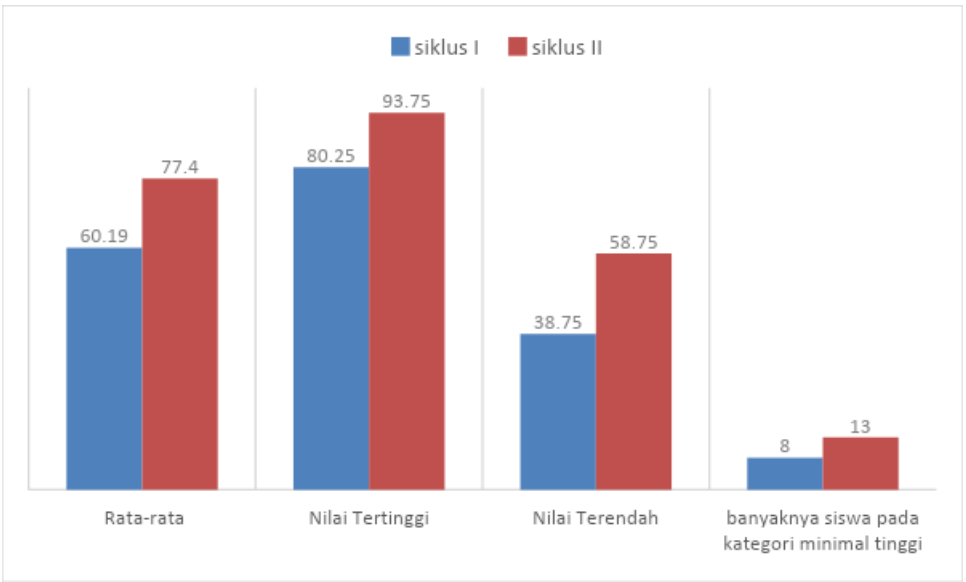

Figure 2. Data comparison on critical thinking skills in cycle I and cycle II

From figure 2 it can be seen that the score of students' mathematical critical thinking skills from Cycle I to cycle II there is a change in the value for the better. The average value of students' critical thinking skills increased 17.21 points from 60.19 to 77.4. The number of students who achieved the minimum high category increased from 8 students to 13 students or from 57.14% to 77.40%. Furthermore, data on the distribution of each aspect of students' mathematical critical thinking skills in cycle I and cycle II is depicted in a bar chart in figure 3.

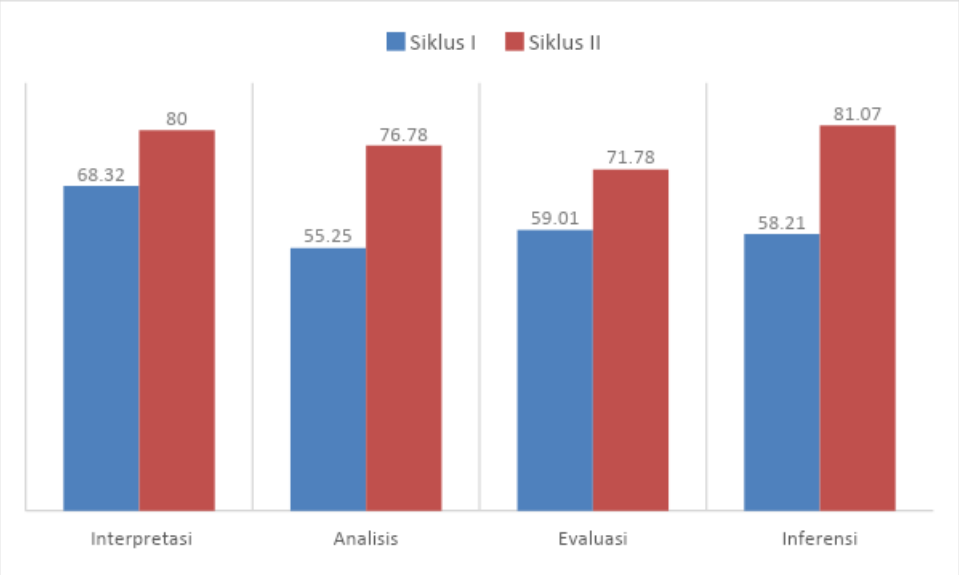

Figure 3. Comparison of the average scores of aspects of critical thinking skills in cycle I and cycle II

Based on figure 3, the average score of each aspect of ability critical thinking also experienced an improvement in value. The highest average score is in the inference aspect, namely 81.07 which is in the "very high" category. This illustrates that the average student is very capable of making complete and precise conclusions. The other three aspects, namely interpretation, analysis, and evaluation, also experienced an increase in average. These three aspects fall into the "high" category. This describes that on average students are able to write and understand information from the questions given, make models and develop strategies in solving problems. Based on the data in cycle II, the percentage of learning outcomes scores and students' mathematical thinking skills have reached the criteria determined in the study. Therefore, this classroom action research stopped in cycle II.

The results of classroom action research using the PBL model show that PBL can improve learning outcomes and students' critical thinking skills. These results are in line with the research by Ayuningsih et al (2019) which resulted in an improvement in values from cycle I to cycle II. The improvement in grades from cycle I to cycle II was due to the PBL LKPD which was developed to be made more detailed so that students were trained to work on the questions in sequence and completely. PBL situations provide an environment that can develop critical thinking skills. This is in line with the results of Birgili's (2015) analysis which states that the use of the PBL environment in learning provides opportunities for students to discover new knowledge from their "prior knowledge". Furthermore, Birgili (2015) explains that this process directs students to think by guessing and analyzing to find solutions to problems through the experiences of students. The research of Pamungkas et al (2019) also showed an increase in critical thinking after using the PBL model. Furthermore, according to Pamungkas et al (2019) an increase in critical thinking increases student learning outcomes. The Pamungkas et al (2019) research provides students with direct experience of how to process problems involving everyday life so that learning is more meaningful.

The difference in learning using the PBL model lies in the learning process and the role of the teacher. Teachers do not just stand in class and explain how to solve problems by providing stages of solving problems that have been finished (Sastrawati et al., 2011). The teacher's role in PBL is to provide facilities for discussion, ask questions, and help students realize the importance of the learning process. The teacher's role in this classroom action research is not the same as the previous research. This is due to online learning. Therefore, the

role of the teacher in this study is as a facilitator by providing direction and instructions to students through the Whatsapp group. In addition, the LKPD given to students is also arranged systematically according to the PBL syntax. The worksheets are given to students also contain problems ill-structured. At first, students found it difficult to work on problems ill-structured, but after following the learning flow and trying to work on them, students were finally able to solve the problem. The purpose of giving this problem ill-structured is so that students have the opportunity to conduct investigations in various ways to find solutions (Delisle. 1997).

CONCLUSION

The conclusion of the research is that the application of Problem-based Learning (PBL) helps improve students' critical thinking skills in mathematics. Increasing students' critical thinking skills resulted in student learning outcomes also increasing. In this study, although the research was conducted online, the results of this study indicate that providing a PBL environment in learning can support students' critical thinking processes. The provision of the PBL environment is given through the LKPD which is presented in detail using the PBL syntax. In addition, LKPD also presents problems ill-structured. The use of problems in PBL should not only be in the form of simple problems but problems that are ill-structured and involve student activities.

REFERENCES

Aizikovitsh-Udi, E., & Cheng, D. (2015). Developing Critical Thinking Skills from Dispositions to Abilities: Mathematics Education from Early Childhood to High School. *Creative Education*, *06*(04), 455–462. https://doi.org/10.4236/ce.2015.64045

Amalia, E., Surya, E., & Syahputra, E. (2017). The Effectiveness of Using PBL in Mathematics Problem Solving Ability for Junior High School Students. IJARIIE, 3(2), 3402-3406.

Arends, R. I. (2012). *Learning to Teach (9th ed)*. New York: McGraw Hill Companies.

As'ari, A. R. (2016). Pengembangan Karakter dalam Pembelajaran Matematika : Prioritas dalam rangka mengembangkan 4C's. *Seminar Nasional Pendidikan Universitas Muhammadiyah Gresik*.

Asriningtyas, A. N., Kristin, F., & Anugraheni, I. (2018). Penerapan model pembelajaran problem based learning untuk meningkatkan kemampuan berpikir kritis dan hasil belajar matematika peserta didik kelas 4 sd. *JIPMat*. https://doi.org/10.26877/jipmat.v3i1.2226

Ayuningsih, D., Kristin, F., & Anugraheni, I. (2019). penerapan model pembelajaran problem based learning (pbl) untuk meningkatkan hasil belajar dan berpikir kritis matematika. *Jurnal Cakrawala Pendas*, *5*(2). https://doi.org/10.31949/jcp.v5i2.1351

Birgili, B. (2015). Creative and Critical Thinking Skills in Problem-based Learning Environments. *Journal of Gifted Education and Creativity*, 2(2), 71-80.

Boell, S. K., & Hovorka, D. (2019). Writing, Arguing, Contributing - A Cogent Argumentation Framework for Identifying, Specifying, and Evaluating Research Contribution. *Australasian Journal of Information Systems*. https://doi.org/10.3127/ajis.v23i0.1857

Christina, L. V., & Kristin, F. (2016). Efektivitas Model Pembelajaran Tipe Group Investigation (GI) dan Cooperative Integrated Reading And Composition (CIRC) Dalam Meningkatkan Kreativitas Berpikir Kritis dan Hasil Belajar IPS Siswa Kelas 4. Scholaria: Jurnal Pendidikan dan Kebudayaan, 6(3), 217-230.

Delisle, R. (1997). *How to use problem-based learning in the classroom*. Alexandria: ASCD.

Deswani. (2019). Peningkatan kemampuan berpikir kritis melalui penerapan model pembelajaran deep dialog critical thinking dalam pembelajaran ekonomi pada peserta

didik smk n 1 yogyakarta. *E-Jurnal Manajemen Universitas Udayana*.

Ennis, R. H, (1996). *Critical Thinking*. United States of America: Prentice-Hall Inc.

Facione, P. A. (2011). *Critical Thinking: What It Is and Why it Counts*. Millbrae: Measured Reasons and The California Academic Press.

Ibrahim, N & Fadzil, N.H. (2013). Informal Setting for Learning on Campus: Usage and Preference. *Procedia-Social Behavioral Sciences,* 105, 344-351.

Kaharuddin, A. (2018). Effect of Problem Based Learning Model on Mathematical Learning Outcomes of 6th Grade Students of Elementary School Accredited B in Kendari City. *International Journal of Trends in Mathematics Education Research*, 1(2), 43-46.

K. Filsaime Dennis. (2008). Menguak Rahasia Berpikir Kritis dan Kreatif. In *Menguak Rahasia Berfikir Kritis dan Kreatif*.

Malmia, W. et al. (2019). Problem-Based Learning As An Effort to Improve Student Learning Outcomes. IJSTR, 8(9), 1140-1143.

Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016). TIMSS 2015 International Results in Mathematics. Retrieved from Boston College, TIMSS & PIRLS International Study Center. *International Review of the Red Cross*, *3*(30), 488. http://timssandpirls.bc.edu/timss2015/international-results/

Mulyanto, et al. (2018). The Effect of Problem Based Learning Model on Student Mathematics Learning Outcomes Viewed from Critical Thinking Skills. International Journal of Educational Research Review,3(2),37-45.

Nofitasari, A., Yuana, R. A., & Maryono, D. (2017). The Use of Robomind Application in Problem Based Learning Model to Enhance the Student's Understanding on the Conceptual Programming Algorithm. *IJIE (Indonesian Journal of Informatics Education)*. https://doi.org/10.20961/ijie.v1i1.4170

OECD. (2019). PISA 2018 insights and interpretations. OECD Publishing, 64. https://www.oecd.org/pisa/PISA 2018 Insights and Interpretations FINAL PDF.pdfPISA 2018 insights and interpretations. *OECD Publishing*, 64. https://www.oecd.org/pisa/PISA 2018 Insights and Interpretations FINAL PDF.pdf

Pamungkas, D., Mawardi, M., & Astuti, S. (2019). Peningkatan Keterampilan Berpikir Kritis dan Hasil Belajar Matematika Pada Peserta didik Kelas 4 Melalui Penerapan Model Problem Based Learning. *Jurnal Ilmiah Sekolah Dasar*. https://doi.org/10.23887/jisd.v3i2.17774

Putra, P. P., Pamujo, P., & Badarudin, B. (2020). Peningkatan Kemampuan Berpikir Kritis Peserta Didik melalui Group Investigation Berbantu Media Videoscribe. *Al-Adzka: Jurnal Ilmiah Pendidikan Guru Madrasah Ibtidaiyah*. https://doi.org/10.18592/aladzkapgmi.v10i1.3552

Rahmadani, N., & Anugraheni, I. (2017). peningkatan aktivitas belajar matematika melalui pendekatan problem based learning bagi peserta didik kelas 4 sd. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *7*(3), 241. https://doi.org/10.24246/j.scholaria.2017.v7.i3.p241-250

Santoso, B., Putri, D. H., & Medriati, R. (2020). Upaya meningkatkan motivasi belajar dan kemampuan pemecahan masalah peserta didik melalui model problem based learning berbantu alat peraga konsep gerak lurus. *Jurnal Kumparan Fisika*. https://doi.org/10.33369/jkf.3.1.11-18

Sastrawati, E., Rusdi, M., & Syamsurizal. (2011). Problem-Based Learning, Strategi Metakognisi dan Keterampilan Berpikir Tingkat Tinggi Peserta didik. *Tekno-Pedagogi*.

Umanailo, M.C.B. et al. (2019). The Thought of Emile Durkheim in the Contestation of Development in Indonesia. *International Journal Scientific Technology Research*, 8(8), 1881-1885.