



The Effect of Problem Based Learning Model on Students' Critical Thinking Abilities

Suyitno Suyitno¹, Dhania Nugrahaning Purwasuyitno²

¹Universitas Islam Balitar, Indonesia

²Universitas Brawijaya, Indonesia

Email: ¹drsuyitno03@gmail.com, ²dhanianugra@gmail.com

Informasi Artikel

Submitted: 29-06-2026

Accepted: 20-08-2026

Published: 10-10-2026

Keywords:

Implications

Expository Learning Model

Problem Based Learning Model

Critical Thinking Skills

Abstract

The aim of this research is to determine the differences and influence of the Problem Based Learning (PBL) model and the expository learning model on critical thinking skills in Social Action, Social Interaction and Identity material for class X students at State Islamic High School (MAN) Boyolangu for the 2025/2026 academic year. This research uses a quasi-experimental method with a one group pretest-posttest Nonequivalent Control Group research design. The data analysis technique in this research uses the normality test, homogeneity test and paired sample t-test. The results of data analysis, the results of the pretest, obtained an average of 66.74, while the posttest obtained an average of 75.00. If you look at the average of the pretest and posttest, it has increased, the results of the independent sample t-test obtained sig. (2-tailed) is worth 0.000 because sig. (2-tailed) value is $0.000 \leq 0.05$ so it is declared significant. Based on the results of data analysis using the paired sample t-test, it shows that between the application of the PBL model and the expository learning model there is a difference in increasing students' critical thinking abilities. The application of the PBL model has a significant effect on students' critical thinking abilities.

1. INTRODUCTION

The quality and success of learning are greatly influenced by the ability and accuracy of teachers in choosing and using learning models [1]. Good teachers must master various learning models so that they can use models that are appropriate to the subject matter [2]; [3]. One of the successes of students in achieving learning objectives in class is greatly influenced by the drive or motivation that students have in participating in learning [4]; [5]. The development of an appropriate learning model basically aims to create learning conditions that allow students to learn actively and enjoyably so that students can achieve optimal learning outcomes and achievements [6]; [7]. The use of appropriate learning models can encourage students to enjoy the lesson [8], foster and increase motivation in doing assignments [9], make it easier to understand the lesson so that students can achieve better learning outcomes, which as is known that the measure of the success of a teacher's teaching is primarily based on whether or not there is an increase in student learning outcomes [10]; [11]. One indicator of success in the learning process is the increase in students' ability to think critically [12]. Critical thinking skills are important for students' cognitive development.

Critical thinking skills can help students adapt to the rapid development of this era. With the many innovations and new information, students are required to have high critical thinking skills. The results of the Program for International Students Assessment (PISA) Indonesia in 2022 are still relatively low, in Mathematics subjects there has been a decline of 12-13 points compared to 2018, and the level of student ability, especially in mathematics in Indonesia, is still at the level of understanding to application but has not yet reached the aspect of critical thinking skills [13]; [14]. This critical thinking is very important for

students, because with the ability to think critically, students can be rational in choosing better alternative answers [15]. In addition, this critical thinking ability can also be used to examine problems that occur in everyday life [16]. Although critical thinking is very important for students, in practice many teachers ignore this. In fact, with good critical thinking skills in students, the implementation of understanding learning concepts will run better [17]. The low level of critical thinking in students requires corrective steps. One effort that can be done is to facilitate students to be able to develop critical thinking skills. Teachers should have a good teaching method and be able to choose the right learning method, so that students can master the competencies determined in the implementation of learning. It is not new when the evaluation of learning outcomes as the final series of the teaching and learning process shows less than satisfactory results. One of the weaknesses is due to the teaching process factor, and the learning model which is teaching and learning [18]. One of the steps taken by a teacher is to choose to use a learning model that can involve students more actively in learning. For this reason, it is necessary to choose a learning model that can make students more active [19].

Critical thinking skills are a core competency in social studies/sociology learning because students are not only required to master concepts but also to analyze social phenomena, identify the causes and impacts of a problem, evaluate various perspectives, and formulate rational solutions based on facts. The characteristics of social studies/sociology material, which is closely related to the realities of community life, require students to possess higher-order thinking skills so they can go beyond memorizing theory and apply it to understand and solve complex social problems [20]. However, learning conditions in the field still demonstrate gaps. The learning process tends to be teacher-centered, emphasizing material delivery and memorization of concepts, while students' opportunities to analyze real-world problems, discuss, present arguments, and evaluate information are still limited [21]. As a result, students' critical thinking skills have not developed optimally. They tend to receive information without conducting analysis, have difficulty connecting concepts to social phenomena in their environment, and are less able to provide logical solutions to the social problems they face. The Problem-Based Learning (PBL) model offers an alternative way to bridge this gap because it places real-world problems as the starting point for learning. Through the process of identifying problems, seeking information, discussing, analyzing evidence, and developing solutions, students gain learning experiences that directly train critical thinking skills. Thus, PBL not only enhances conceptual understanding but also develops the ability to reason, make decisions, and solve problems systematically. In the context of social studies/sociology, this condition can cause students to be less sensitive to social issues in their environment, easily accept information without verification, and lack the necessary skills to participate actively and responsibly in community life [22]. Therefore, the implementation of PBL is crucial as an effort to bridge the gap between the demands of critical thinking competencies and learning practices that are still dominated by teacher-centered approaches.

The activeness of these students makes students more free to think and question what they have absorbed from the teacher. One of the learning models that can improve student understanding is the PBL model [23]; [24]. This Problem Based Learning learning model is a model that requires students to face problems so that it can indirectly stimulate students to think critically. This is in line with the opinion of [25]; [26], that the PBL model is a learning model by creating confrontations for students with practical problems and has a context with the real world. With this model, teachers can focus on helping students achieve self-direction skills so that problems in achieving learning objectives can be resolved [27]. [28] argues that the problem-based learning model is a teaching and learning process that presents contextual problems so that students are stimulated to learn. Problems are faced before the learning process takes place so that they can trigger students to research, describe and find solutions to the problem. Previous research has generally investigated the development of critical thinking skills in mathematics and natural science subjects. The results of the study [29]; [30]) stated that in mathematics and found that the problem-based learning approach allows students to be more active in exploring and presenting their ideas in group discussions to solve various mathematical problems. Several studies have also observed improving students' critical thinking skills through the application of the PBL model on the material of Effort and Energy [31]; [32]; [33]. The way students think critically will ultimately be seen when they do it trying to analyze problems related to the topics they are studying. Previous studies generally emphasize the importance of critical thinking skills in learning mathematics or Natural Sciences. This study examines students' critical thinking skills in subjects within the scope of social sciences that have not been widely carried out by previous researchers, namely to determine the effect of the Problem Based Learning learning model on the critical thinking skills of class X students at MAN Boyolangu on the material "Social Action, Social Interaction and Identity".

2. METHODS

This research was conducted through a quantitative approach with a quasi-experimental research method, namely research that does not carry out full treatment in the control class. This research was conducted on students of class X at MAN Boyolangu with the material Growth and Development of the odd semester of the 2025/2026 academic year and samples were taken from students in classes XA and XB with a total of 36 students each. The research design used by the researcher is the Pretest-Posttest Control Group Design which is presented in table 1 below:

Tabel 1. Pretest-Posttest Control Group Design

R1	O1	X	O2
R2	O3	Y	O4

Description:

R1: PBL model class

R2: Expository learning model class

O1: PBL model class pretest

O2: PBL model class posttest

O3: PBL model class pretest

O4: Expository learning model class posttest

X: PBL model implementation

Y: Expository learning model implementation

The data collection technique used is the critical thinking ability test technique in this study consisting of 6 descriptive questions. Critical thinking skills that can be measured from the questions given include: (1) Providing simple explanations, (2) Building basic skills, (3) Concluding, (4) Providing further explanations, and (5) Strategy and tactics. The scoring criteria for each question in this test have a maximum value of 4 and a minimum of 0 (zero). The scoring criteria refer to the scoring technique shown in table 2 below, namely:

Table 2. Critical Thinking Ability Test Scoring Rubric

Measured Indicators	Criteria for Students' Answers to Critical Thinking Questions	No
Elementary clarification (providing simple explanations)	Focusing questions, analyzing arguments, asking and answering questions	1
Basic Support (building basic skills)	Considering the credibility of a source	2
Inference (Concluding)	Arranging and considering deductions, arranging and considering inductions, making decisions and considering the results	3
Providing further explanations	Identifying terms and considering definitions, identifying assumptions	4
Strategies and tactics (strategies and tactics)	Determining an action and interacting with others	5

Before being empirically tested, the instrument was assessed for content validity through a three-person expert review. The purpose of this process was to ensure that each item represented indicators of critical thinking skills and aligned with the learning objectives and Sociology learning materials. The instrument and item design were evaluated by experts consisting of university lecturers specializing in education and educational assessment, as well as experienced Sociology teachers. The experts assessed each item based on its relevance to critical thinking indicators, content appropriateness, item construction, language clarity, and readability. The experts' suggestions and comments were used to revise and improve the instrument. After the revision process, the instrument was deemed to have adequate content validity and was subsequently pilot-tested to verify its empirical validity and reliability before being used in the main study. This procedure ensured that the instrument was theoretically sound and empirically valid for measuring students' critical thinking skills in the context of the PBL model.

Next, the data analysis stage consists of: 1) normality test using Kolmogorov-Smirnov, with the value criteria ($p > 0.05$) declared normal; 2) homogeneity test, using Levene's test; 3) Independent Sample t-test, with the criteria if ($p < 0.05$) then between the posttest of the experimental class and the control class there is a difference in students' critical thinking abilities and; 4) Paired Sample t-test with the criteria if ($p < 0.05$) then the application of the PBL model has a significant effect on students' critical thinking abilities. The analysis tool uses the SPSS version 21 program.

3. RESULTS AND DISCUSSION

3.1. Result and Analysis

Overall, the observation results showed that the entire syntax of the PBL model could be implemented according to the planned stages. Each stage was implemented with a 100% implementation rate, both for teacher and student activities, thus indicating that the implementation of the learning model was consistent and in accordance with established learning procedures.

a. Validity Test

Analysis for this empirical validity test uses the product moment formula using SPSS version 21. If the r_{count} value $>$ r_{table} at a significance level of 0.05, then the question item is valid. The results of the instrument validity test in this study are as in table 3

Table 3. Validity Test Results

Item	Correlation coefficient value (r_{stat})	Sig.	r_{table}	Criteria
1	0.856	0.000	0.389	Valid
2	0.617	0.001	0.389	Valid
3	0.843	0.000	0.389	Valid
4	0.905	0.000	0.389	Valid
5	0.656	0.000	0.389	Valid

Source: processed primary data

Based on table 4, it can be seen that all questions have a calculated r value greater than r table, so it can be stated that the question items are in the valid category and can be used in the data analysis process.

b. Reliability Test

The following are the results of the reliability test using SPSS version 21 that the Cronbach's Alpha value is 0.834. It is known that the overall test reliability is 0.834. Based on the significance that $0.834 \geq 0.60$, it can be concluded that the research instrument items are declared reliable as data collection tools in the study.

c. Normality Test

The normality test aims to determine whether the data sample used is normally distributed or not. The normality test is carried out using the one-sample Kolmogorov Smirnov test. The following are the results of the normality test using the SPSS version 21 for Windows application analysis presented in table 4 below:

Table 4. Normality Test Results

Variable	Sig. Level	Normality test Criteria	Decision
Control class Pretest	0.519	0.05	Normal
Control class Posttest	0.120	0.05	Normal
Experiment Class Pretest	0.537	0.05	Normal
Experiment Class Posttest	0.501	0.05	Normal

Based on table 5, it can be seen that the significance value (Asymp. Sig. (2-tailed)) for the control class Pretest is 0.519; Control class Posttest is 0.120; Experimental class Pretest is 0.537; Experimental class Posttest is 0.501. Because the significance for both variables is $>$ 0.05, it can be concluded that the data distribution in the control class and the experimental class is normal.

d. Homogeneity Test

The homogeneity test using the Levene Statistic test aims to determine whether the two sample classes have homogeneous variants or not with the criteria that if the significance value on the average value is $>$ 0.05, then the data is homogeneously distributed. The results of the homogeneity test between the pretest and posttest values are as shown in the following table 5.

Table 5. Results of the Homogeneity Test for Pretest Questions
 Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	.434	1	45	.513
	Based on Median	.399	1	45	.531
	Based on Median and with Adjusted df	.399	1	44.594	.531
	Based on trimmed mean	.432	1	45	.514

The results of the homogeneity test of the pretest value obtained a sig. 0.513 > 0.05 and the homogeneity test of the posttest value was sig. 0.480 > 0.05. So it can be concluded that both value variances are homogeneous.

Table 6. Pretest and Posttest Results of the Control Class and Experimental Class

Sample Group	N	Average	Standar Deviasi	Varians	Lowes score	Highest score
Pretest XA	23	57.83	10.748	115.514	35	80
Posttest XA	23	66.74	8.740	76.383	45	80
Pretest XB	23	52.61	12.235	149.704	40	80
Posttest XB	23	78.48	8.974	80.534	60	95

Based on table 6, the mean pretest result of the experimental class was 52.61 and the posttest of the experimental class was 78.48, while the mean pretest result of the control class was 57.83 and the posttest of the control class was 66.74. The median pretest result of the experimental class was 50 and the posttest of the experimental class was 75, while the median pretest result of the control class was 60 and the posttest of the control class was 65. The mode result of the experimental class pretest was 40 and the posttest of the experimental class was 75, while the mode result of the control class pretest was 60 and the posttest of the control class was 65.

From the table, it can be seen that the average pretest result of the control class and the pretest of the experimental class were 57.83 and 52.61; the standard deviation of the control class pretest was 10.748 and the pretest of the experimental class was 12.235. The highest pretest score was 80 and the lowest score was 35. Then the average posttest results of the control class were 66.74 and the experimental class 75.00; the standard deviation of the posttest of the control class was 8.740 and the experimental class 8.974. The highest posttest score was 95 and the lowest score was 45.

From the description above, it can be seen that the average of the posttest sample group is higher than the average of the pretest sample group. This can be assumed that there was an increase in student scores when the posttest was carried out.

Table 7. Summary of Student Scores in the Experimental Class

No	Indicators Critical Thinking Skill	Experiment Class				Control Class			
		Average		DifferenceImprovement		Average		DifferenceImprovement	
		Pretest	Posttest			Pretest	Posttest		
1	Elementary Clarification	40	80	40	40%	45	62	17	17%
2	Basic Support	55	86	31	31%	66	70	4	4%
3	Inference	55	67	12	12%	63	63	0	0%
4	Advanced Clarification	55	80	25	25%	55	67	12	12%
5	Staegies and Tactics	56	78	22	22%	59	72	13	13%

Based on table 7, it can be seen that critical thinking skills in each independent variable in the experimental class increased with percentages of 40%, 31%, 12%, 25%, 22%, respectively. The average results of critical thinking indicators from the lowest to the highest are inference with a score of 67%, strategies and tactics with a score of 78%, elementary clarification with a score of 80%, advanced clarification with a score of 80%, basic support with a score of 86%. Based on table 4.5, it can be seen that critical thinking skills in the control class in each independent variable increased with percentages of 17%, 4%, 0%, 12%, 13%, respectively. The average results of critical thinking indicators from the lowest to the highest are elementary clarification with a score of 62%, inference with a score of 63%, advanced clarification with a score of 67%, basic support with a score of 70%, strategies and tactics with a score of 72%.

e. Hypothesis Testing

Hypothesis testing was conducted on pretest and posttest data. In this study, the hypothesis test used SPSS independent sample t-test to determine whether there was an effect of the PBL model on students' critical thinking skills and paired sample t-test was conducted to determine whether there was a difference before and after the implementation of the PBL model on the critical thinking skills of class X students at MAN Boyolangu. The results of the Independent Sample t-test between the control class posttest and the experimental class posttest are shown in table 8 and the Paired Sample t-test between the pretest and posttest of the control class and the control class are shown in table 9:

Table 8. Paired Sample t-test Results

Class	N	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Pretest-Posttest Control	23	7.379	1.539	0.000
Pretest-Posttest Experiment	23	13.539	2.823	0.000

Based on the Paired Sample t-test, the sig. (2-tailed) value is 0.000 because the sig. (2-tailed) value is $0.000 \leq 0.05$ that there is a difference before and after the implementation of the PBL model on students' critical thinking skills.

Table 9. Results of the Independent Sample t-test

Class	N	Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
Posttest Control	23	66.74	8.740	1.822	0.000
Posttest Experiment	23	78.48	8.974	1.871	0.000

Based on the Independent Sample t-test, the sig. (2-tailed) value is 0.000 because the sig. (2-tailed) value is $0.000 \leq 0.05$, which means that the implementation of the PBL model has a significant effect on the critical thinking skills of students X class at MAN Boyolangu.

3.2. Discussion

a. Differences Before and After Implementing PBL on Students' Critical Thinking Skills

The implementation of the Problem-Based Learning (PBL) model in accordance with each learning syntax indicates that the learning process provided students with opportunities to construct knowledge through problem-solving activities. The successful implementation of each PBL phase not only reflects the effective execution of the learning process but also explains why this model can enhance students' critical thinking skills. In PBL, students do not passively receive information; instead, they actively identify problems, gather relevant information, analyze alternative solutions, and draw conclusions based on the evidence they obtain. These activities represent the core components of critical thinking.

The improvement in students' critical thinking skills can be explained by the characteristics of each PBL phase. During the problem orientation stage, students are presented with contextual problems that require them to identify facts, formulate problems, and activate their prior knowledge. This process encourages students to interpret and analyze the available information. In the organizing and investigation stages, students work individually and collaboratively to collect information from various sources, evaluate its accuracy, and discuss possible solutions. These activities develop their ability to analyze arguments, evaluate evidence, and construct logical reasoning before making decisions. Finally, during the presentation and evaluation stages, students are required to defend their ideas through discussion and respond to feedback from both the teacher and their peers. This process strengthens their ability to explain their reasoning, draw evidence-based conclusions, and reflect on their problem-solving process.

Based on the results of this study, the average critical thinking skills of students who use the PBL model are higher than the critical thinking skills of students who use the conventional model, this is in line with the results of the research of [34]; [35]. While the highest increase in the simple explanation indicator experienced the highest increase of 40%. The characteristics of the questions in this indicator are related to students' skills in focusing questions, analyzing explanations or challenges [36] ; [37]. In the experimental class, the researcher only directed students to the problems that had been selected, then the students independently carried out the process of solving the problems. When solving problems, students' thinking was optimized through the group work process by students collecting information related to the problems from the student handbook, then processing the information by discussing with the group and conducting

experiments and presenting the results of group work in front of the class. Students have begun to get used to the PBL model of learning and also the exercises given by the researcher in the form of questions to stimulate students' activeness and critical thinking analysis. This is interesting and motivates students to be able to answer questions with good analysis. Students' high critical thinking skills can make it easier for students to understand concepts and can maximize students' sensitivity to a problem so that they can find the right solution and then apply the concept in various different situations. This is in accordance with the statement of [38] that critical thinking skills are related to the ability to focus the mind on a problem and efforts to solve it. To be able to provide an explanation, students must be able to use the knowledge they have and relate it to the context of the problem at hand. Smith [39] stated that critical thinking is basically about reasoned arguments, meaning that critical thinking skills will produce an argument with clear and logical reasons so that it can be used as a basis for solving problems and solutions.

b. The Influence of PBL on Critical Thinking Skills

The improvement in students' critical thinking skills can be attributed to the systematic implementation of each Problem-Based Learning (PBL) syntax, as confirmed by the learning implementation observations. The findings indicate that both teachers and students consistently carried out each phase of the learning process as intended, creating a learning environment that actively engaged students in problem-solving activities. Although students initially experienced difficulties in completing essay questions and solving complex problems, this condition was understandable because they were unfamiliar with PBL and had previously been accustomed to learning activities that primarily emphasized lower-order cognitive skills (C1 and C2). As students became more familiar with the PBL process, they gradually developed the ability to analyze problems, evaluate information, and formulate appropriate solutions.

The statistical analysis demonstrated that students taught using the PBL model achieved significantly better critical thinking skills than those taught using the conventional model. This finding can be explained by the characteristics of PBL, which encourage students to understand authentic problems, plan appropriate solution strategies, investigate relevant information, and evaluate the effectiveness of their solutions. These learning experiences provide students with meaningful opportunities to practice higher-order thinking skills, particularly analysis, evaluation, and reasoning. This finding is consistent with constructivist learning theory, which emphasizes that knowledge is actively constructed through meaningful learning experiences and social interaction. It also supports previous studies reporting that PBL is effective in fostering critical thinking because it shifts the learning process from teacher-centered instruction to student-centered inquiry and problem solving.

The problem-based learning model also has advantages, namely by solving problems it can develop critical thinking skills, find new knowledge, increase learning activities, practice thinking in dealing with something and to apply their knowledge in real life [40]. This is in line with research conducted by [41] that there is a significant difference in the critical thinking abilities of grade V students at SD Krikilan 2 between classes taught using the PBL model and classes taught through expository learning in science subjects. The Problem Based Learning model is a learning model that can help students to be active and independent in developing critical thinking skills to solve problems through data searches so that rational and authentic solutions are obtained [42]; [26]. The PBL method in education increases team involvement and student learning capacity, provides opportunities to practice skills, educates professionals with a holistic vision, improves critical thinking, and increases capacity to face different market conditions [24]; [15]. The PBL learning model can be applied in elementary schools, because both models aim to activate students' roles in their learning, develop deeper understanding, and skills that are relevant to the real world and also support the development of students as active and independent learners [43]; [44]. The application of this problem-based learning model has been proven to be able to direct students in gaining new knowledge, using analysis from various knowledge and learning experiences they have. After that, connect what you have with the learning problems given by the teachers. The learning process that prioritizes the ability to analyze learning materials from students independently is used to learn to think critically about solving real problems they face.

4. CONCLUSION

The application of problem-based learning models has been shown to have differences with the application of direct learning models in the category of expository learning models on the critical thinking skills of class X students at MAN Boyolangu. The critical thinking skills of students in the experimental group increased in each variable, namely elementary clarification 40%, inference 31%, advanced clarification 12%, basic support 25%, and strategies and tactics 22%.

Based on the results of the research that has been conducted, it can be concluded that there is a significant influence of the application of the Problem Based Learning model on the critical thinking skills of class X students at MAN Boyolangu which is based on the results of the Independent Sample t-test obtained a sig. (2-tailed) value of 0.000 because the sig. (2-tailed) value of $0.000 \leq 0.05$. The Problem Based Learning model is a learning model that is based on problems as a starting point for obtaining or integrating new knowledge that is useful for stimulating students to think critically in problem-oriented situations, encouraging learners (students) to apply critical thinking, problem-solving skills, connecting knowledge about real-world problems and issues.

In relation to the research results obtained, suggestions that can be conveyed to other researchers who will conduct research on critical thinking skills at the senior high school level are that standard instruments are not yet available, so researchers who will conduct research on the critical thinking skills of senior high school students can develop critical thinking instruments by adapting standard instruments.

REFERENCES

- [1] E. Emidar and V. Indriyani, "The effect of learning planning skills and teaching material development skill on teacher teaching skills," *JPPI*, vol. 9, no. 3, p. 1804, Sep. 2023, doi: 10.29210/020232814.
- [2] R. Meyanti, Y. Bahari, and I. Salim, "Optimalisasi Minat Belajar Siswa Melalui Model Pembelajaran Problem Solving," *icote*, vol. 2, no. 2, p. 262, Dec. 2019, doi: 10.26418/icote.v2i2.38239.
- [3] D. Destari, H. Kurniawati, A. Tesalonika Yolanda, H. Tannady, and M. Magdalena, "The Analysis of Improving Student Learning Outcomes Using The Value Clarification Technique Learning Model," *joe*, vol. 6, no. 1, pp. 3300–3305, Jun. 2023, doi: 10.31004/joe.v6i1.3395.
- [4] N. Mawaddah, "The Drill Method for Increasing Motivation to Learn FIQH for Middle School Students," *IJRER*, vol. 2, no. 1, pp. 10–19, Dec. 2022, doi: 10.51574/ijrer.v2i1.655.
- [5] A. Aseery, "Enhancing learners' motivation and engagement in religious education classes at elementary levels," *British Journal of Religious Education*, vol. 46, no. 1, pp. 43–58, Jan. 2024, doi: 10.1080/01416200.2023.2256487.
- [6] D. Susanti, L. Y. Sari, and V. Fitriani, "Increasing Student Learning Motivation through the Use of Interactive Digital Books Based on Project Based Learning (PjBL)," vol. 8, no. 4, 2022.
- [7] D. Arisanty and R. Riyah, "Application of make a match model to improve geography learning outcomes," *J. Technol. Sci. Educ.*, vol. 9, no. 1, p. 32, Feb. 2019, doi: 10.3926/jotse.547.
- [8] A. S. Ditta, C. M. Strickland-Hughes, C. Cheung, and R. Wu, "Exposure to information increases motivation to learn more," *Learning and Motivation*, vol. 72, p. 101668, Nov. 2020, doi: 10.1016/j.lmot.2020.101668.
- [9] E. Jääskä, J. Lehtinen, J. Kujala, and O. Kauppi, "Game-based learning and students' motivation in project management education," *Project Leadership and Society*, vol. 3, p. 100055, Dec. 2022, doi: 10.1016/j.plas.2022.100055.
- [10] D. A. Cook and A. R. Artino, "Motivation to learn: an overview of contemporary theories," *Med Educ*, vol. 50, no. 10, pp. 997–1014, Oct. 2016, doi: 10.1111/medu.13074.
- [11] Y. Rahmawati, E. Harini, and A. F. Setyawan, "Increasing Learning Motivation And Success Through The PBL Model In The Class III," *Teacher Education*, 2023.
- [12] A. Ramdani, A. W. Jufri, G. Gunawan, M. Fahrurrozi, and M. Yustiqvar, "Analysis of Students' Critical Thinking Skills in terms of Gender Using Science Teaching Materials Based on The 5E Learning Cycle Integrated with Local Wisdom," *JPII*, vol. 10, no. 2, pp. 187–199, Jun. 2021, doi: 10.15294/jpii.v10i2.29956.
- [13] D. S. F. Arif and A. N. Cahyono, "Analisis Kemampuan Berpikir Kritis Matematis Pada Model Problem Based Learning (PBL) Berbantu Media Pembelajaran Interaktif dan Google Classroom," *SEMINAR NASIONAL PASCASARJANA 2020: ISSN: 2686 6404*, 2020.
- [14] R. Thoyyibah, E. Anggraini, and M. Marhayati, "Kemampuan Berpikir Kritis Siswa Dalam Menyelesaikan Soal Himpunan Berbasis Kesenian Wayang Topeng Kabupaten Malang Ditinjau Dari Self Regulated Learning," *supremum j of mathematics education*, vol. 8, no. 1, pp. 87–99, Jan. 2024, doi: 10.35706/sjme.v8i1.10842.

- [15] F. Martin, C. Wang, A. Jokiah, B. May, and S. Gröbmeyer, "Examining Faculty Readiness to Teach Online: A Comparison of US and German Educators," *European Journal of Open, Distance and E-Learning*, vol. 22, no. 1, pp. 53–69, Jul. 2019, doi: 10.2478/eurodl-2019-0004.
- [16] Ariadila S N, Silalahi Y F N, Fadiyah F H, Jamaludin U, and Setiawan S, "Analisis Pentingnya Keterampilan Berpikir Kritis Terhadap Pembelajaran Bagi Siswa," Oct. 2023, doi: 10.5281/ZENODO.8436970.
- [17] Siti Zubaidah, "Revealing the Relationship between Reading Interest and Critical Thinking Skills through Remap GI and Remap Jigsaw," *INT J INSTRUCTION*, vol. 11, no. 2, pp. 41–56, Apr. 2018, doi: 10.12973/iji.2018.1124a.
- [18] A. Asyafah, "MENIMBANG MODEL PEMBELAJARAN (Kajian Teoretis-Kritis atas Model Pembelajaran dalam Pendidikan Islam)," *TIIJE*, vol. 6, no. 1, pp. 19–32, May 2019, doi: 10.17509/t.v6i1.20569.
- [19] P. Mupa and T. I. Chinooneka, "Factors contributing to ineffective teaching and learning in primary schools: Why are schools in decadence?," *Journal of Education and Practice*, 2015.
- [20] Z. A. Fauzi and H. Ayuni, "Improving Social Studies Learning In Elementary Schools: A Literature Study," 2024.
- [21] N. Wahyuni, "Teachers' Perceptions of Teacher-Centered Learning (TCL) in Learning English at Senior High Schools in Agam Regency," vol. 13, no. 1, 2024.
- [22] N. Sari, Elizar, and Sumarno, "Analysis of the Effectiveness of Using Problem Based Learning (PBL) Model in Social Studies Learning in Elementary School: A Systematic Literature Review," *j. lesson learning stud.*, vol. 8, no. 2, pp. 419–427, Jul. 2025, doi: 10.23887/jlls.v8i2.92709.
- [23] R. M. Hidayati and W. Wagiran, "Implementation of problem-based learning to improve problem-solving skills in vocational high school," *jpv*, vol. 10, no. 2, Oct. 2020, doi: 10.21831/jpv.v10i2.31210.
- [24] A. A. Razak *et al.*, "Improving Critical Thinking Skills in Teaching through Problem-Based Learning for Students: A Scoping Review," *IJLTER*, vol. 21, no. 2, pp. 342–362, Feb. 2022, doi: 10.26803/ijlter.21.2.19.
- [25] D. Aini, S. Latifah, and A. Hamid, "Problem Based Learning (PBL) Model: Its Effect in Improving Students' Critical Thinking Skill," *IJSME*, vol. 4, no. 2, pp. 183–190, Jul. 2021, doi: 10.24042/ijsm.v4i2.8660.
- [26] H. Yuan, W. Kunaviktikul, A. Klunklin, and B. A. Williams, "Promoting Critical Thinking Skills Through Problem-Based Learning," vol. 2, 2008.
- [27] M. N. Fita, B. Jatmiko, and E. Sudibyo, "The Effectiveness of Problem Based Learning (PBL) Based Socioscientific Issue (SSI) to Improve Critical Thinking Skills," *Stud. Learn. Teach.*, vol. 2, no. 3, pp. 1–9, Dec. 2021, doi: 10.46627/silet.v2i3.71.
- [28] F. Setiawan, S. Masitoh, and A. Mariono, "The PBL-STs Model for Achieving Critical Thinking Skills in Elementary School Students," *ijsl*, vol. 3, no. 3, pp. 293–307, Aug. 2023, doi: 10.47134/ijsl.v3i3.193.
- [29] R. N. Sari and D. Juandi, "Improving Student's Critical Thinking Skills in Mathematics Education: A Systematic Literature Review," *Cendekia*, vol. 7, no. 1, pp. 845–861, Mar. 2023, doi: 10.31004/cendekia.v7i1.2091.
- [30] M. A. Zulkarnain, S. Syaiful, and S. Suratno, "Using learning models problem based learning to improve students' mathematical critical thinking skills," *DJM*, vol. 6, no. 2, p. 153, Aug. 2023, doi: 10.24042/djm.v6i2.18087.
- [31] A. R. Rosmasari and Z. A. I. Supardi, "Penerapan Model Pembelajaran Problem Based Learning (PBL) untuk Meningkatkan Keterampilan Berpikir Kritis Peserta Didik pada Materi Usaha dan Energi Kelas X MIPA 4 SMAN 1 Gondang," *pendipa. jurnal. pendik. sains*, vol. 5, no. 3, pp. 472–478, Jun. 2021, doi: 10.33369/pendipa.5.3.472-478.
- [32] C. O. Windari and F. A. Yanti, "Penerapan model problem based learning untuk meningkatkan keterampilan berpikir kritis peserta didik," *Edu Sains*, vol. 9, no. 1, pp. 61–70, Jun. 2021, doi: 10.23971/eds.v9i1.2716.
- [33] A. Rasyid and Y. Wiyatmo, "Pengembangan E—Modul Fisika Berbasis Pbl Berbantuan Aplikasi Canva Untuk Meningkatkan Keterampilan Berpikir Kritis Dan Kemandirian Belajar Peserta Didik SMA," 2024.
- [34] D. Dakabesi and I. S. Y. Luoise, "The effectiveness of problem-based learning model to increase the students' critical thinking skills," *EduLearn*, vol. 13, no. 4, pp. 543–549, Nov. 2019, doi: 10.11591/edulearn.v13i4.12940.

- [35] L. E. W. Fajari, Sarwanto, and Chumdari, "Enhancement of Students Critical Thinking Skills Through Problem-Based Learning Multimedia," in *Proceedings of the 3rd International Conference on Learning Innovation and Quality Education (ICLIQE 2019)*, Solo Baru, Indonesia: Atlantis Press, 2020. doi: 10.2991/assehr.k.200129.121.
- [36] D. F. Annisa and I. Ifdil, "Konsep Kecemasan (Anxiety) pada Lanjut Usia (Lansia)," *JIK*, vol. 5, no. 2, p. 93, Jun. 2016, doi: 10.24036/02016526480-0-00.
- [37] W. Suciono, R. Rasto, and E. Ahman, "Analisis Faktor-Faktor yang Mempengaruhi Keterampilan Berpikir Kritis Siswa dalam Pembelajaran Ekonomi Era Revolusi 4.0," *SOCIA*, vol. 17, no. 1, pp. 48–56, Mar. 2021, doi: 10.21831/socia.v17i1.32254.
- [38] P. D. Sundari and D. Sarkity, "Keterampilan Berpikir Kritis Siswa SMA pada Materi Suhu dan Kalor dalam Pembelajaran Fisika," *JNSI*, vol. 4, no. 2, p. 149, Oct. 2021, doi: 10.24014/jnsi.v4i2.11445.
- [39] Y. Susilowati, "Interseksi Berpikir Kritis Dengan High Order Thinking Skill (Hots) Berdasarkan Taksonomi Bloom," *ISSN*, vol. 5, 2020.
- [40] L. Darling-Hammond, L. Flook, C. Cook-Harvey, B. Barron, and D. Osher, "Implications for educational practice of the science of learning and development," *Applied Developmental Science*, vol. 24, no. 2, pp. 97–140, Apr. 2020, doi: 10.1080/10888691.2018.1537791.
- [41] Y. Darmawati and A. Mustadi, "The Effect of Problem-Based Learning on the Critical Thinking Skills of Elementary School Students," *J. Prim. Edukasia*, vol. 11, no. 2, pp. 142–151, Jul. 2023, doi: 10.21831/jpe.v11i2.55620.
- [42] G. A. Desiana, S. Sulastri, and S. Syahrial, "Penerapan Model Pembelajaran Project Based Learning (Pjbl) Pada Pembuatan Koloid Untuk Meningkatkan Keterampilan Berpikir Kritis Dan Kemandirian Belajar Siswa," *j.tadris.kimiya*, vol. 7, no. 1, pp. 37–52, Jun. 2022, doi: 10.15575/jtk.v7i1.13395.
- [43] F. Istiqomah, A. Firdaus, and R. S. Dewi, "Analisis Perencanaan, Pelaksanaan, dan Evaluasi Problem Based Learning dan Project Based Learning," vol. 06, no. 01, 2023.
- [44] B. S. Narmaditya, D. Wulandari, and S. R. B. Sakarji, "Does Problem-Based Learning Improve Critical Thinking Skills?," no. 3, 2018.