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Problem-Oriented Project-Based Learning Model (POP): Enhancing Critical Thinking in Elementary School Students

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ABSTRACT

Society 5.0 represents a human-centered paradigm that integrates advanced technologies to address social challenges and enhance quality of life, requiring mastery of 21st-century skills. Education serves as the primary medium for fostering these competencies. However, the 2022 PISA results indicate that Indonesian students' literacy in reading, science, and mathematics, key indicators of critical thinking remains low, ranking 69th out of 80 participating countries. To respond to this issue, a novel PoP (Project Based on Problem) learning model was developed by integrating elements of project-based and problem-based learning. This study aimed to (1) describe the characteristics of the PoP model, (2) assess its feasibility, and (3) evaluate its effectiveness in enhancing students' critical thinking skills. The research adopted the Borg and Gall R&D model, consisting of ten systematic stages of development, validation, and refinement. The participants comprised 70 fifth-grade students from three elementary schools in Blora Regency. Data were collected through a ten-item essay test measuring critical thinking related to the topic "Bumiku Sayang, Bumiku Malang" and teacher–student response questionnaires assessing feasibility. Data were analyzed using an Independent Sample T- Test, yielding a significance value of 0.002 ($\alpha < 0.05$), indicating a statistically significant difference between the experimental and control groups. The findings confirm that the PoP learning model is both feasible and effective in improving the critical thinking abilities of elementary school students.

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1. INTRODUCTION

The social and industrial structural revolution is influenced by advances in technology and communication. These changes have culminated in an uncontrolled environment characterized by volatility, uncertainty, complexity, and ambiguity, commonly referred to as the VUCA era (Alimudin, 2019). This revolution has had a massive and systematic impact on all sectors of life, one of which is education. In the era of Industry 4.0 and Society 5.0, education plays a crucial role in preparing and improving the quality of human resources (Supa'at & Ihsan, 2023). In this regard, teachers play a crucial role as designers and implementers of the learning process. Teachers are obligated to plan and implement innovative learning according to student needs and improve the competency of graduates with 21st-century skills (Darmuki & Hidayati, 2023).

21st-century skills require students to possess several abilities, one of which is critical thinking skills (Asna, 2024). Learning loss due to the Covid-19 pandemic, in the form of declining student learning outcomes and difficulty understanding material, has further weakened the critical thinking skills of elementary school students (Utami, 2024). Based on a survey conducted by the World Economic Forum (WEF) regarding the 2016-2017 Global Competitiveness Index (GCI), Indonesia ranked 41st out of 138 countries, below the GCI of Malaysia and Thailand (Nababan, 2019). This is reinforced by PISA data in 2022, which shows that students' abilities in reading, science, and mathematics literacy are ranked 69th out of 80 countries (OECD, 2023). Not only in Indonesia, but globally, several studies also show that students' critical thinking skills are also at a low level, including in (Ploysangwal, 2018) and (Kwon, 2020) in Thailand.

Critical thinking skills can be measured using instruments in the form of questions designed using critical thinking ability indicators. One such measure is implemented by PISA, which uses questions to measure critical thinking and reasoning capacity (Aprilia et al., 2024), which aims to periodically evaluate the educational process in each country (Setyowati et al., 2021). This is because critical thinking skills significantly influence students'

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cognitive development (Syafitri et al., 2021) and impact future education systems. Critical thinking skills can be cultivated by optimizing innovative learning, one of which is through the selection and development of learning models. A learning model is a systematic guideline containing strategies, techniques, methods, materials, media, and assessment tools to achieve learning objectives (Rusman, 2010). Teachers need to ensure that learning models are appropriate and capable of stimulating critical thinking skills. The Problem Based Learning (PBL) and Project Based Learning (PjBL) learning models are models that can be considered because they contain indicators to assess critical thinking skills (Pratiwi & Setyaningtyas, 2020).

The PBL and PjBL learning models have been proven to be effective in improving critical thinking skills (Suradika et al., 2023), so innovative development is needed to collaborate the advantages of both models. PBL is able to optimize critical thinking skills by providing learning that is sourced from problem analysis (Perdana et al., 2020). The PBL model has the advantage of being a form of implementing meaningful learning where students learn to solve problems by maximizing all knowledge and finding out what knowledge should be used (Misla, M., & Mawardi, M., 2020). Likewise, the PjBL model has been proven effective in improving students' critical thinking skills by focusing on project planning (Musa'ad et al., 2024). The PjBL model is a form of stimulant that can provide students with a real picture of theoretical and conceptual problem solutions ((Misla, M., & Mawardi, M., 2020).

Based on this, the development of these two models results in a learning model that begins with the presentation of a problem and ends with the creation of a project to solve the problem. The combination of the PBL and PjBL learning models can improve students' critical thinking skills through observation, problem formulation, analysis, and presentation of data, which are the results of students' learning (Nursalam & Suardi, 2024). This is necessary so that students can develop critical thinking skills through problem-oriented projects. This learning model was developed with the characteristics of elementary school students in mind.

The concept of developing the learning model in this research is called the PoP (Project Based on Problem) learning model. This learning model is a collaborative innovation between problem-based learning and project-based learning models, which share the same characteristics: making students active, skilled, and reason critically, thus developing 21st-century skills, namely critical thinking skills. The PoP learning model has a coherent syntax resulting from collaboration and will be compiled into a research product in the form of a guidebook. This guidebook can be used flexibly in all forms of learning that require the PoP learning model concept in elementary schools.

2. MATERIAL AND METHOD

Research Design and Setting

This research employed a Research and Development (R&D) approach using the Borg and Gall model. The Borg and Gall Research and Development (R&D) model consists of ten systematic stages designed to develop and validate educational products or programs. The process begins with research and information collecting, where relevant literature and field data are gathered to identify problems and needs. This is followed by the planning stage, in which objectives, procedures, and designs are formulated based on the findings. The third stage involves developing a preliminary form of the product, which is then subjected to preliminary field testing to obtain feedback on its practicality and effectiveness.

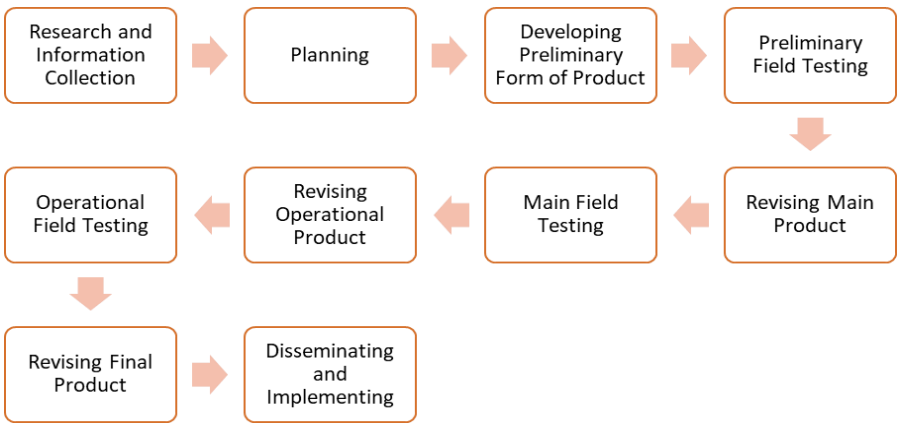

Figure 1. Research and Development Stages (Borg & Gall, 1983)

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Based on the results, revisions are made to produce an improved version for main field testing, conducted on a larger scale to assess reliability and validity. Subsequent operational product revisions ensure further refinement before operational field testing is carried out in real settings. After analyzing results from these trials, final product revisions are made to perfect the model or material. The final stage, dissemination and implementation, involves distributing the validated product and providing guidance for its effective use in relevant educational or institutional contexts. Borg and Gall research and development stages as shown in Figure 1. The Borg and Gall R&D model was used because it offers a systematic and evidence-based framework for developing, testing, and refining a new learning model. Its iterative stages ensure that the model is theoretically sound, empirically validated, and practically effective in real educational settings.

Development Procedure

The preliminary study involved research and information gathering from elementary schools in Blora Regency, conducted through interviews with fifth-grade teachers and students. The interview data were analyzed using source triangulation and described qualitatively. The planning stage involves considering preliminary study to determine the PoP learning concept, which integrates components of critical thinking ability arranged in five learning syntaxes. The initial product development of the PoP learning model was validated by language, content, and learning experts. Each expert was provided with a validation instrument containing specific indicators relevant to their area of expertise. The content expert evaluated the accuracy, relevance, and alignment of the material with the intended learning objectives. The language expert assessed grammatical accuracy, clarity, and the appropriateness of language for the target learners. Meanwhile, the learning expert reviewed the model's alignment with learning theories, the suitability of strategies and media used, and the coherence among learning components. The results of the validation were analyzed both quantitatively to determine the level of validity and qualitatively to obtain suggestions for revision, which were then used to improve the product before field testing. The PoP learning model presented in a guidebook containing learning syntax, implementation procedures, and sets of critical thinking questions. After expert validation, the model was tested through main field testing to assess its practicality and initial effectiveness, followed by operational field testing to examine its consistency and applicability in real classroom settings. The results demonstrated that the PoP learning model was both feasible and effective in enhancing elementary students' critical thinking skills.

Data Collection Instruments and Techniques

The research employed two main instruments: a critical thinking ability test and a teacher– student response questionnaire. Critical thinking skills were measured based on student learning outcomes using a 10-item essay test on the topic "Bumiku Sayang, Bumiku Malang", while the questionnaire gathered perceptions of the learning model's practicality, effectiveness, and appeal. Both instruments underwent validity testing using the Pearson Product-Moment correlation, at a significance level of $\alpha = 0.05$; items with rcount ≥ rtable were deemed valid. Internal consistency (reliability) was evaluated using Cronbach's alpha, with $\alpha \geq 0.70$ indicating acceptable reliability; additionally. These procedures ensured that the instruments were valid, internally consistent, and suitable for subsequent statistical analyses.

All questions were analyzed using Pearson's correlation through SPSS Statistics 24 and were declared valid and had a high level of reliability, with a Cronbach's alpha of 0.819. The feasibility of the PoP learning model was determined based on the results of the validated questionnaire responses through SPSS Statistics 24, which showed that ten of the 12 assessment aspects were valid, with a reliability of 0.735. The results of the student questionnaire responses were converted into qualitative data using the criteria listed in Table 1.

Table 1. Conversion of Quantitative Data to Qualitative Data

Quantitative Data	Range	Percentage	Qualitative Data
4	3,25 < M ≤ 4,00	81,26% – 100%	Very Good
3	2,50 < M ≤ 3,25	62,26% – 81,25%	Good
2	1,75 < M ≤ 2,50	43,76% – 62,25%	Less Good
1	0,00 < M ≤ 1,75	0% – 43,75%	Not Good

Source: (Widoyoko, 2014)

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The conversion of quantitative scores into qualitative categories. For example, a mean score between 3.25 and 4.00 (81.26%–100%) is classified as Very Good, enabling easier interpretation of data quality in descriptive terms.

Field Testing and Data Analysis

Preliminary field testing was conducted on 10 fifth-grade students at SDN Megeri 2 to determine the feasibility of the PoP learning model through teacher and student response questionnaire. The main field testing was conducted at SDN Megeri 1 on 20 fifth-grade students to determine the results of the pre- and post-tests of the students' critical thinking skills, which were analyzed using a Paired Sample T-Test. Operational field testing was used to determine the effectiveness of the PoP learning model in improving students' critical thinking skills, which was carried out on 40 fifth-grade students of SDN Nglebak 2. The data were analyzed using an Independent Sample T-Test by comparing the post-test data of the experimental and control classes. The data were subjected to prerequisite tests, namely, the normality and homogeneity tests. The normality test used the Shapiro–Wilk test assisted by the SPSS Statistics 24 application to determine whether the data were normally distributed based on a 5% significance level. The homogeneity test used Lavene's test to determine whether the data were homogeneous.

3. RESULTS

Teachers and students need more varied, problem-based, and project-based learning to make the material easier to understand, relevant to everyday experiences, and provide opportunities for students to produce work they can be proud of. To address these issues, researchers developed a learning model that can be applied in active, creative, and innovative learning. This model is called the PoP (Project Based on Problem) learning model.

Characteristics of the PoP Learning Model

The PoP (Project-Based on Problem) learning model was developed as a collaborative effort between Problem-Based Learning (PBL) and Project-Based Learning (PjBL) structures. This model is designed to integrate the strengths of PBL in presenting authentic problems as learning triggers with the strengths of PjBL in guiding students to produce meaningful and real-world products. This integration is systematically structured, considering indicators of critical thinking skills, so that each learning stage not only fosters conceptual understanding but also stimulates analytical, evaluation, and creative solution-making skills. The syntax of the PoP learning model is shown in Figure 2.

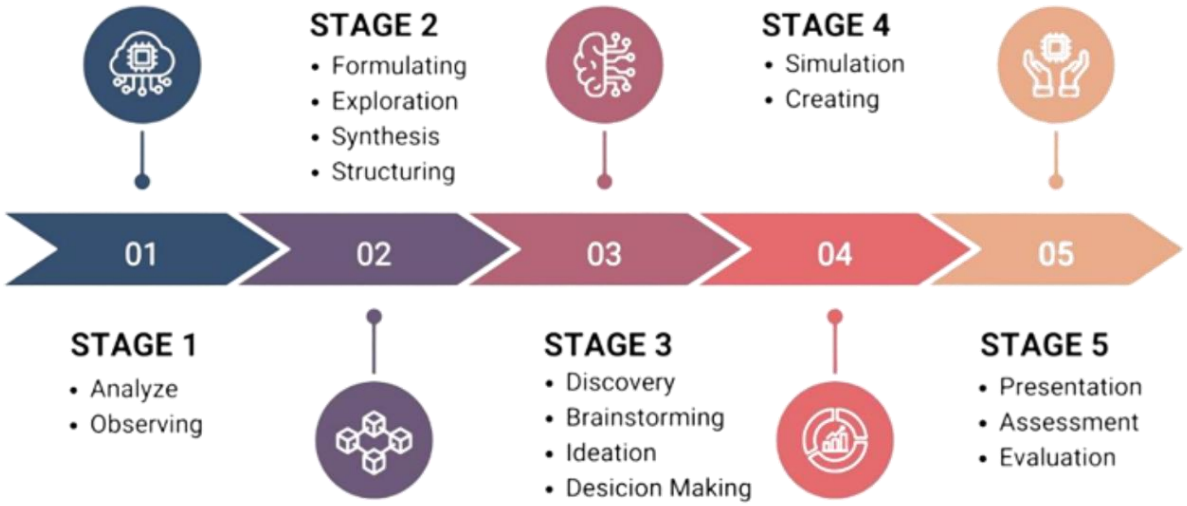

Figure 2. Conceptualization of the 5 Steps of PoP Learning

The PoP (Project-Based on Problem) learning model is developed through five stages integrated with critical thinking skill indicators. The first stage (Stage 1) is analysis and observation, where students are encouraged to recognize phenomena and identify problems through direct observation. This is because

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observing activities, supported by concrete media, can enhance conceptual knowledge, provide students with direct experience, and enable them to relate concepts to real-life objects (Tegeh et al., 2020). In the second stage (Stage 2), students formulate, explore, synthesize, and structure problems, gather information, and organize and connect concepts. These components align with problem identification indicators, which emerged as one of the most prominent aspects of critical thinking skills (Nadia & Laksono, 2021).

In the third stage (Stage 3), students engage in discovery, brainstorming, ideation, and decision- making to generate alternative solutions and select the best ones. Research results show a significant increase in students' critical thinking scores because they actively analyze information and make decisions based on their own understanding (Zahra & Suwarna, 2023). Furthermore, in the fourth stage (Stage 4), students engage in the simulation and creation process, testing ideas while producing concrete work. This aligns with findings that indicate an increase in the critical thinking evaluation phase, as students not only understand the theory but also design and implement project-based solutions (Putri et al., 2023). The fifth stage (Stage 5), which includes presentation, assessment, and evaluation, provides space for students to showcase their work and to reflect. Research shows that students respond positively and experience an increase in understanding and critical thinking skills after going through the presentation and reflection stages (Fadilah et al., 2024).

PoP Learning Syntax

The Project Based on Problem (PoP) learning model is structured into five learning syntaxes, each with its own characteristics, are presented in Table 2.

Table 2. PoP Syntax Learning Model

Syntax	Description
Problem Statement	Examine or analyze problems through observations in everyday life and then formulate relevant problems to be solved. Having a clear and relevant problem encourages students to think critically, conduct analyses, and motivates them to learn because they feel the problem is a real issue that needs to be solved (Dhianti et al., 2022).
Organizing Ideas	Formulate ideas based on the identified problem and organize potential ideas and alternative solutions. The analysis and design stages (which include idea formation) are crucial for the effectiveness of the learning tool and the development of students' critical thinking skills (Hidayati et al., 2023).
Developing a Project	Develop a project plan and design the product in greater depth through discussions or focus group discussions (FGDs). Discussions are the primary step used as part of project development and development strategy (Zahra & Masyithoh, 2024)
Creating a Product	Implement the project by creating a product based on the previously developed design or idea. Translate the plan into concrete actions, experimenting, failing if necessary, refining, and learning directly from the experience. This step is crucial because it provides real-world experience and tests students' understanding of the concepts taught (Fadillah et al., 2024).
Evaluating the Outcomes	Evaluate the project results through product presentations, reflections, and assessments of the achievement of the learning objectives. This activity evaluates not only the final product but also the context, input, process, and the product. Students' ability to identify all of these aspects demonstrates a high level of thinking ability (Yunanda et al., 2025).

Based on the basic development concepts above, five syntaxes of the PoP learning model were created, as shown in Figure 3.

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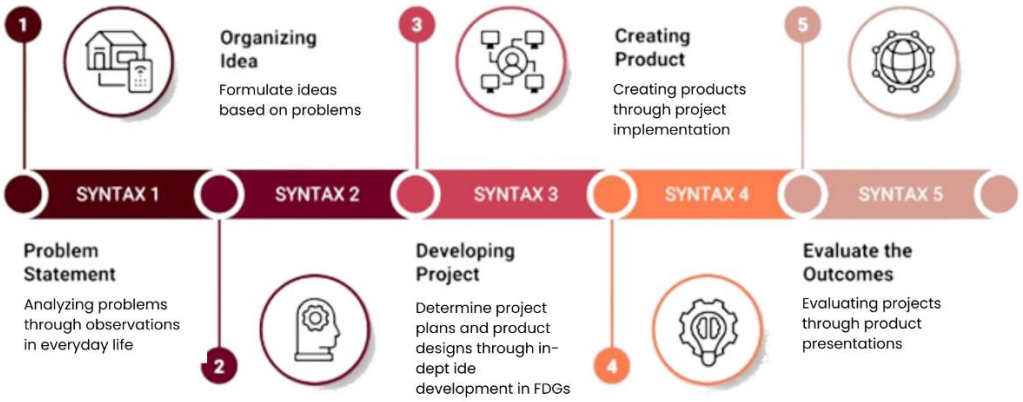

Figure 3. PoP Learning Model Syntax

Feasibility of the PoP Learning Model

The PoP Learning Model is presented in the form of an e-book. Product feasibility was demonstrated through expert validation results, including language, content, and learning experts, compiled on a 4-point scale and analyzed using descriptive percentages. The results of an initial field trial were used to determine product feasibility through questionnaire responses. The expert validation results for the PoP Learning Model guidebook are presented in Table 3.

Table 3. Expert Validation Results

Expert Validation	Assessment Score		Percentage	Category
	Before Revision	After Revision		
Content Expert	3,26	3,78	94,5 %	Very Good
Language Expert	3,78	4,00	100%	Very Good
Learning Expert	3,00	3,87	96,75%	Very Good

Based on the expert validation results, the product was revised according to the suggested improvements. The revised product was tested in an initial trial to determine the feasibility of using the PoP learning model based on teacher and student feedback. The preliminary field testing was conducted at Megeri 2 Public Elementary School in Blora Regency with 10 fifth-grade students, measured using a questionnaire. The researcher acknowledges that the study faced limitations in the number of research subjects due to institutional licensing constraints, which restricted broader participation during data collection. To address this limitation, efforts will be made to include a larger and more diverse group of subjects in subsequent testing phases to strengthen the validity, generalizability, and reliability of the research findings.

The instrument underwent validation and was declared valid with a significance value of ≤ 0.05 and reliable with a Cronbach's alpha of 0.74. The teacher response questionnaire results showed an average score of 3.81 for the technical, language, material, and instructional aspects of the PoP learning model, which was considered to be very good. The student response questionnaire results showed that 69% strongly agreed, 19.5% agreed, and 2.5% disagreed, indicating that the PoP learning model was feasible and suitable for teaching.

The main field testing phase was conducted at Megeri 1 Public Elementary School with 20 fifth- grade students to assess their critical thinking skills and provide suggestions and improvements based on the teacher and student response questionnaires. The results of the main field testing were measured based on the pretest and posttest results by examining the differences before and after using the PoP learning model. Based on the analysis of the results of main field testing, the statistical description is shown in the Table 4.

Table 4. Descriptive Statistics Main Field Testing

Group	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	20	40	77	57,35	11,426
Posttest	20	78	95	87,00	4,823

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The table indicates a clear improvement in students' performance from the pretest (Mean = 57.35) to the posttest (Mean = 87.00). This increase suggests that the learning intervention had a positive effect on students' outcomes. The pre- and post-test results were analyzed using parametric prerequisite tests and paired-sample t-tests, as shown in Table 5.

Table 5. Results of the Main Field Testing Analysis

Test	Test Type	Sign.	Decision	Conclusion
Normality				
Pretest	Shapiro Wilk	0,605	H_0 accepted	Normal data
Posttest		0,372	H_0 accepted	Normal data
Homogeneity	Levene's Test	0,291	H_0 accepted	Homogeneous data
T-Test	Paired Sample T-test	0,000	H_0 rejected	There are difference

Based on the results of the Paired Sample T-Test analysis, the significance level of 0.000 was less than α = 0.05, thus rejecting H0, indicating a difference in the pre- and post-test of fifth-grade students' critical thinking skills before and after using the PoP learning model. Further analysis was conducted to determine the magnitude of the effect of the PoP learning model treatment using Cohen's d, with the assistance of the Effect Size Calculators website. The result shows a Cohen's d value of 3.38 and an effect size r of 0.86, indicating a very large effect size based on Cohen's criteria. The results of Cohen's d analysis on main field testing are shown in the Figure 4.

Figure 4. Cohen's d Result

This means that the treatment had a strong and substantial impact on improving students' learning outcomes. The high effect size suggests that the learning model effectively enhanced students' performance. However, further testing with a larger and more diverse sample is needed to confirm the consistency and generalizability of these findings across different contexts. This is supported by the results of the teacher response questionnaire, which showed that the technical, language, material, and overall learning aspects were categorized as very good, with an average score of 3.72. The results of the student response questionnaire indicated that the PoP learning model was suitable for learning, with 79% of students strongly agreeing, 17% agreeing, and 3% disagreeing with the learning process. The results of student responses were analyzed in SPSS Statistics 24 to determine the mean and standard deviation for each questionnaire item, which are shown in Table 6.

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Table 6. Descriptive Statistics Student Response Questionnaire

Item Number	N	Minimum	Maximum	Mean	Std. Deviation
Item 1	20	3	4	3.90	0.308
Item 2	20	2	4	3.65	0.671
Item 3	20	2	4	3.55	0.605
Item 4	20	2	4	3.55	0.686
Item 5	20	2	4	3.55	0.759
Item 6	20	3	4	3.65	0.489
Item 7	20	3	4	3.85	0.366
Item 8	20	2	4	3.65	0.587
Item 9	20	2	4	3.60	0.598
Item 10	20	3	4	3.90	0.308
Item 11	20	3	4	3.85	0.366
Item 12	20	2	4	3.40	0.821

Based on the table, the mean scores for all 12 items range from 3.40 to 3.90, indicating that respondents generally gave high (very good) evaluations. The low standard deviation values show consistent responses across participants, suggesting agreement in their assessments.

Effectiveness of the PoP Learning Model

An operational field testing was conducted to determine the PoP learning model's effectiveness in improving students' critical thinking skills. The operational field testing was conducted at SDN Nglebak 2 with 40 fifth-grade students as respondents, divided into two groups: a control and an experimental group. The experimental group received treatment using the PoP learning model, whereas the control group received the teacher-directed learning process. Based on the analysis of the results of operational field testing, the statistical description is shown in the Table 7.

Table 7. Descriptive Statistics Operational Field Testing

Group	N	Minimum	Maximum	Mean	Std. Deviation
Experiment	20	60	93	78.90	9.536
Control	20	47	83	67.00	10.633

The table shows that the experimental group achieved a higher mean score compared to the control group, indicating better learning outcomes after the treatment. The data from the control and experimental groups were analyzed using parametric prerequisite tests, followed by an Independent Sample T-test to determine whether there were differences in the post-test results of the two groups' critical thinking skills. The data from the operational field trial analysis are presented in Table 8.

Table 8. Results of Operational Field Testing Analysis

Test	Test Type	Sign.	Decision	Conclusion
Normality				
Control	Shapiro Wilk	0,118	H_0 accepted	Normal data
Experiment		0, 349	H_0 accepted	Normal data
Homogeneity	Levene's Test	0,420	H_0 accepted	Homogeneous data
T-Test	Independent Sample T- test	0,002	H_0 rejected	There are difference

The operational field testing data, which had passed prerequisite testing, were then tested for effectiveness using an Independent Sample T-Test based on the gain score, which is the difference in post-test results between the control and experimental classes. The analysis showed a significance level (2-tailed) of 0.002 <α, thus rejecting H0, indicating a difference in students' thinking skills between the two groups. The analysis showed that the average critical thinking skills of the students in the experimental group were better than those

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in the control group. Based on this, the learning model was effective and capable of improving the critical thinking skills of fifth-grade students at a public elementary school in Blora.

The research produced positive results, showing that the PoP learning model effectively enhanced students' critical thinking skills. However, during implementation, several real conditions may have influenced the outcomes. Some teachers demonstrated high enthusiasm and strong classroom management, while others faced challenges adapting to the new learning syntax. In addition, differences in classroom atmosphere and student participation levels affected how smoothly the model was applied. These contextual variations may have contributed to the results; therefore, while the findings are encouraging, further research in different schools and with various teachers is needed to ensure the model's consistency and generalizability.

During the operational field trial, the product underwent revisions based on teacher observations, which were used to improve the product components. Based on the revision results, the final product was created in an e-book format, and PoP learning syntax was integrated into the learning design (teaching module). The e-book and PoP learning designs are shown in Figure 5.

Figure 5. E-book Format (left) and PoP Learning Designs (right)

4. DISCUSSION

The urgency of the emergence of learning models such as PoP (Project Based on Problem) is very real in the era of 21st-century education, where students are no longer satisfied with simply knowing facts or procedures, but must be able to face real and complex problems (Setiawan, 2021). Problem-Based Learning provides a Learning framework that focuses on problem-solving, while PjBL encourages larger projects with concrete results and presentations, collaboration, and creativity. The combination of the two through the new PoP model is crucial because it produces a learning process that not only triggers problem-solving but also builds real projects as solutions, making learning more meaningful and contextual (Habibah & Safrudin, 2024).

The PoP learning model combines problem analysis (as in PBL) and solution implementation through projects (as in PjBL), so that students learn to think critically, creatively, and collaboratively. The combined implementation of these two models has been shown to increase student motivation (Falaah et al., 2025; Nauap & Widana, 2024) as well as critical, analytical, and creative thinking skills in problem-solving (Pridayanti & Alyani, 2022; Tobing et al., 2025). PoP can encourage the development of metacognitive skills (reflection on the learning process, evaluating solutions), which are often lacking in traditional learning. When PoP is implemented well, elementary school students become accustomed to facing problems, identifying solutions, planning and implementing projects, and reflecting—all of which strengthen aspects of critical thinking (Darmawati & Mustadi, 2023; Satritama et al., 2024; Umayroh & Siregar, 2024), such as evaluating arguments, seeking evidence, and comparing alternative solutions.

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The first learning step is the problem statement, where students are invited to analyze the problem through observations in their daily lives. This activity began with watching a video about waste problems in the surrounding environment. Through this video, students were able to identify a real-world problem, namely, the accumulation of waste that disrupts the cleanliness of the school environment and their homes. The goal of problem-based learning is to start from contextual issues so that students feel close to the problem being studied and are motivated to find solutions (Misla & Mawardi, 2020; Mustaghfirin, 2022). Thus, students not only understand the problem abstractly but also feel the urgency to find alternative solutions to it. The Problem Statement stage is illustrated in Figure 6.

Figure 6. Problem Statement through Observation of Everyday Phenomena

The second step is the organizing idea. Students are invited to discuss in small groups to develop various solutions for waste problems in their surroundings. Group discussions have proven effective in fostering active student participation, critical thinking skills, and enriching the ideas emerging in problem-solving (Misla & Mawardi, 2020). The activity was expanded by inviting students to directly observe the school environment. They perform simple actions, such as picking up scattered trash, as a form of implementation of the results of the problem analysis. This activity provides a real-life learning experience that fosters environmental awareness while directly reducing waste (Putriani et al., 2022). Student involvement in real-life activities related to problem-solving can improve critical thinking skills and foster an environmentally conscious character (Suwarningsih, 2025). This finding is also supported by Syahwanti et al. (2022), who showed that elementary school students invited to participate in environmental observations and actions had a higher awareness of maintaining cleanliness and taking responsibility for their environment. The idea-organizing activity is shown in Figure 7.

Figure 7. Organizing Ideas Through Discussion and Exploration

The third step is developing a project. Students begin to develop a product design based on ideas previously generated through group discussions, considering the functional, material, and aesthetic aspects of waste processing. Students demonstrate enthusiasm in determining the design of each product created. This enthusiasm demonstrates a high level of creativity (Lestari et al., 2024; Ngabdiningsih et al., 2023). This activity accustoms students to developing projects through a thorough design, from sketching and material selection to estimating the size and operation of the final product. Furthermore, developing a project based on an idea can

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encourage students to actively participate in the actual product design (Avicenna et al., 2024; Sinta et al., 2022). The developing project activities are shown in Figure 8.

Figure 8. Developing a Project through Product Design

The fourth stage is Creating a Product, where students begin to create a tangible product based on the design they developed. Students carry out the production process confidently at each step of the creation process. This confidence grows because students feel that their ideas and designs are valued from the design stage, and they are confident in the planned concept and methods during execution. This activity also hones students' practical skills in implementing plans into tangible products (Fariza & Kusuma, 2024; Hasbullah & Mahmudah, 2024). Students involved in waste processing projects become more active in creating tangible products based on their ideas (Puspitasari et al., 2024). The developing project activities are shown in Figure 9.

Figure 9. Creating a Product Based on a Design Plan

The fifth stage is evaluating the outcomes. Students evaluate the project through a product presentation in front of the class, where they explain their ideas, the manufacturing process, and the benefits of their projects. This presentation provides a forum for sharing experiences, providing opportunities for mutual feedback, and fostering a sense of pride in their work. This pride arises because each group can demonstrate a tangible product that is the result of their creativity, collaboration, and perseverance during the project-based learning process (Puspitasari et al., 2024). This activity also fosters an appreciation for the entire process (Lestari et al., 2024), both successes and challenges encountered, as students learn that the ultimate value lies not only in the final product but also in the collaborative process that underlies it (Hasbullah & Mahmudah, 2024). The evaluation of the outcome activity is shown in Figure 10.

The entire syntax of Project Based on Problem (PoP) learning has been implemented comprehensively in teaching and learning activities, starting from the problem identification stage to the evaluation of the work results. The implementation process shows that each step has a positive impact on student engagement, both in observing, analyzing, discussing, and producing meaningful products. The limitations in this study can be further developed in terms of maximizing externally and periodically related to field trials and the resulting products. The results of the activity show an increase in the critical thinking skills of elementary school students, so that the PoP model can be declared effective for use in learning.

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Figure 10. Evaluate the Outcomes Activity

5. CONCLUSION

The Project Based on Problem (PoP) model integrates the advantages of Problem-Based Learning (PBL) and Project-Based Learning (PjBL) through five core learning phases: Problem Statement, Organizing Ideas, Developing Projects, Creating Products, and Evaluating Outcomes. Each phase offers a structured learning progression, beginning with problem identification and analysis, moving to solution development, project design, product creation, and outcome assessment. These features demonstrate that PoP emphasizes not only problem-solving but also cultivates practical skills, collaboration, and creativity through projects relevant to students' real-world experiences.

The implementation of the PoP learning model for fifth-grade students at a public elementary school in Blora Regency has undergone various testing stages and has been declared suitable for use in elementary school contexts. Each syntax has been proven to work in accordance with learning objectives, has a positive impact on student engagement, and improves the quality of the classroom learning process. Observations and evaluations indicate that the PoP implementation is effective in developing students' critical thinking skills, as students not only understand problems but also are trained to process ideas, make decisions, and generate concrete solutions through their work. Therefore, the PoP model can be recommended as an innovative alternative to improve the quality of learning in elementary schools, particularly in the context of developing 21st-century critical thinking skills.

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7. REFERENCES

Alimudin, Z. (2019). *The new you: Petakan ulang hidupmu*. Buku Kita.

Aprilia, R. S., Firmanti, P., Tasnim Rahmat, & Rusdi, R. (2024). Analisis Kemampuan Berpikir Kritis Siswa dalam Menyelesaikan Soal PISA di Kelas IX-F SMP Negeri 1 Bukitiinggi. *Indo-MathEdu Intellectuals Journal*, *5*(4), 5111–5118. https://doi.org/10.54373/imeij.v5i4.1737

Asna, F. A. (2024). Upaya meningkatkan keterampilan berpikir kritis peserta didik pada pembelajaran IPA dengan pendekatan berbasis STEM-PjBL. *Proceeding Seminar Nasional IPA*, 312–320. https://proceeding.unnes.ac.id/snipa/article/view/3690

Avicenna, A. F., Suhartono, S., & Suryandari, K. C. (2024). Peningkatan kreativitas produk menggunakan model projects based learning (PjBL) pada pembelajaran IPA siswa kelas V SD. *Kalam Cendekia: Jurnal Ilmiah Kependidikan, 12*(1). https://doi.org/10.20961/JKC.V12I1.75949

Borg, W. R., & Gall, M. D. (1983). *Educational research: An introduction* (4th ed.). Longman.

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v9i2.109367

Darmawati, Y., & Mustadi, A. (2023). The effect of problem-based learning on the critical thinking skills of elementary school students. *Jurnal Prima Edukasia, 11*(2), 142–151. https://doi.org/10.21831/JPE.V11I2.55620

Darmuki, A., & Hidayati, N. A. (2023). Model project based learning untuk meningkatkan keterampilan berpikir tingkat tinggi. *Jurnal Educatio FKIP UNMA, 9*(1), 15–22. https://doi.org/10.31949/EDUCATIO.V9I1.3064

Dhianti, L., Purwanto, S., & Murdiyanto, T. (2022). Pengaruh pembelajaran online berbasis masalah terhadap peningkatan kemampuan berpikir kritis matematis ditinjau dari motivasi belajar siswa. *Jurnal Riset Pembelajaran Matematika Sekolah, 6*(1), 48–52. https://doi.org/10.21009/JRPMS.061.05

Fadilah, N., Suhartini, S., & Aloysius, S. (2024). Fostering critical thinking: Designing problem-based learning student worksheet on environmental change topic. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *10*(1), 291–298. https://doi.org/10.22219/jpbi.v10i1.30931

Fadillah, U. A., Restian, A., & Suhartanti, N. (2024). Penerapan model pembelajaran PjBL dengan proyek konkret ARESATIK untuk meningkatkan hasil belajar siswa kelas V SDN Punten 01 Batu. *Pendas: Jurnal Ilmiah Pendidikan Dasar, 9*(3), 555–565. https://doi.org/10.23969/JP.V9I3.18252

Falaah, M. Y., Ardianti, S. D., & Ratnasari, Y. (2025). Increasing student learning interest using the problem based learning (PBL) learning model assisted by puzzle media in science learning for grade IV of Kayuapu Elementary School. *PIONIR: Jurnal Pendidikan, 14*(1), 182–190. https://doi.org/10.22373/PJP.V14I1.25742

Fariza, N. A., & Kusuma, I. H. (2024). Implementasi model pembelajaran berbasis proyek dalam meningkatkan kreativitas siswa sekolah dasar. *Pubmedia Jurnal Penelitian Tindakan Kelas Indonesia, 1*(3), 10–10. https://doi.org/10.47134/PTK.V1I3.453

Habibah, N., & Safrudin, S. (2024). Penerapan model pembelajaran project based learning (PjBL) untuk meningkatkan keterampilan menulis siswa kelas IV SD Negeri 026 Tambusai. *Jurnal Pendidikan Tambusai, 8*(3), 43570–43580. https://jptam.org/index.php/jptam/article/view/20810

Hasbullah, H., & Mahmudah, M. (2024). Pengembangan Kurikulum Berbasis Proyek untuk Meningkatkan Kreativitas dan Kolaborasi Siswa. *Jurnal Pendidikan Dan Kewirausahaan*, *12*(3), 987- 1000. https://doi.org/10.47668/pkwu.v12i3.1507

Hidayati, R.W., Siswono, T. Y. E., & Sendi, S. (2023). Development of Problem-Based Mathematical Learning Tools to Improve Critical Thinking Skills of Grade V Elementary School Students. *Jurnal Teknologi Pendidikan : Jurnal Penelitian Dan Pengembangan Pembelajaran*, *8*(3), 707–713. https://doi.org/10.33394/jtp.v8i3.8625

Kwon, T. (2020). The effects of the use of literature in intercultural language teaching and learning on Thai students' critical reading skills and cultural awareness. *Payap University Journal, 30*(1), 16–25.

Lestari, E. A., Fardani, M. A., & Fajrie, N. (2024). Pengaruh model project based learning dengan memanfaatkan limbah plastik untuk meningkatkan kreativitas siswa kelas V sekolah dasar. *Jurnal Pendidikan Dasar Perkhasa, 10*(2), 899–917. https://doi.org/10.31932/JPDP.V10I2.3786

Misla, M., & Mawardi, M. (2020). Efektivitas PBL dan problem solving siswa SD ditinjau dari kemampuan berpikir kritis. *Jurnal Ilmiah Sekolah Dasar, 4*(1), 60–65. https://doi.org/10.23887/JISD.V4I1.24279

Musa'ad, F., Ahmad, R. E., Sundari, S., & Hidayani, H. (2024). Pembelajaran berbasis proyek untuk meningkatkan kemampuan berpikir kritis siswa. *Jurnal Cendekia: Jurnal Pendidikan Matematika, 8*(2), 1481–1487. https://doi.org/10.31004/CENDEKIA.V8I2.3361

Mustaghfirin. (2022). Pengaruh penerapan problem-based learning terhadap motivasi siswa SMP. *Journal of Informatics and Vocational Education, 5*(3), 113–122. https://doi.org/10.20961/JOIVE.V5I3.70708

Nababan, T. S. (2019). Development analysis of Global Competitiveness Index of ASEAN-7 countries and its relationship on gross domestic product. *Integrated Journal of Business and Economics, 3*(1), 1. https://doi.org/10.33019/ijbe.v3i1.108

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v9i2.109367

Nadia, F. I., & Laksono, E. W. (2021). Investigating students' critical thinking skill in chemical equilibrium using the discovery learning. *Jurnal Kependidikan: Penelitian Inovasi Pembelajaran, 5*(1), 45–59. https://doi.org/10.21831/JK.V5I1.40337

Nauap, Z. A., & Widana, I. W. (2024). Application of problem-based learning (PBL) model and project-based learning (PjBL) in learning mathematics in elementary schools. *International Journal of Educational Technology and Society, 1*(4), 25–36. https://doi.org/10.61132/IJETS.V1I4.152

Ngabdiningsih, S. W., Darmadi, D., & Rivaningsih, S. A. (2023). Meningkatkan kreativitas siswa melalui model pembelajaran project based learning (PjBL) pada materi IPA kelas VII di SMP Negeri 1 Sumberrejo. *Reforma: Jurnal Pendidikan dan Pembelajaran, 13*(1), 52–72. https://doi.org/10.30736/RF.V13I1.818

Nursalam, N., & Suardi, S. (2024). Learning innovation combination of project based learning and problem based learning based on research and devotion. *JED (Jurnal Etika Demokrasi), 9*(1), 101–113. https://doi.org/10.26618/JED.V9I1.14401

OECD. (2023). *PISA 2022 Results (Volume I): The state of learning and equity in education*. OECD Publishing. https://doi.org/10.1787/53f23881-en

Perdana, R., Rudibyani, R. B., Budiyono, Sajidan, & Sukarmin. (2020). The effectiveness of Inquiry Social Complexity to improving critical and creative thinking skills of senior high school students. *International Journal of Instruction, 13*(4), 477–490. https://doi.org/10.29333/iji.2020.13430a

Ploysangwal, W. (2018). An assessment of critical thinking skills of Thai undergraduate students in private Thai universities in Bangkok through an analytical and critical reading test. *UTCC Journal Humanities and Social Sciences, 38*(3), 75–91. https://so06.tci-thaijo.org/index.php/utccjournalhs/article/view/158002

Pratiwi, E. T., & Setyaningtyas, E. W. (2020). Kemampuan berpikir kritis siswa melalui model Problem Based Learning dan Project Based Learning. *Jurnal Basicedu, 4*(2), 379–388. https://doi.org/10.31004/basicedu.v4i2.362

Pridayanti, S., & Alyani, F. (2022). The effect of problem based learning (PBL) method on students' critical thinking ability in fifth grade science learning in elementary schools. *Unnes Science Education Journal, 11*(2), 84–89. https://doi.org/10.15294/USEJ.V11I2.57386

Puspitasari, D., Muhlis, M., Inayah, F., Ristiana, E., Saleh, A. R., & S., M. I. (2024). Project based learning pengolahan sampah pada siswa SD Muhammadiyah 3 Makassar. *Jurnal Abdimas Indonesia, 4*(1), 97–104. https://doi.org/10.53769/JAI.V4I1.658

Putri, A. J., Sukmono, T., & Wicaksana, E. J. (2023). The influence of problem based learning (PBL) model based on STEM approach on critical thinking ability Phase-E in biology learning. *Jurnal Penelitian Pendidikan IPA, 9*(9), 7056–7063. https://doi.org/10.29303/JPPIPA.V9I9.4568

Putriani, I., Malahayati, E. N., & Sholihah, M. (2022). Pengolahan sampah organik untuk mewujudkan budaya sekolah berwawasan lingkungan di SDN Kanigoro 03 Kabupaten Blitar. *Panrita Abdi, 6*(4), 729–738. https://journal.unhas.ac.id/index.php/panritaabdi/article/view/21328/8484

Satritama, M. R., Altaftazani, D. H., & Nurfurqon, F. F. (2024). Use of problem based learning models to improve primary school students' critical thinking ability. *Journal of Educational Experts*, 7(2), 103–110. https://doi.org/10.30740/jee.v7i2.236

Rusman. (2010). *Model-model pembelajaran (Mengembangkan profesionalisme guru, edisi kedua)* (2nd ed.). Raja Grafindo Persada.

Setiawan, A. (2021). Problem based learning (PBL) model for the 21st century generation. *Social, Humanities, and Educational Studies (SHES): Conference Series, 4*(6), 290–296. https://doi.org/10.20961/SHES.V4I6.68457

Setyowati, R., Sarwanto, & Muzzazinah. (2021). How students' higher order thinking skills through e-learning during the COVID-19 pandemic? What does it have to do with university? *Journal of Physics: Conference Series, 1808*(1), 012032. https://doi.org/10.1088/1742-6596/1808/1/012032

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v9i2.109367

Sinta, M., Sakdiah, H., Novita, N., Ginting, F. W., & Syafrizal, S. (2022). Penerapan model pembelajaran project based learning (PjBL) untuk meningkatkan kemampuan berpikir kreatif siswa pada materi hukum gravitasi Newton di MAS Jabal Nur. *Jurnal Phi (Jurnal Pendidikan Fisika dan Fisika Terapan), 8*(1), 24–28. https://doi.org/10.22373/P-JPFT.V8I1.14546

Supa'at, S., & Ihsan, I. (2023). The challenges of elementary education in Society 5.0 era. *International Journal of Social Learning (IJSL), 3*(3), 341–360. https://doi.org/10.47134/ijsl.v3i3.214

Suradika, A., Dewi, H. I., & Nasution, M. I. (2023). Project-based learning and problem-based learning models in critical and creative students. *Jurnal Pendidikan IPA Indonesia, 12*(1), 153–167. https://doi.org/10.15294/jpii.v12i1.39713

Suwarningsih, T. (2025). Pengaruh PjBL berbasis isu lingkungan terhadap sikap peduli lingkungan siswa di SD Negeri 1 Abepura. *Indonesian Research Journal on Education, 5*(3), 882–888. https://doi.org/10.31004/IRJE.V5I3.3316

Syafitri, E., Armanto, D., & Rahmadani, E. (2021). Aksiologi kemampuan berpikir kritis (Kajian tentang manfaat dari kemampuan berpikir kritis). *Journal of Science and Social Research, 4*(3), 320–325. https://doi.org/10.54314/JSSR.V4I3.682

Syahwanti, H., Wahyu, Z., & Anggraini, I. M. (2022). Meningkatkan pemahaman peduli lingkungan bersih dengan pemilahan sampah di SD Negeri 24 Pontianak Timur. *GERVASI: Jurnal Pengabdian Kepada Masyarakat, 6*(2), 444–451. https://journal.upgripnk.ac.id/index.php/gervasi/article/view/3529

Tegeh, I. M., Parwata, I. G. L. A., & Ostaviani, B. G. (2020). *The observing learning activity assisted by concrete media improves student's conceptual knowledge*. *Jurnal Pendidikan Indonesia*, 9(2), 182–192. https://doi.org/10.23887/jpi-undiksha.v9i2.25206

Tobing, M. R. L., Thesalonika, E., & Purba, N. (2025). The effect of project based learning model on students' critical thinking abilities in the science subject of grade V UPTD SDN 124385 Pematangsiantar. *MSJ: Majority Science Journal, 3*(2), 28–38. https://doi.org/10.61942/MSJ.V3I2.324

Umayroh, R., & Siregar, N. (2024). The effect of project-based learning (PjBL) model on students' critical thinking skills on building space material in elementary school. *ELSE (Elementary School Education Journal): Jurnal Pendidikan dan Pembelajaran Sekolah Dasar, 8*(3). https://doi.org/10.30651/ELSE.V8I3.23853

Utami, N. R. R. (2024). Pembelajaran daring di sekolah dasar Kecamatan Kradenan Kabupaten Blora. *AL-MIKRAJ Jurnal Studi Islam dan Humaniora, 4*(02), 186–206. https://doi.org/10.37680/ALMIKRAJ.V4I02.4607

Widoyoko, E. P. (2014). *Teknik penyusunan instrumen penelitian*. Pustaka Pelajar.

Yunanda, A. F., Damanik, J. D., Nissa, S. M., & Syahrial. (2025). Evaluasi pembelajaran berbasis proyek pada materi magnet, listrik, dan teknologi untuk kehidupan di kelas 5 SD dengan model CIPP. *GURUKU: Jurnal Pendidikan dan Sosial Humaniora, 3*(3), 20–23. https://doi.org/10.59061/guruku.v3i3.1056

Zahra, N., & Masyithoh, S. (2024). Strategi pembelajaran berbasis proyek pada anak sekolah dasar. *ELSCHO: Jurnal Pendidikan Guru Sekolah Dasar, 2*(2). https://doi.org/10.25299/ELSCHO.2024.17079

Zahra, S., & Suwarna, I. P. (2023). Exploration of increasing students' critical thinking in the guided discovery learning model on light waves. *Jurnal Ilmiah Pendidikan Fisika, 7*(2), 354–368. https://doi.org/10.20527/JIPF.V7I2.9141

p-ISSN: 2597-7792 / e-ISSN: 2549-8525
DOI: https://doi.org/10.20961/ijpte.v9i2.109367