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Enhancing Elementary Students' Critical Thinking Skills through Project-Based Learning in IPAS Learning

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ABSTRACT

This study is motivated by the low level of critical thinking skills among fifth-grade students in IPAS learning. Critical thinking skills are essential competencies in the 21st century that enable students to analyze information, evaluate ideas, and draw conclusions based on evidence. However, research examining the implementation of Project-Based Learning (PjBL) to develop critical thinking skills in elementary IPAS learning within the Merdeka Curriculum context remains limited. This study aims to improve students' critical thinking skills through the implementation of Project-Based Learning in IPAS learning. This study employed Classroom Action Research (CAR) using the Kemmis and McTaggart model consisting of planning, action, observation, and reflection stages. The participants were 20 fifth-grade students. Data were collected through critical thinking observation sheets and essay tests based on analysis, evaluation, and inference indicators. The instruments were validated through expert judgment to ensure alignment between the assessment indicators and research objectives. Data were analyzed using qualitative and quantitative descriptive analysis. The results showed that PjBL improved students' critical thinking skills through continuous improvement across cycles. The percentage of students achieving mastery increased from 20% (4 students) in the pre-cycle stage to 60% (12 students) in Cycle I and 95% (19 students) in Cycle II. The findings indicate that PjBL supports students' critical thinking development through investigation, project completion, discussion, and reflection activities. Therefore, PjBL has potential as an alternative learning model to support elementary students' critical thinking skills development in IPAS learning.

Keywords: *Project-Based Learning; Critical Thinking Skills; IPAS Learning; Elementary School; Classroom Action Research*

ABSTRAK

Penelitian ini dilatarbelakangi oleh rendahnya keterampilan berpikir kritis peserta didik kelas V pada pembelajaran IPAS. Keterampilan berpikir kritis merupakan salah satu kompetensi penting abad ke-21 yang perlu dikembangkan melalui pembelajaran yang melibatkan peserta didik dalam proses berpikir tingkat tinggi.

Penelitian ini bertujuan untuk meningkatkan keterampilan berpikir kritis peserta didik melalui penerapan model Project-Based Learning (PjBL) pada pembelajaran IPAS. Metode penelitian yang digunakan adalah Penelitian Tindakan Kelas (PTK) dengan model Kemmis dan McTaggart yang meliputi tahap perencanaan, pelaksanaan tindakan, observasi, dan refleksi. Subjek penelitian terdiri atas 20 peserta didik kelas V. Data penelitian dikumpulkan melalui lembar observasi keterampilan berpikir kritis dan tes esai yang disusun berdasarkan indikator berpikir kritis, yaitu analisis, evaluasi, dan inferensi. Data dianalisis menggunakan analisis deskriptif kuantitatif dan kualitatif. Hasil penelitian menunjukkan bahwa penerapan PjBL dapat meningkatkan keterampilan berpikir kritis peserta didik secara bertahap pada setiap siklus. Persentase peserta didik yang mencapai ketuntasan meningkat dari 20% (4 peserta didik) pada tahap prasiklus menjadi 60% (12 peserta didik) pada siklus I dan mencapai 95% (19 peserta didik) pada siklus II. Temuan penelitian menunjukkan bahwa PjBL mendukung pengembangan keterampilan berpikir kritis melalui kegiatan penyelidikan masalah, penyelesaian proyek, diskusi, dan refleksi. Dengan demikian, PjBL dapat menjadi alternatif model pembelajaran untuk mendukung pengembangan keterampilan berpikir kritis peserta didik sekolah dasar pada pembelajaran IPAS.

Kata Kunci: *Project-Based Learning; Keterampilan Berpikir Kritis; IPAS; Sekolah Dasar; Penelitian Tindakan Kelas*

INTRODUCTION

In line with the rapid development of the education sector, the fulfillment of educational needs for relevant skills has become a major issue. Therefore, the development of 21st-century skills is considered a strategic step in preparing students to face various challenges in the future. Education in the 21st century requires a shift from teacher-centered learning toward student-centered learning that emphasizes students' active involvement, thinking abilities, and learning skills (Sunita et al., 2024). Student-centered learning approaches provide opportunities for students to actively construct knowledge through meaningful learning experiences, collaboration, and problem-solving activities (Kokotsaki et al., 2016). In accordance with the implementation of the Merdeka Curriculum in Indonesia, students are expected to master the 4C competencies, namely critical thinking, creativity, communication, and collaboration. Among these competencies, critical thinking is considered one of the essential skills because it enables students to understand information, analyze problems, evaluate ideas, and make logical decisions in various learning contexts.

Rahardhian (2022) explains that critical thinking is a reflective thinking process and an important cognitive ability that enables individuals to analyze information, evaluate ideas, and find rational solutions through learning experiences. Hasanah et al. (2023) state that critical thinking involves analyzing information, evaluating arguments, and drawing logical conclusions. Ariadilla et al. (2023) state that critical thinking is the ability to recognize errors in reasoning, especially in analyzing information rationally and logically. Juliyantika & Batubara (2022) describe critical thinking as a cognitive process that encourages students to think reflectively. Furthermore, Facione (as cited in Hadi, 2020) explains that critical thinking consists of several indicators, including analysis, evaluation, and inference. Ennis (2018) defines critical thinking as reasonable and reflective thinking focused on deciding what to believe or do. This perspective emphasizes that critical thinking involves not only cognitive processes but also the ability to make decisions based on logical reasoning and evidence. These indicators are relevant in elementary learning because students need to develop the ability to understand problems, evaluate information, and construct conclusions based on evidence. Critical thinking is an essential skill that students must possess in order to face challenges in

the digital era (Wahyuningsih et al., 2025). Therefore, critical thinking skills need to be developed from elementary school so that students are able to face various learning and life challenges in the future.

However, the implementation of critical thinking skills development in elementary schools still faces several challenges. Based on initial observations conducted in Grade V at SD Negeri 5 Jungjang, students' critical thinking skills were still relatively low. Students experienced difficulties in analyzing problems, evaluating information, and inference during the learning process. This condition occurred because learning activities were still dominated by teacher explanations, while students had limited opportunities to explore concepts, express ideas, discuss, and solve problems independently. Teachers also tended to focus on completing learning materials rather than providing meaningful learning experiences that could encourage students' higher-order thinking skills. Therefore, appropriate learning innovations are needed to create learning environments that actively involve students in developing critical thinking skills.

In relation to the development of critical thinking skills, IPAS learning has an important role in providing meaningful learning experiences for elementary school students. IPAS, as an integration of science and social studies in the Merdeka Curriculum, encourages students to understand natural and social phenomena through investigation and contextual learning activities. Science learning is a process of constructing knowledge through observation of natural phenomena and systematic scientific methods (Kumala, 2016). Science learning requires students' active participation in understanding and applying scientific concepts, while teachers act as facilitators in supporting the learning process (Pahru et al., 2025). Wijaya et al. (2025) state that science learning based on the nature of science encourages students to understand scientific concepts through observation, inquiry, and evidence-based reasoning, which are important processes in developing scientific literacy and critical thinking skills. Uneng et al. (2022) explains that science is a branch of knowledge that studies natural phenomena factually through observation and investigation. Furthermore, research in science education highlights that inquiry-based scientific practices involving investigation, evidence analysis, and reasoning processes are important for developing students' scientific thinking and critical thinking abilities (García-Carmona, 2023).

One learning model that can support the development of students' critical thinking skills is Project-Based Learning (PjBL). PjBL is a student-centered learning model that emphasizes investigation, problem-solving, collaboration, and the creation of meaningful products. Nugraha et al. (2023) state that PjBL emphasizes the concept of learning by doing, which allows students to actively engage in inquiry and problem-solving processes. Nugraha (2021) explains that PjBL is a project-based learning model that encourages students to participate actively and develop clear concepts through learning experiences. Nababan et al. (2023) emphasize that PjBL encourages students to actively construct knowledge through systematic project activities. Furthermore, PjBL positions teachers as facilitators who guide students in designing, implementing, and evaluating projects (Rehani & Mustofa, 2023). PjBL also emphasizes the process of systematically designing and completing projects (Subiyantoro, 2025), allowing students to explore real-world problems and construct knowledge through meaningful learning experiences (Tanjung et al., 2025). Loyens et al. (2023) explain that PjBL provides

opportunities for students to develop higher-order thinking skills through investigation, collaboration, and problem-solving activities. These activities encourage students to analyze problems, evaluate information, and draw conclusions based on evidence, which are important indicators of critical thinking skills.

Previous studies have shown that the implementation of Project-Based Learning (PjBL) can contribute to improving students' critical thinking skills. Fitriani & Istianti (2017) found that PjBL improved elementary students' critical thinking skills in Social Studies learning. Similarly, Suharyati & Sakura (2023) reported that the implementation of PjBL improved students' critical thinking skills in Civic Education learning at the elementary school level. Winarti et al. (2022) also revealed that PjBL could improve elementary students' critical thinking skills through meaningful learning activities. International research confirms that PjBL supports students' cognitive development through authentic tasks involving analysis, evaluation, collaboration, and decision-making processes (Guo et al., 2020). However, previous studies have mainly focused on specific subjects or general learning contexts, while research examining how PjBL facilitates the development of specific critical thinking indicators in IPAS learning within the Merdeka Curriculum context remains limited. Similar findings were reported by Zhang et al. (2024), who found that project-based learning activities could enhance students' higher-order thinking skills through active exploration, collaboration, and problem-solving processes.

Therefore, this study contributes empirical evidence regarding the implementation process of Project-Based Learning in IPAS learning through Classroom Action Research to improve elementary students' critical thinking skills. Unlike previous studies that mainly examined PjBL outcomes in specific subjects, this study focuses on how PjBL activities facilitate students in developing critical thinking indicators, including analyzing, evaluating, and drawing conclusion during classroom learning. The purpose of this study was to improve fifth-grade students' critical thinking skills through the implementation of Project-Based Learning in IPAS learning.

METHODS

Type and Design

This study employed Classroom Action Research (CAR), which aims to improve the quality of learning practices through systematically planned actions in the classroom. Classroom Action Research is a reflective research activity conducted to identify problems, implement improvements, and evaluate the effects of actions taken during the learning process (Maolani & Cahyana, 2016).

This study applied the Classroom Action Research model developed by Kemmis and McTaggart, which consists of four stages: planning, action, observation, and reflection. The research was conducted in two cycles because the expected improvement in students' critical thinking skills had not been fully achieved in the first cycle. Each cycle consisted of planning, implementation of action, observation, and reflection activities.

In the planning stage, the researcher prepared lesson modules based on the Project-Based Learning (PjBL) model, learning media, student worksheets, observation sheets, and critical thinking assessment instruments. In the action stage, the researcher implemented IPAS

learning using the PjBL syntax, including determining essential questions, designing project plans, preparing project schedules, monitoring project activities, assessing project results, and evaluating learning experiences. In the observation stage, the researcher and observer recorded teacher activities, student participation, and students' critical thinking skills during the learning process. In the reflection stage, the researcher analyzed the results of each cycle to determine the improvements required for the next cycle.

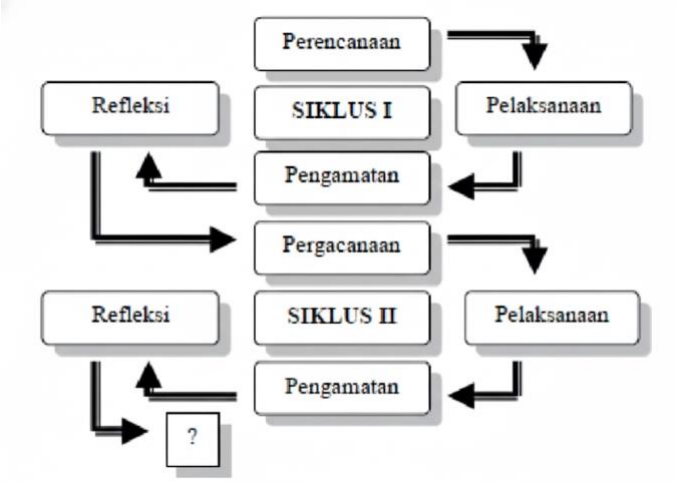

Figure 1. Classroom Action Research Model of Kemmis and McTaggart

This study was conducted in Grade V of SD Negeri 5 Jungjang, Arjawinangun District, Cirebon Regency. The research subjects consisted of 20 students, including 13 female students and 7 male students, with an age range of 9–10 years. The research location was selected based on initial observations indicating that students' critical thinking skills during IPAS learning were still relatively low.

Before conducting the research, the researcher obtained permission from the school principal and the Grade V teacher. Information regarding the research activities was provided to students and parents. The researcher ensured that students' identities and collected data were kept confidential and were only used for research purposes.

Data and Data Sources

The data in this Classroom Action Research consisted of qualitative and quantitative information related to the implementation of Project-Based Learning (PjBL) and the improvement of students' critical thinking skills in IPAS learning.

The primary data were obtained from teacher activity observations, student learning activity observations, students' critical thinking skills observation sheets, and students' critical thinking skills test results. Supporting data sources included lesson modules, student worksheets, learning documentation, and learning media in the form of ecosystem dioramas used during the learning process on ecosystem topics, particularly the distribution of flora and fauna in Indonesia.

Data Collection Technique

Data collection techniques were used to obtain information regarding the implementation of Project-Based Learning and the improvement of students' critical thinking skills. The data collection techniques consisted of observation and tests.

1. Observation

   Observation was conducted during the learning process to obtain data regarding the implementation of PjBL, teacher performance, student learning activities, and students' critical thinking skills. The observation instruments consisted of teacher activity observation sheets, student activity observation sheets, and students' critical thinking skills observation sheets.

   The students' critical thinking skills observation sheet was developed based on three indicators of critical thinking proposed by Facione, namely analysis, evaluation, and inference. The analysis indicator focused on students' ability to identify problems, examine relevant information, and determine relationships between concepts. The evaluation indicator assessed students' ability to assess information, provide logical arguments, and evaluate solutions based on evidence. The inference indicator measured students' ability to formulate conclusions based on investigation results and discussions during the learning process.

2. Test

   Tests were administered to measure students' critical thinking skills after implementing the Project-Based Learning model in IPAS learning. The test instrument consisted of three essay questions administered at the end of each cycle.

   The essay questions were developed based on critical thinking indicators of analysis, evaluation, and inference. Each question was designed according to IPAS learning objectives and ecosystem materials. Students' answers were assessed using a scoring rubric with criteria covering the ability to identify problems, explain ideas logically, evaluate information based on evidence, and formulate appropriate conclusions. The scoring rubric was used consistently for all students' responses to maintain assessment consistency.

   To ensure alignment between the assessment instrument and the critical thinking indicators, the distribution of essay questions is presented in Table 1.

Table 1. Distribution of Essay Questions Based on Critical Thinking Indicators

Question	Critical Thinking Indicator	Description
Question 1	Analysis	Identifying problems, relevant information, and relationships among concepts related to ecosystem issues
Question 2	Evaluation	Evaluating information, arguments, and solutions based on available evidence
Question 3	Inference	Drawing conclusions and proposing solutions based on investigation

	results and supporting evidence

The test instrument was validated through expert judgment involving experts in elementary education and IPAS learning. The validation process was conducted to ensure the suitability of content, clarity of questions, and alignment between the instrument and research objectives. Revisions were made based on suggestions provided by validators before the instruments were implemented.

Data analysis

The collected data were analyzed using quantitative and qualitative descriptive analysis. Quantitative analysis was used to determine improvements in students' critical thinking skills based on essay test results in each cycle. Qualitative analysis was used to describe the implementation process of Project-Based Learning, teacher activities, student learning activities, and changes in students' critical thinking behaviors during the learning process.

1. Quantitative Data Analysis

   Quantitative data were obtained from students' critical thinking skills test results administered at the end of each cycle. The results were analyzed by calculating the mean score and the percentage of students achieving mastery based on the Learning Objectives Achievement Criteria (KKTP) established by the school. The improvement of students' critical thinking skills was determined by comparing the results obtained during the pre-cycle, Cycle I, and Cycle II.

   The mean score was calculated using the following formula:

   a. Mean Score

$$\bar{x} = \frac{\sum x}{\sum N}$$

   Where:

   $\bar{x}$= Mean score

   $\sum x$ = Total score obtained by all students

   $\sum N$ = Total number of students

   The percentage of students achieving mastery was calculated using the following formula:

$$\text{Mastery Percentage} = \frac{\text{Number of students achieving mastery}}{\text{Total number of students}} \text{ x } 100\%$$

   Students were categorized as achieving mastery when their scores reached the Learning Objectives Achievement Criteria (KKTP) determined by the school, which was 75.

2. Qualitative Data Analysis

   Qualitative data analysis was conducted based on observation results obtained during the implementation of Project-Based Learning. The data sources included teacher

performance observation sheets, student learning activity observation sheets, and students' critical thinking skills observation sheets.

The observation data were analyzed descriptively to describe changes in the learning process, student involvement, and the development of students' critical thinking skills during each cycle.

The observation scores were calculated using the following formula:

$$\text{Observation Percentage} = \frac{\text{Obtained Score}}{\text{Maximum Score}} \times 100\%$$

The percentage results obtained from the observation instruments were interpreted based on the criteria for action success presented in Table 2

Table 2. Criteria for Action Success

Percentage Of Action Success	Success Level
80-100%	Very Good
60-79%	Good
40-59%	Fair
10-39%	Poor
0-9%	Very Poor

RESULTS AND DISCUSSION

Result

This study was conducted using Classroom Action Research (CAR) through two cycles by implementing the Project-Based Learning (PjBL) model in IPAS learning. The research results include the quality of learning modules, teacher performance, student learning activities, students' critical thinking skills based on observation results, and students' critical thinking skills based on essay test results.

1. Learning Module Results

The learning module assessment was conducted to determine the quality of learning planning developed based on the Project-Based Learning (PjBL) model. The results of the learning module assessment are presented in Table 3 and Figure 2.

Table 3. Recapitulation of Learning Module Results

Cycle	Number of Achieved Indicators	Percentage
Pre-cycle	17 of 27 indicators	62,97%
Cycle I	26 of 27 indicators	96,30%
Cycle II	27 of 27 indicators	100%

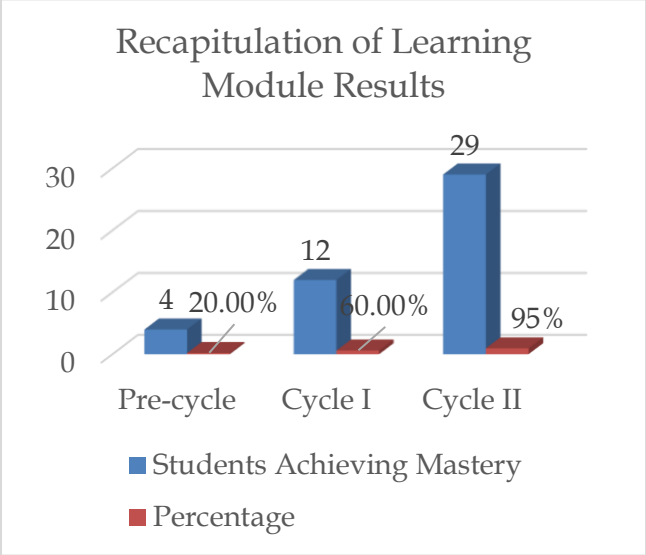

Figure 2. Recapitulation of Teaching Module Result

Based on Table 3, the quality of the learning module increased in each cycle. In the pre-cycle stage, 17 of 27 indicators were achieved, with a percentage of 62.97%. After improvements were made through the implementation of Project-Based Learning, the achievement increased to 96.30% in Cycle I and reached 100% in Cycle II. These results indicate that the learning planning developed by the researcher became increasingly aligned with the characteristics of PjBL, including problem orientation, project planning, investigation activities, and evaluation processes.

2. Teacher Performance Results

Teacher performance observations were conducted during the implementation of the Project-Based Learning model. The results of teacher performance observations are presented in Table 4 and Figure 3.

Table 4. Recapitulation of Teacher Performance Results

Cycle	Number of Achieved Indicators	Percentage
Pre-cycle	13 of 21 indicators	61,91%
Cycle I	18 of 21 indicators	85,71%
Cycle II	21 of 21 indicators	100%

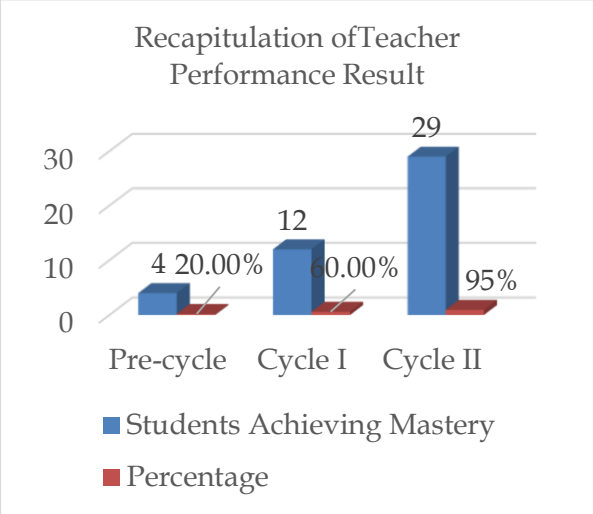

Figure 3. Recapitulation of Teacher Performance Results

Based on Table 4, teacher performance showed continuous improvement throughout the research cycles. In the pre-cycle stage, teacher performance reached 61.91%. After implementing PjBL, teacher performance increased to 85.71% in Cycle I and reached 100% in Cycle II. This improvement indicates that teachers were increasingly able to act as facilitators by guiding students during problem identification, project completion, discussion activities, and reflection processes.

3. Students' Learning Activities Results

Student learning activities were observed during the implementation of Project-Based Learning. The results are presented in Table 5 and Figure 4.

Table 5. Recapitulation of Students' Learning Activities Results

Cycle	Students Achieving Mastery (Percentage)	Non-Mastery (Percentage)
Pre-cycle	5 students (25%)	15 students (75%)
Cycle I	12 students (60%)	8 students (40%)
Cycle II	20 students (100%)	0 students (0%)

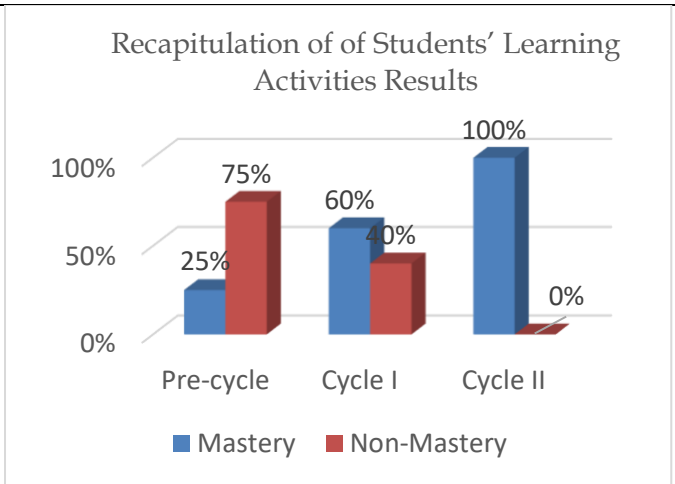

Figure 4. Recapitulation of Students' Learning Activities Results

Based on Table 5, students' learning activities showed continuous development during the research implementation. In the pre-cycle stage, only 5 students (25%) achieved mastery. After the implementation of PjBL, the number increased to 12 students (60%) in Cycle I and reached 20 students (100%) in Cycle II.

The improvement indicates that PjBL encouraged students to participate actively through discussion, investigation, collaboration, project development, and presentation activities. Students were involved in constructing knowledge rather than only receiving information from the teacher.

4. Students' Critical Thinking Skills Observation Results

Observation of students' critical thinking skills was conducted during the learning process based on three indicators: analysis, evaluation, and inference. The results are presented in Table 6 and Figure 5.

Table 6. Recapitulation of Students' Critical Thinking Skills Observation Results

Cycle	Students Achieving Mastery (Percentage)	Non-Mastery (Percentage)
Pre-cycle	4 students (20%)	16 students (80%)
Cycle I	12 students (60%)	8 students (40%)
Cycle II	19 students (95%)	1 student (5%)

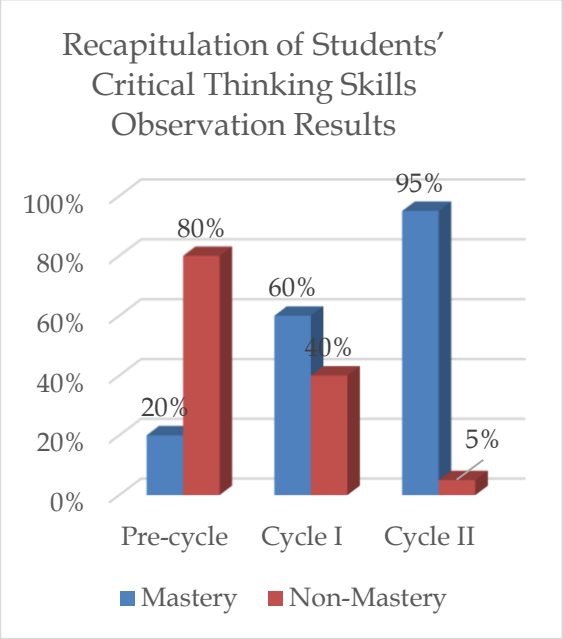

Figure 5. Recapitulation of Students' Critical Thinking Skills Observation Results

Based on Table 6, students' critical thinking skills based on observation results increased in each cycle. In the pre-cycle stage, only 4 students (20%) demonstrated good critical thinking skills. After implementing PjBL, the number increased to 12 students (60%) in Cycle I and reached 19 students (95%) in Cycle II.

The observation results indicate that students gradually demonstrated better critical thinking behaviors during learning activities. Students were able to identify problems, discuss solutions, evaluate information, and draw conclusions through project

investigation activities. Only 1 student did not achieve mastery, accounting for the remaining 5%.

5. Students' Critical Thinking Skills Test Results

The students' critical thinking skills test was conducted using three essay questions based on the indicators of analysis, evaluation, and inference. The results are presented in Table 7 and Figure 6.

Table 7. Recapitulation of Students' Critical Thinking Skills Test Result

Cycle	Students Achieving Mastery	Percentage
Pre-cycle	4 students	20%
Cycle I	12 students	60%
Cycle II	19 students	95%

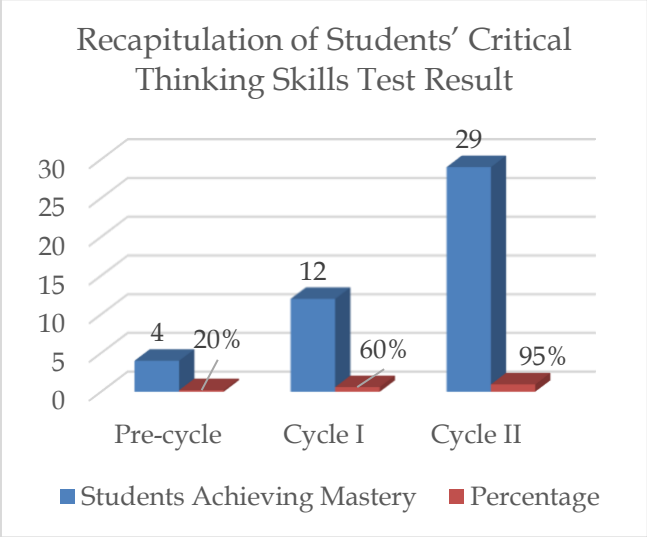

Figure 6. Recapitulation of Student's Critical Thinking Skills Test

Before implementing the Project-Based Learning model, a pre-cycle critical thinking skills test was conducted to identify students' initial abilities. The results showed that students' initial critical thinking skills were relatively low, as indicated by the total score of 1090 with an average score of 54.5. The highest score obtained was 75, while the lowest score was 50. Based on the Learning Objectives Achievement Criteria (KKTP) of 75 established by the school, only 4 students (20%) achieved mastery, while 16 students (80%) had not achieved mastery.

Based on Table 7, students' critical thinking skills measured through essay tests showed improvement throughout the implementation of Project-Based Learning cycles. The number of students achieving mastery increased from 4 students (20%) in the pre-cycle stage to 12 students (60%) in Cycle I and reached 19 students (95%) in Cycle II.

The results of the Cycle II critical thinking skills test showed a total score of 1820, with an average score of 91. The highest score obtained by students was 100, while the lowest score was 60. The KKTP established by the school remained 75. Although observation results and essay test results showed the same percentage of mastery, the two

instruments measured different aspects of students' critical thinking skills. The observation sheet assessed students' critical thinking behaviors during learning activities, while the essay test measured students' ability to apply critical thinking processes through written responses.

Discussion

1. Planning of Project-Based Learning Implementation to Enhance Students' Critical Thinking Skills in IPAS Learning

   The improvement in learning module quality indicates that systematic planning is an important component in supporting the implementation of Project-Based Learning (PjBL) in IPAS learning. The planning stage involved preparing teaching modules, student worksheets, learning media, observation instruments, and critical thinking assessment instruments aligned with learning objectives and students' needs.

   Effective planning is essential in PjBL because this learning model emphasizes authentic learning experiences, student involvement, investigation activities, collaboration, and meaningful product creation. In this study, critical thinking indicators consisting of analysis, evaluation, and inference were integrated into learning activities and assessment processes. This design encouraged students to identify problems, process information, evaluate ideas, and formulate conclusions based on evidence.

   These findings are consistent with Markula & Aksela (2022), who explained that effective PjBL implementation requires structured planning, meaningful tasks, and teacher guidance to support students' active involvement in science learning. Similarly, Almulla (2020) stated that well-designed project-based learning environments can increase student engagement and higher-order thinking skills. Therefore, the planning stage became an important foundation for developing students' critical thinking skills.

2. Implementation of Project-Based Learning to Enhance Students' Critical Thinking Skills in IPAS Learning

   The implementation of PjBL contributed to students' critical thinking development through structured learning activities. During the stage of determining essential questions, students were encouraged to identify problems related to ecosystem topics. This activity supported analysis skills because students needed to understand problems and identify relevant information.

   During project planning and completion, students collaborated to collect information, discuss ideas, and develop ecosystem diorama projects. These activities supported evaluation skills because students compared information, assessed possible solutions, and provided arguments based on evidence. Furthermore presentation and reflection activities encouraged students to develop inference skills by drawing conclusions from investigation results.

   The development of critical thinking occurred because PjBL involves students in cognitive processes such as investigation, decision-making, reflection, and knowledge construction. PjBL does not only emphasize the final product but also the learning process experienced by students.

Similar to Chen & Yang (2019), this study found that PjBL enhanced students' cognitive engagement. However, this study extends previous findings by demonstrating how specific critical thinking indicators, including analysis, evaluation, and inference, developed through IPAS project activities in the context of the Merdeka Curriculum. Furthermore, Guo et al. (2020) emphasized that PjBL supports students' cognitive development through authentic tasks, collaboration, and meaningful learning experiences.

3. Improvement of Students' Critical Thinking Skills through Project-Based Learning in IPAS Learning

   The findings of this study indicate that the implementation of Project-Based Learning was associated with improvements in students' critical thinking skills. The percentage of students achieving mastery increased from 20% in the pre-cycle stage to 60% in Cycle I and reached 95% in Cycle II.

   The improvement occurred because PjBL provided opportunities for students to actively engage in problem-solving activities. Through project activities, students practiced identifying problems, analyzing information, evaluating evidence, discussing solutions, and drawing conclusions. These activities were directly related to the critical thinking indicators assessed in this study.

   The findings support previous research showing that PjBL facilitates higher-order thinking development through authentic tasks, collaboration, and exploration activities. Loyens et al. (2023) explained that PjBL provides opportunities for students to develop higher-order thinking skills through investigation, collaboration, and problem-solving activities. Almulla (2020) also emphasized that PjBL can increase student engagement and support meaningful learning processes.

   However, the improvement in students' critical thinking skills should not be interpreted as being influenced solely by PjBL. Several factors may have contributed to the improvement, including teacher guidance, students' familiarity with project-based learning procedures, repeated learning experiences, classroom interaction, and student motivation. Therefore, the findings reflect the interaction between the implementation of PjBL and classroom learning conditions.

   Overall, this study provides empirical evidence that Project-Based Learning can support the development of elementary students' critical thinking skills in IPAS learning. Through authentic and student-centered learning experiences, PjBL helps students develop the ability to analyze problems, evaluate information, and draw conclusions based on evidence

CONCLUSION

The implementation of Project-Based Learning (PjBL) in IPAS learning contributed to the improvement of fifth-grade students' critical thinking skills. The improvement was demonstrated through the increase in the percentage of students achieving mastery, from 20% in the pre-cycle stage to 60% in Cycle I and 95% in Cycle II. The implementation of PjBL provided students with meaningful learning experiences through problem identification, project planning, investigation, collaboration, presentation, and reflection activities that

supported the development of critical thinking indicators, including analysis, evaluation, and inference.

The findings indicate that PjBL can be an effective alternative learning model for developing elementary students' critical thinking skills in IPAS learning within the context of the Merdeka Curriculum. Through student-centered activities, PjBL encourages students to actively construct knowledge, evaluate information, and formulate conclusions based on evidence. Therefore, teachers are encouraged to implement project-based learning strategies to create learning environments that promote active participation and higher-order thinking skills. Future research may examine the implementation of PjBL with larger samples, different learning topics, and additional assessment approaches to obtain broader evidence regarding its effectiveness in developing students' critical thinking skills.

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