

DISCOVERY LEARNING IN REAL CLASSROOMS: VIEWS ON CRITICAL THINKING AND COLLABORATION

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ABSTRACT

This study aims to explore the effectiveness of Discovery Learning in fostering students' critical thinking and collaboration skills in IPAS learning at the elementary school level. The research employed a mixed-methods approach with a convergent exploratory design, involving one Grade V IPAS teacher and 21 students at a public elementary school in Muaro Jambi Regency. Quantitative data were collected through a Likert-scale questionnaire, while qualitative data were obtained from interviews and learning documentation. The data were analyzed descriptively and thematically and then integrated using a joint display technique. The results indicate that the teacher perceived the implementation of Discovery Learning as very effective in developing critical thinking (87%) and collaboration skills (85%). In comparison, students' perceptions were categorized as good, with an average score of 81%, and the lowest achievement was in the information evaluation aspect (75%). These findings imply that Discovery Learning can support the development of critical thinking and collaboration skills in elementary IPAS learning when appropriately scaffolded and effectively facilitated by teachers.

Keywords: Discovery Learning, critical thinking, collaboration, IPAS, *Kurikulum Merdeka*.

INTRODUCTION

The development of 21st-century education requires a transformation of the learning paradigm from merely transmitting knowledge toward fostering higher-order thinking skills and collaborative abilities. In the Indonesian context, the implementation of the Merdeka Curriculum emphasizes student-centered, exploratory, and contextual learning, particularly in the IPAS subject at the elementary school level (Rahmawati et al., 2023). This orientation requires the learning process to focus not only on conceptual mastery but also on the development of students' analytical, reflective, and social capacities as part of strengthening the Pancasila Student Profile.

Conceptually, IPAS learning has significant potential to develop critical thinking and collaboration skills, given its integrative nature, which combines natural and social phenomena. Critical thinking is understood as a cognitive process involving interpretation, analysis, evaluation, inference, and self-regulation in assessing information and making decisions (Facione, 2011). Meanwhile, collaboration emphasizes positive interdependence, individual accountability, and promotive interaction within learning groups (Johnson & Johnson, 2013). Therefore, IPAS learning should ideally be designed as a pedagogical space that simultaneously encourages analytical activities and cooperative work.

However, classroom realities have not fully reflected this orientation. Preliminary observations conducted at one elementary school in Muaro Jambi Regency indicate that IPAS learning is still largely dominated by lecture methods and the use of textbooks as the primary source. Students' active participation in discussions, questioning, and drawing data-based conclusions remains relatively limited. Students are not yet accustomed to presenting logical arguments or working productively in groups. This condition demonstrates a gap between curriculum demands and actual instructional practices.

As a pedagogical alternative, Discovery Learning is considered capable of bridging this gap because it positions students as active subjects in the process of constructing knowledge through discovery (Bruner, 1961). This model aligns with scientific and contextual approaches in 21st-century learning, which emphasize observing, questioning, collecting information, reasoning, and communicating (Hosnan, 2014). Theoretically, student involvement in investigative processes and group discussions can foster the development of critical thinking skills and collaboration.

Various empirical studies have confirmed the contribution of Discovery Learning to improving elementary students' critical thinking skills (Aqila et al., 2025; Putri et al., 2023). Literature reviews also show the consistent influence of this model on the development of higher-order cognitive skills (Ayu et al., 2025). In the context of IPAS and the Merdeka Curriculum, inquiry- and discovery-based learning models have been reported to enhance critical thinking abilities significantly (Pangestu et al., 2024). In addition, Discovery Learning has been shown to improve collaboration skills through structured group work activities (Syafii, 2022).

Nevertheless, previous studies reveal two important research gaps. First, a methodological gap is evident: most studies on Discovery Learning employ quantitative experimental designs that primarily measure improvements in learning outcomes or specific skill scores. Such approaches tend to position effectiveness as a linear numerical outcome, while the experiential and perceptual dimensions of learning actors remain insufficiently explored. Second, an empirical gap exists in the limited number of studies that simultaneously examine teachers' and students' perceptions within authentic classroom contexts. In fact, the success of implementing a learning model is determined not only by its design but also by the construction of meaning, readiness, and learning experiences that emerge from authentic classroom interactions.

Based on this gap, the present study offers a different perspective by simultaneously exploring teachers' and students' perceptions of the effectiveness of implementing Discovery Learning in IPAS instruction to enhance critical thinking and collaboration skills. The novelty of this study lies in three main aspects. First, it shifts the focus from measuring learning gains to exploring the construction of meaning regarding effectiveness within real implementation contexts. Second, it integrates two perspectives of learning actors to identify possible alignments and differences in perceptions. Third, it is conducted within the context of implementing the Merdeka Curriculum in elementary IPAS learning, thereby providing contextual contributions relevant to current educational policies. Using a mixed-methods approach, this study is expected to provide a more comprehensive understanding of the effectiveness of Discovery Learning as a contextual and dynamic pedagogical practice.

LITERATURE REVIEW

This study is grounded in the **constructivist paradigm, which serves as the grand theoretical foundation** for the implementation of Discovery Learning. Constructivism positions learners as active subjects in constructing knowledge through exploration and discovery processes. Bruner (1961) emphasized that learning becomes more meaningful when students independently discover concepts rather than receive information passively. Within this perspective, Discovery Learning represents an instructional model that operationalizes constructivist principles through investigative learning activities. This principle aligns with problem-based and inquiry-based learning approaches that emphasize investigation as a means of developing deeper cognitive structures (Hmelo-Silver, 2004). In the Indonesian educational context, the scientific and contextual approaches implemented in the national curriculum align epistemologically with the principles of Discovery Learning (Hosnan, 2014). Therefore, Discovery Learning can be understood as a pedagogical framework derived from constructivist theory that promotes reflective, constructive thinking.

The strengthening of such cognitive activities is closely related to the development of critical thinking skills as one of the key competencies of the 21st century. Facione (2011) explains that critical thinking involves the abilities of interpretation, analysis, evaluation, inference, and self-regulation in assessing information. In the global context, these skills are categorized under learning and innovation skills, or the 4C framework, which includes critical thinking, creativity, collaboration, and communication (Zubaidah, 2018). IPAS learning, which conceptually integrates natural and social phenomena, requires analytical skills to understand cause-and-effect relationships and reflective abilities to draw data-based conclusions. Several studies indicate that implementing Discovery Learning improves elementary students' critical thinking skills (Aqila et al., 2025; Putri et al., 2023), including in the context of the Merdeka Curriculum in IPAS learning (Pangestu et al., 2024). These findings reinforce the assumption that discovery-based learning systematically facilitates higher-order cognitive engagement.

In addition to the cognitive dimension, the development of 21st-century skills also includes collaboration as an essential social competence. Johnson and Johnson (2013) assert that effective collaborative learning requires positive interdependence, individual accountability, promotive interaction, and interpersonal skills that support group success. In the practice of Discovery Learning, group discussion activities and role distribution during the inquiry process serve as mechanisms that enable collaborative interaction. Research by Warsah et al. (2021) shows that collaborative learning significantly improves students' critical thinking skills, underscoring the close relationship between the cognitive and social dimensions of the learning process. Syafii (2022) also found that Discovery Learning enhances collaboration skills through well-organized group work structures. Thus, this model has the potential to develop both skills simultaneously.

Although numerous studies have demonstrated the effectiveness of Discovery Learning in improving critical thinking and collaboration skills, most employ quantitative experimental designs that focus on measuring improvements in learning outcomes. Such approaches tend to position effectiveness as a statistically measurable increase in scores, while the experiential and perceptual dimensions of learning actors have received limited in-depth examination. In fact, the successful implementation of a learning model is strongly influenced by how teachers perceive it as a facilitator and students as learning subjects. Positive perceptions can foster engagement and sustainability of implementation, whereas less supportive perceptions may hinder the optimal application of the model in classroom practice.

Based on this theoretical and empirical synthesis, it can be concluded that Discovery Learning has a strong conceptual foundation for the development of critical thinking and collaboration, supported by empirical findings. However, studies that integrate cognitive, social, and perceptual dimensions within real implementation contexts in elementary schools remain relatively limited. Therefore, this study seeks to address this gap by simultaneously exploring teachers' and students' perceptions of the effectiveness of implementing Discovery Learning in IPAS instruction. The integration of constructivist theory, critical thinking frameworks, collaboration theory, and educational perception perspectives forms the conceptual foundation for understanding the model's effectiveness as a contextual and dynamic pedagogical construct.

METHODOLOGY

This study employed a mixed-methods approach using a convergent design, in which quantitative and qualitative data were collected within a relatively similar timeframe and analyzed separately before integration at the interpretation stage. The design was selected to obtain a comprehensive understanding of teachers' and students' perceptions of the effectiveness of implementing Discovery Learning in IPAS instruction. This approach enables the study not only to describe perceptual tendencies numerically but also to reveal meanings, experiences, and the dynamics of model implementation within real classroom contexts. The integration of both

types of data generated meta-inferences regarding the model's effectiveness as a contextual and progressive pedagogical construct.

The research was conducted at a public elementary school in Muaro Jambi Regency that has implemented the Merdeka Curriculum. The research subjects consisted of one fifth-grade IPAS teacher and 21 fifth-grade students who participated in Discovery Learning. All students participated as questionnaire respondents, using a total sampling technique to obtain a comprehensive overview of classroom perceptions. For in-depth qualitative data, six students were selected as interview informants using purposive sampling with a maximum variation approach, based on variations in participation levels and questionnaire responses (high, medium, and low categories). This selection aimed to ensure diversity of perspectives so that interpretations would not be centered on a single perception group.

The research instruments included teacher and student perception questionnaires, semi-structured interview guidelines, and learning documentation. The questionnaires were developed using a four-point Likert scale (1–4) to measure two main dimensions: critical thinking skills and collaboration. The indicators of critical thinking were based on Facione's (2011) framework, which includes analysis, evaluation, inference, and problem-solving, while the indicators of collaboration were based on Johnson and Johnson's (2013) theory, covering positive interdependence, individual accountability, active participation, and communication. Content validity of the instruments was examined through expert judgment to ensure alignment between the indicators and the theoretical constructs. Interviews were conducted to explore learning experiences, perceptions of effectiveness, and challenges in implementing the model. Documentation of lesson plans and classroom activities was used as supporting data in the source triangulation process to enhance the credibility and consistency of the findings.

Quantitative data were analyzed using descriptive statistics, including calculation of mean scores and percentages. The scores were then categorized into very good, good, sufficient, and poor criteria based on percentage intervals proportionally determined from the maximum score range. Qualitative data were analyzed using thematic analysis techniques in three stages: data reduction, data display, and iterative conclusion drawing, until pattern consistency was achieved. Data integration was conducted at the interpretation stage through convergence and divergence analysis of findings presented in a joint display format. This process aimed to identify alignments and differences between questionnaire and interview results to obtain a more comprehensive understanding of the effectiveness of Discovery Learning in developing critical thinking and collaboration skills, as perceived by teachers and students.

RESULT AND DISCUSSION

The results of this study are presented using a **convergent (concurrent) mixed methods integration**, in which quantitative and qualitative findings are interpreted together to provide a comprehensive understanding of the effectiveness of implementing Discovery Learning in IPAS instruction. In this approach, questionnaire data and interview findings were analyzed separately and then integrated during interpretation to identify patterns of convergence and divergence between the two data sources.

The presentation of the results is organized systematically into three stages: (1) quantitative findings describing teachers' and students' perceptions, (2) qualitative findings explaining learning experiences and implementation dynamics, and (3) integrated findings presented through a joint display to obtain meta-inferences regarding the effectiveness of Discovery Learning. This study analyzed the perceptions of one teacher and 21 students regarding the effectiveness of implementing Discovery Learning in IPAS instruction, focusing on two main dimensions: critical thinking skills and collaboration. Interview informants represented variations of high, medium, and low perceptions as determined during the sampling stage.

The questionnaire results indicate that the teacher had a highly positive perception of Discovery Learning's effectiveness. This assessment was not merely general in nature, but was reflected in each measured indicator.

Table 1. Teacher's Perception of the Effectiveness of Discovery Learning

Dimension	Indicator	Score (%)	Category
Critical Thinking	Analyzing problems	90%	Very Good
	Evaluating information	85%	Very Good
	Drawing conclusions	88%	Very Good
	Solving problems	84%	Very Good
Dimension Average		87%	Very Good
Collaboration	Cooperation	86%	Very Good
	Responsibility	85%	Very Good
	Active participation	88%	Very Good
	Communication	82%	Good
Dimension Average		85%	Very Good

Substantively, the high scores on the indicators of analysis and conclusion indicate that the teacher viewed the stages of problem identification and verification in Discovery Learning as primary triggers of students' cognitive activity. In the interview, the teacher stated that "students think more independently before asking questions," indicating a shift from passive learning toward reflective learning. This finding is consistent with Bruner's (1961) view that active discovery encourages more meaningful internalization of concepts.

In the collaboration dimension, the indicator of active participation received a high score, suggesting that the teacher observed increased student involvement in group discussions. However, the communication score was lower than the other indicators, indicating that the quality of verbal interaction had not yet reached optimal levels. This suggests that although the group work structure has functioned well, the deepening of argumentative dialogue still requires strengthened facilitation.

In contrast to the teacher's highly positive perspective, students' perceptions showed greater variation, though they still fell within the good-to-very good range.

Table 2. Students' Perceptions of the Development of Critical Thinking and Collaboration

Indicator	Score (%)	Category
Analyzing problems	82%	Good
Drawing conclusions	80%	Good
Evaluating information	75%	Good
Group cooperation	84%	Very Good
Responsibility	83%	Very Good
Communication	81%	Good
Average	81%	Good

The collaboration indicators obtained higher scores than the information evaluation. This indicates that students more easily perceive the benefits of group work than the more abstract evaluative thinking processes. Several students stated that group discussions helped them understand the material because they "could explain it to each other in their own words." This statement reinforces the findings of Warsah et al. (2021), who found that collaborative learning increases cognitive activity through social interaction.

However, the indicator of evaluating information received the lowest score. Interviews revealed that some students still waited for teacher guidance when required to assess the correctness of answers or draw conclusions. This finding is consistent with Facione's (2011) critical thinking framework, which states that evaluation is a higher-order cognitive stage requiring continuous practice and scaffolding.

To comprehensively assess the model's effectiveness, quantitative and qualitative results were integrated in the following joint display.

Table 3. Integration of Quantitative and Qualitative Findings on the Effectiveness of Discovery Learning

Dimension	Specific Indicator	Quantitative Results (%)	Qualitative Findings	Integration Pattern	Pedagogical Implications
Critical Thinking	Problem analysis	82–90	Students actively identified problems during discussions	Convergent	The stimulation and identification stages are effective
	Information evaluation	75–85	Students still waited for teacher guidance when assessing answers	Partial divergence	Scaffolding is needed at the verification stage
	Drawing conclusions	80–88	Some students were able to conclude, but their arguments were inconsistent	Moderate convergence	Reflection and elaboration need strengthening
Collaboration	Cooperation & responsibility	83–86	Students shared tasks and supported one another	Strong convergence	Group structure is effective
	Argumentative communication	81–82	Discussions were active, but arguments lacked depth	Moderate divergence	Critical dialogue facilitation is needed

The integration of quantitative and qualitative data reveals a strong convergence pattern in the indicators of problem analysis and group cooperation. The high scores on these two indicators are supported by interview findings indicating increased student participation in identifying problems and in sharing responsibilities within groups. This indicates that the initial stages of Discovery Learning syntax—particularly stimulation and problem identification—activate cognitive and social processes simultaneously.

However, in the indicators of information evaluation and argumentative communication, a pattern of partial divergence was identified. Although the questionnaire scores fell within the good category, interview data revealed that some students still relied on teacher guidance when evaluating answers or strengthening their arguments. This finding indicates that the model's effectiveness has not been fully optimized at the verification and generalization stages. In other words, critical thinking processes have not yet fully reached the evaluative-reflective level as proposed by Facione (2011). This moderate divergence suggests

that the effectiveness of Discovery Learning is gradual and contextual. While the model successfully activates participation and initial analytical processes, developing deeper evaluation requires additional strategies, such as higher-order prompting questions or structured reflection. Pedagogically, this finding confirms that the model's success is not automatic but highly dependent on the quality of the teacher's scaffolding.

The findings of this study indicate that implementing Discovery Learning in IPAS instruction contributes to the simultaneous development of critical thinking and collaboration skills, though with varying levels of depth across indicators. Improvements in problem analysis and conclusions suggest that students have begun to engage in reflective thinking beyond mere recall. This aligns with Ennis's (2018) cross-curricular vision of critical thinking, which emphasizes that such skills must be developed through active engagement in reasoning and argument evaluation. In discovery-based learning, this process is facilitated through stages of problem identification, data exploration, and verification, as conceptualized within Bruner's (1961) constructivist framework. Thus, the effectiveness of Discovery Learning in this study is reflected not only in numerical achievements but also in shifts in participation patterns and students' thinking structures throughout the learning process.

Nevertheless, the achievement in the information evaluation indicator suggests that higher-order critical thinking skills have not yet fully developed optimally. Interview data indicate that some students still require teacher guidance to verify answers and strengthen arguments. This condition demonstrates that discovery-based learning cannot be separated from the need for structured scaffolding. Kirschner, Sweller, and Clark (2006) critically argue that learning without adequate guidance may be ineffective, particularly at complex cognitive stages. This finding does not imply that Discovery Learning is ineffective, but rather that its effectiveness depends heavily on the quality of the teacher's pedagogical intervention in guiding reflection and evaluation. From a higher-order thinking skills (HOTS) development perspective, Sani (2019) emphasizes that advanced thinking abilities require systematic habituation in formulating reasons, evaluating evidence, and constructing logical arguments. Therefore, strengthening the verification and generalization stages becomes an important pedagogical implication of this study.

In the collaboration dimension, the findings show that the group work structure within Discovery Learning effectively fosters cooperation and responsibility. High scores in cooperation and active participation indicate the presence of positive interdependence among group members, as described in Johnson and Johnson's (2013) cooperative learning theory. This finding is reinforced by Slavin (2022), who states that cooperative learning in elementary schools is effective in increasing student engagement and the quality of academic interaction when accompanied by clear role distribution. Research by Hidayati and Suryani (2020) also demonstrates that collaborative learning significantly influences elementary students' communication and teamwork skills. In this study, students reported that group discussions helped them understand the material through idea exchange, although some groups still showed tendencies of dominance. This condition indicates that structural collaboration has been established, yet the quality of argumentative communication still requires deeper facilitation.

Compared with previous studies, these findings are consistent with those of Aqila et al. (2025) and Putri et al. (2023), who found that Discovery Learning improves elementary students' critical thinking skills. Furthermore, a meta-analysis conducted by Mulyono (2025) demonstrated that inquiry-based learning models have a significant positive effect on critical thinking skills across educational levels. This study reinforces these findings within the context of IPAS and the Merdeka Curriculum, while also extending them by emphasizing the dimensions of perception and learning experience as integral components of pedagogical effectiveness. Thus, effectiveness is measured not solely by test outcomes, but by how students experience the learning process as a space for exploration and reflection.

In the context of collaboration, the findings of this study also align with those of Wibisono and Dewi (2025), who demonstrated that problem-based models are effective in improving elementary students' cooperative attitudes. This indicates that active learning models, whether discovery- or problem-based, share a similar potential to foster academic social interaction. However, this study reveals that without strengthening argumentative communication and regulating participation, collaboration may remain limited to task division without deeper critical discourse. Therefore, teachers need to design discussion mechanisms that encourage each student to explicitly articulate reasons and evidence.

The integration of quantitative and qualitative data in this study provides the understanding that the effectiveness of Discovery Learning is gradual and contextual. The convergence of findings in the indicators of analysis and cooperation reflects the model's success in activating students' initial engagement. However, partial divergence in the evaluation indicator reveals a gap between numerical perceptions and the depth of students' reflection. The mixed-methods approach enabled the researcher to identify these dynamics more comprehensively, so that effectiveness is understood not dichotomously but as a spectrum of competency development. In the context of IPAS implementation as described by Rahmawati et al. (2023), the integration of cognitive and social dimensions is key to successful learning, and this study's findings indicate that Discovery Learning has the potential to meet these demands when supported by consistent pedagogical facilitation.

Theoretically, the findings reinforce the constructivist assumption that students' active engagement in discovery processes can simultaneously integrate cognitive and social dimensions, particularly in developing problem analysis and group cooperation. However, strengthening the evaluation and critical argumentation stages still requires more systematic scaffolding. Practically, the results highlight the importance of the teacher's role in designing higher-order questions, facilitating reflective dialogue, and managing group dynamics so that collaboration does not stop at mere task division but evolves into meaningful academic discourse. Nevertheless, this study is limited by the small number of participants, confined to one school with one teacher and 21 students, thus requiring caution in generalizing the findings. Furthermore, the focus on perceptions does not fully measure long-term impacts on objective cognitive achievement, so further research with broader coverage and longitudinal designs is necessary to strengthen the external validity of these findings.

Ultimately, this study demonstrates that Discovery Learning is perceived as effective in developing critical thinking and collaboration skills, with stronger outcomes observed in the collaborative dimension compared to higher-level critical evaluation. Such effectiveness is not automatic but is strongly influenced by the quality of scaffolding, the design of higher-order questions, and the management of group dynamics. With reinforcement at the stages of reflection and argumentation, this model has the potential to become a relevant strategy for supporting the development of 21st-century competencies, as emphasized in global frameworks, while remaining contextually relevant to the needs of IPAS learning in Indonesian elementary schools.

CONCLUSION

This study demonstrates that the implementation of Discovery Learning in IPAS instruction is perceived as effective in developing elementary students' critical thinking and collaboration skills. However, the level of development varies across indicators. The model has proven capable of activating problem analysis, increasing participation, and positively fostering cooperation and group responsibility. However, the aspects of information evaluation and argumentative communication have not yet developed optimally and still require more systematic and reflective pedagogical scaffolding. The integration of quantitative and qualitative data confirms that the effectiveness of Discovery Learning is contextual and gradual, strongly influenced by the quality of teacher facilitation and the design of higher-order questions in the

learning process. Conceptually, this study expands the discourse on the effectiveness of instructional models by positioning teachers' and students' perceptions as part of the pedagogical construct, thereby contributing to a deeper understanding of the implementation of Discovery Learning within the Merdeka Curriculum in elementary schools.

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