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THE EFFECT OF COLLABORATIVE INQUIRY-BASED LEARNING MODEL AND LEARNING MOTIVATION ON CRITICAL THINKING SKILLS OF ELEMENTARY SCHOOL STUDENTS

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Abstrak
Keterampilan berpikir kritis merupakan keterampilan penting untuk membantu peserta didik menganalisis, Menganalisis dan menyelesaikan tantangan belajar. Tujuan dari penelitian ini adalah untuk menguji bagaimana motivasi belajar dan metode pembelajaran berbasis penyelidikan kolaboratif memengaruhi kemampuan siswa sekolah dasar untuk berpikir kritis. Desain kuasi-eksperimental dengan posttest only control group adalah metodologi penelitian yang digunakan. ANOVA dua arah digunakan untuk melakukan uji analitis dan prosedur pengumpulan data. Soal ujian pilihan ganda dan survei motivasi belajar yang telah menjalani uji validitas dan reliabilitas berfungsi sebagai alat pengumpul data. Menurut temuan penelitian, kemampuan berpikir kritis siswa mengalami peningkatan secara signifikan oleh model pembelajaran berbasis penyelidikan kolaboratif dibandingkan dengan model pembelajaran berbasis kolaborasi. Siswa dengan motivasi belajar yang kuat dan mereka yang memiliki motivasi belajar yang rendah memiliki tingkat kemampuan berpikir kritis yang berbeda. Meskipun demikian, penelitian ini tidak menemukan hubungan antara kemampuan berpikir kritis siswa dan model pembelajaran atau motivasi belajar.

Kata Kunci: pembelajaran inkuiri kolaboratif; motivasi belajar; keterampilan berpikir kritis.

Abstract
Critical thinking skills are important skills that can help students analyze, evaluate, and solve problems in Analyze and resolve learning challenges. The purpose of this study is to examine how learning motivation and collaborative inquiry-based learning methods affect elementary school students' ability to think critically. Quasi-experimental designs with posttest-only control group designs are the study methodology employed. Two-way ANOVA was used to conduct analytical tests and data collection procedures. Multiple-choice exam questions and learning motivation surveys that have experienced validity and reliability testing served as the tools. According to the study's findings, students' critical thinking abilities are significantly enhanced by the collaborative inquiry-based learning model as opposed to the collaboration-based learning model. Students with strong learning motivation and those with low learning motivation have different levels of critical thinking abilities. Nevertheless, this study found no relationship between students' critical thinking abilities and the learning model or learning motivation.

Keyword*: collaborative inquiry based learning; learning motivation; critical thinking skill*

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INTRODUCTION

The rapid advancement of technology in the era of the Industrial Revolution 4.0 has brought significant changes, particularly in the field of education. Education plays a crucial role in ensuring the sustainability of a nation, especially at the elementary level, which aims to equip students with knowledge, skills, character building, and scientific attitudes appropriate to their developmental stage. The emergence of various innovations and new information requires students to master a range of 21st-century skills. One of the most crucial and cognitively beneficial skills is critical thinking.

According to Anugerahwati (2019), there are six essential skills that need to be developed, known as the 6Cs: critical thinking, collaboration, communication, creativity, citizenship/cultural awareness, and connectivity/character education. Critical thinking skills enable learners to search for, analyze, synthesize, and conceptualize information in order to enhance creativity and make effective decisions (Arif et al., 2019; Simbolon et al., 2017). As stated by Ennis (1986) in Sipayung et al. (2019), critical thinking is an active process of acquiring, evaluating, and integrating information rationally. Education systems emphasize the strengthening of critical thinking skills as a vital element in forming a competitive, adaptive generation capable of facing global challenges while also developing other essential skills.

Critical thinking serves as the foundation for developing other skills needed to process information and make better decisions. According to Izhab (2004), as cited by Tanjung (2018), critical thinking is a mental process involving the analysis of information obtained through observation, experience, communication, and reading. Despite its importance, several studies have shown that the critical thinking skills of Indonesian students remain low. Research indicates that 68.57% of students have poor critical thinking ability (Sains et al., 2019). Contributing factors include the use of teaching models that do not emphasize exploration and problem-solving, limited learning media that support critical thinking development, and a lack of opportunities for students to engage in in-depth discussions.

Moreover, low learning motivation also significantly affects the development of students' critical thinking skills (Fauzi et al., 2023). High motivation encourages students to be more active and enthusiastic in the learning process (Sitti Rahma et al., 2023). Motivated students are more inclined to explore materials, participate in discussions, and express their opinions confidently. Discussions enrich students' understanding and help them master concepts through learning experiences and information exchange, thus improving their problem-solving abilities (Nugrahani et al., 2023). Exploratory activities assist students in enhancing critical thinking skills while enabling better comprehension of the subject matter (Arimbawa et al., 2024).

One strategy to enhance students' critical thinking and learning motivation is the application of the collaborative inquiry-based learning model. This model combines collaborative and inquiry-based approaches, emphasizing group cooperation among students to solve problems through discussion and investigation. Collaborative inquiry-based learning aims to enhance conceptual understanding, scientific skills, and encourage students to think and work like scientists—critically and collaboratively (Nainggolan, 2022).

The National Curriculum and Educational Assessment Standards Agency emphasizes that science education should be based on fundamental ideas, such as fostering scientific attitudes (a strong sense of curiosity, critical and analytical thinking skills, and the ability to draw valid conclusions) to cultivate wisdom in students. This aligns with the implementation of the Independent Curriculum in schools (Kemendikbud, 2022). Science learning contributes to shaping the Pancasila Student Profile, which represents the ideal characteristics of Indonesian learners.

According to PERMENDIKBUD No. 22 of 2020 regarding the Ministry of Education and Culture's Strategic Plan for 2020–2024, the Pancasila Student Profile is defined by six core traits: (1) faith, devotion to God Almighty, and noble character; (2) global diversity awareness; (3) mutual cooperation; (4) independence in taking initiative and responsibility; (5) critical reasoning to analyze information deeply; and (6) creativity in generating innovative ideas. This learning model contributes to shaping a superior and character-driven Indonesian generation in accordance with the Pancasila Student Profile, particularly in the aspects of critical, creative, and collaborative thinking. In addition to critical thinking, students are also expected to possess empathy, a strong sense of responsibility, and the ability to work effectively in various situations.

Based on observations, the development of students' critical thinking skills in science subjects has not been optimal. Classroom teachers reported that students lack enthusiasm for learning, have difficulty concentrating, and are not yet capable of conducting analysis, investigation, evaluation, and argumentation. This condition indicates that poor critical thinking ability stems from a lack of interactive teaching strategies and low learning motivation. These gaps between actual classroom conditions and the ideal implementation of the Independent Curriculum prompted the researcher to adopt a learning model that enhances both critical thinking and student motivation. The collaborative inquiry-based learning paradigm was chosen because of its potential to help students develop their critical thinking skills. To create a better and more competitive generation, this study aims to contribute to the development of more effective learning methodologies.

Therefore, the objectives of this research are to determine how the implementation of the collaborative inquiry-based learning model affects students' critical thinking skills; how students with high and low learning motivation differ in their critical thinking abilities; and how the implementation of collaborative inquiry-based learning and learning motivation interact in influencing students' critical thinking skills.

METHOD

This study was conducted in October and November 2024. The research methodology employed was Quasi-Experimental Designs (QEDs) using a posttest-only control group design. To determine the extent to which the learning model could enhance students' critical thinking skills, a posttest was administered after the treatment was implemented. The research design used for the posttest-only control group follows the format presented in Table 1 below:

Table 1. Posttest Only Control Group Experimental Research Design

Group	Treatment	Posttest
Eksperiment	**X**	**O**
Control	**-**	**O**

In addition, the collaborative inquiry-based learning model served as the independent variable in this study, while learning motivation functioned as the moderating variable and critical thinking skills as the dependent variable. All participants in this study were fifth-grade students from two classes at SDN Mojorejo 01, Batu City, during the 2024–2025 academic year. A total of 28 students from Class V A acted as the control group, which did not use the collaborative inquiry-based learning model, whereas 26 students from Class V B comprised the experimental group, which was taught using the collaborative inquiry-based learning model.

The collaborative inquiry-based learning model consists of four phases in its instructional process, as outlined in Table 2 below:

Table 2. Collaborative inquiry based learning model phases

Learning Phase	Activity	
	Teacher	**Student**
Phase 1: Framing the Problem	1. Communicates the learning objectives to students. 2. Assists students in forming groups of 4–5 members. 3. Facilitates students in understanding the main problem to be investigated.	1. Listens to the teacher's explanation about the learning objectives. 2. Forms heterogeneous groups. 3. Identifies and formulates problems related to the topic.
Phase 2: Collecting Evidence	1. Guides and supports students in gathering data or evidence from relevant information sources.	1. Searches for information from various sources to gather and analyze relevant data to address the problem.
Phase 3: Analyzing Evidence	1. Guides students in synthesizing group findings. 2. Provides reinforcement and correction during the data analysis process. 3. Instructs students to record their analysis results on the answer sheet.	1. Engages in group discussions. 2. Analyzes collected data to draw conclusions. 3. Records analysis results on the answer sheet.
Phase 4: Celebrating And Sharing	1. Organizes a session for presenting the results of collaborative inquiry. 2. Facilitates discussions to explain the entire inquiry process. 3. Provides feedback on students' collaborative work. 4. Guides students in final reflection on the learning process and outcomes.	1. Presents analysis results in the form of a presentation, report, or other media as a group. 2. Discusses findings with other groups to gain new perspectives. 3. Responds to group presentations by providing feedback. 4. Reflects on the process and outcomes of learning.

Questionnaires and tests were used as research instruments. Students' critical thinking skills were assessed through a test, while a questionnaire was used to measure students' level of learning motivation. A written test consisting of 20 multiple-choice questions was used to evaluate students' critical thinking skills. Meanwhile, a 15-item questionnaire with five response options was employed to assess learning motivation.SPSS for Windows version 27.0 was used to assess the validity of each questionnaire and test item. The critical thinking skills test instrument, consisting of 20 items, was found to be valid and reliable with a Cronbach's Alpha coefficient of 0.842. Similarly, the analysis of the 15-item learning motivation questionnaire met the criteria for validity and reliability, with a Cronbach's Alpha coefficient of 0.756, indicating a high level of reliability in both the critical thinking skills and learning motivation measurements.

Subsequently, quantitative and descriptive analysis techniques were employed to process the collected research data. The methods used in this study included individual test score calculations, assumption testing, and hypothesis testing. Posttest data were used to compute the individual test scores. The Shapiro-Wilk test was used to determine data normality, and the Levene's test was used to assess data homogeneity. Furthermore, with the assistance of SPSS for Windows version 27.0, a two-way ANOVA test was conducted to test the research hypotheses.

RESULT

The results of the critical thinking skill test based on the learning model showed that the average score of students' critical thinking skills using the collaborative inquiry-based learning model was 79.602, while the average score of students using the collaborative-based learning model was 63.095. This result indicates that the use of the collaborative inquiry-based learning model is more effective in improving students' critical thinking skills, with a mean difference of 16.507, compared to the collaborative-based learning model. Thus, the relatively significant difference

suggests that the collaborative inquiry-based learning model has a greater positive impact on the development of fifth-grade elementary students' critical thinking skills in science learning.

The average critical thinking score of students with low learning motivation was 65.625, whereas the average for students with high learning motivation was 77.073, based on the results of the critical thinking skill test related to motivation. The 11.448-point gap reveals that students with higher motivation contribute more significantly to the development of critical thinking skills than those with low motivation. Consequently, it can be concluded that learning motivation plays a crucial role in enhancing students' critical thinking ability.

The experimental class consisted of 26 students. The results of testing the effects of the learning model and learning motivation on critical thinking ability showed that the average critical thinking score in this class was 85.38. Conversely, the control class, consisting of 28 students, had an average score of 64.64. In the experimental class, there were 4 students with low motivation, scoring an average of 71.25, and 22 students with high motivation, scoring an average of 87.95. Meanwhile, in the control class, 7 students with low motivation scored an average of 60.00, and 21 students with high motivation scored an average of 66.19.

Normality testing was conducted on samples from both the experimental and control classes using the Shapiro-Wilk method, resulting in a significance value of 0.351 for critical thinking skills, which is greater than 0.05. This indicates that the data are normally distributed, and thus the assumption of normality is met. Furthermore, based on the homogeneity test using Levene's Test of Equality of Error Variances, the significance value for students' critical thinking skills was 0.367 > 0.05, indicating that the data are homogeneous. Therefore, the results of the comparison between the experimental and control classes are shown in the following table:

Table 3. Results of the Difference Test between Experimental Class and Control Class
Dependent Variable : Critical thinking skill

Source	Type III Sum of Square	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected model	6945,650[a]	3	2315.217	68,217	<,001	,804
Intercept	167617,136	1	167617.136	2938,798	<,001	,990
Model	2242,971	1	2242.971	66,089	<,001	,569
Motivation	1078,718	1	1078.718	31,784	<,001	,389
Model*Motivation	227,493	1	227.493	6,703	,013	,118
Error	1696,943	50	33.939			
Total	309400,000	54				
Corrected Total	8642,593	53				
R Squared = ,804 (Adjusted R Quared = ,792						

Table 3 above shows that the dependent variable "critical thinking skill" under the "Model" row has a probability value of 0.001 < 0.005, indicating a significant difference in students' critical thinking skills based on the applied learning model. Based on this result, the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_1) is accepted. This suggests that students taught using the collaborative inquiry-based learning model differ significantly in critical thinking ability compared to those taught using the collaborative-based learning model. Furthermore, the dependent variable "critical thinking skill" under the "Motivation" row shows a probability value of 0.001 < 0.005, indicating that H_0 is rejected and H_1 is accepted. This implies that students with high learning motivation and those with low learning motivation have significantly different levels of critical thinking skill. In addition, the "Motivation * Model" interaction row for the dependent variable "critical thinking skill" shows a probability value of 0.013 < 0.05. Therefore, H_1 is rejected and the third hypothesis is accepted. This result indicates that students' critical thinking

skills are not influenced by an interaction between learning motivation and the collaborative inquiry-based learning model.

DISCUSSION

The hypothesis testing results indicate that the collaborative inquiry-based learning model has a greater impact on students' critical thinking skills compared to the collaborative-based learning model. The average critical thinking skill score of students taught using the collaborative inquiry-based learning model was 79.602, whereas those taught using the collaborative-based learning model had an average score of 63.095. This demonstrates that students' critical thinking skills improved significantly with the implementation of collaborative inquiry-based learning. The learning environment fostered by this approach promotes the development of critical thinking, problem-solving, creativity, discovery, as well as collaboration and communication skills (Aji, 2019). Learners are also able to connect new information and skills by comparing them to their prior knowledge (Adi et al., 2020). Therefore, this model can enhance motivation, curiosity, active participation, and reinforce collaborative processes in learning.

Previous studies support the effectiveness of the collaborative inquiry-based learning model in improving critical thinking skills. Research by Sipayung et al. (2019) showed a 57.8% increase in students' critical thinking skills. Meanwhile, Priastuti et al. (2020) reported a 66.41% improvement in scores. These findings consistently demonstrate that this model positively influences the development of critical thinking skills, which include the ability to analyze, evaluate, and generate solutions to problems. Collaboration enables teams to share ideas, provide feedback, and gain diverse perspectives that enrich the process of formulating more effective performance goals (Aprianto et al., 2023). The learning model's process—which includes collaborative discussion, exploration, and problem-solving—supports students in enhancing their critical thinking skills. This aligns with the argument of H. F. H. Su et al. (2016) that critical thinking enables individuals to seek truth in everyday informational events. Thus, these skills are essential not only at higher education levels but also need to be developed in primary education.

Collaborative inquiry learning and collaborative learning model are integrated to form the collaborative inquiry-based learning model. Inquiry-based learning emphasizes the methodical, critical, logical, and analytical exploration of content, enabling students to independently draw conclusions (Aprilya, 2020). On the other hand, collaborative learning encourages students to work together in groups to achieve shared learning goals (Liu et al., 2021). The application of this model has been shown to significantly enhance students' collaboration and communication abilities (Lawrie et al., 2014). Moreover, this technique is effective in teaching and fostering critical thinking, teamwork, communication, and creativity skills (Todd-Gibson, 2017). The combination of both methods enables students to collaboratively investigate and solve problems, thereby supporting the development of their critical thinking skills.

Based on the analysis of students' critical thinking skill data, a significance value of $\alpha = 0.001$ was obtained. This indicates that the probability value ($0.001 < 0.005$) signifies a significant difference in the critical thinking skills of students with high and low learning motivation. Additionally, the average score of students with high motivation was 77.073 ($n = 43$), while those with low motivation scored an average of 65.625 ($n = 11$). This suggests that critical thinking skills are not always directly related to learning motivation. Learning motivation may also be influenced by other factors, such as the learning model used.

Motivation is an internal or external drive that encourages individuals to learn and enhance their knowledge, skills, and abilities to achieve predetermined goals (Uno, 2016). Learning motivation involves both intrinsic and extrinsic factors. Intrinsic motivation arises from within the

individual (Evans, 2015; P. Su et al., 2024), influenced by factors such as curiosity, self-satisfaction, good habits, and awareness. Extrinsic motivation, on the other hand, stems from the surrounding environment, such as praise, advice, encouragement, rewards, imitation, or even punishment (Santrock, 2007; Sari, 2018).

According to Sardiman (2018), motivation functions to encourage individuals to take action, determine the direction of the action, and complete tasks to achieve learning objectives. Motivation can increase along with students' enthusiasm for collaboration (Reni et al., 2024). Furthermore, motivation serves three essential roles: (1) encouraging action, (2) directing behavior toward specific goals, and (3) sustaining effort until learning goals are achieved (Sardiman, 2018). This becomes an important factor in supporting the improvement of students' critical thinking skills.

Students' critical thinking skills can develop when they engage in learning processes that involve discovering, integrating data, sharing, and evaluating information. These activities are simultaneously supported through the collaborative inquiry-based learning model, which has been proven effective in significantly enhancing critical thinking skills by guiding students through experiences such as framing the problem, collecting evidence, analyzing evidence, and celebrating and sharing. This approach not only improves critical thinking but also enhances students' learning motivation.

Students with low critical thinking skills do not necessarily have low motivation, and vice versa. However, for some students, their critical thinking ability may indeed be directly influenced by their learning motivation. Research by Antara et al. (2023) found that students with low motivation tend to participate in learning reluctantly, which adversely affects their critical thinking skills. They prefer to solve problems procedurally without deeper understanding or critical analysis. In contrast, critical thinking skills can improve when students are involved in processes of searching for, analyzing, synthesizing, and conceptualizing information, which foster creativity and risk-taking (Arif et al., 2019; Simbolon et al., 2017). Therefore, learning motivation significantly influences students' participation in the learning process, as seen in their active engagement, confidence, and enthusiasm—traits associated with highly motivated learners.

The findings of this study indicate that students' critical thinking skills are not significantly affected by either learning motivation or the collaborative inquiry-based learning model. There is no interaction between the learning model and learning motivation on students' critical thinking ability, as shown by a probability value of $0.013 < 0.005$, which means H_0 is accepted and H_1 is rejected. This condition may result from students' critical thinking abilities not being strongly influenced by the level of their learning motivation, whether high or low. Nevertheless, the collaborative inquiry-based learning model emphasizes processes involving exploration, collaboration, and problem-solving, which can encourage active engagement and student confidence during the learning process. However, the results suggest that other factors may play a more dominant role in influencing the development of critical thinking skills.

Students with high learning motivation tend to achieve higher critical thinking skill scores when using the collaborative inquiry-based learning model. Meanwhile, students with lower critical thinking abilities can still benefit from the investigative process, group interactions, and teacher guidance. These findings indicate that the collaborative inquiry-based learning model positively influences both learning motivation and the development of critical thinking skills. Active student participation provides meaningful learning experiences, both individually and in groups, making this collaborative inquiry model applicable for solving learning problems continuously. Therefore, even though the study shows no significant interaction between the

collaborative inquiry-based learning model and learning motivation in relation to students' critical thinking skills, this model remains an effective instructional innovation for enhancing students' critical thinking through interactive and collaborative learning experiences.

CONCLUSION

Based on the analysis of data, hypothesis testing, and discussion, it can be concluded that the collaborative inquiry-based learning paradigm significantly improves students' critical thinking skills, as indicated by an average score of 79.602, demonstrating its effectiveness in enhancing the critical thinking abilities of fifth-grade students at SDN Mojorejo 01, Batu City. Furthermore, students with high learning motivation and those with low learning drive exhibit different levels of critical thinking skills, with the highly motivated group achieving an average score of 77.33 and the less motivated group scoring an average of 64.09, suggesting that learning motivation contributes to the development of critical thinking. However, the study found no evidence that learning motivation and the collaborative inquiry-based learning model interactively affect students' critical thinking skills, indicating that while the model itself has a significant positive impact, this effect is not influenced by students' levels of motivation. Therefore, the collaborative inquiry-based learning model can be regarded as an effective, innovative teaching strategy to improve classroom learning quality, particularly in fostering students' critical thinking and motivation to learn.

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