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The Effect of the Inquiry Learning Model on Scientific Literacy and Critical Thinking Skills of Fifth-Grade Students at SDN Sukadanau 04

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Abstract

Scientific literacy and critical thinking skills are essential competencies for students in responding to the demands of twenty-first-century education. However, various assessments indicate that Indonesian students' scientific literacy remains relatively low, underscoring the need for instructional models that actively engage learners in inquiry-based knowledge construction. This study aimed to examine the effect of the Inquiry Learning model on the scientific literacy and critical thinking skills of fifth-grade students at SDN Sukadanau 04. A quantitative approach with a quasi-experimental non-equivalent control group design was employed. The sample consisted of 60 students divided into experimental and control groups. Data were collected through observation, interviews, tests, and documentation, and were analyzed using normality tests, homogeneity tests, independent sample t-tests, and regression analysis. The findings revealed that the Inquiry Learning model had a positive and significant effect on students' scientific literacy and critical thinking skills. The independent sample t-test showed a significance value of 0.000 ($p < 0.05$), while regression analysis produced an R^2 value of 0.707, indicating that the model substantially

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explained improvements in the measured competencies. These findings demonstrate that Inquiry Learning is more effective than conventional instruction in enhancing scientific literacy and critical thinking skills among elementary school students. The study contributes to science education by providing empirical evidence on the effectiveness of Inquiry Learning as an alternative instructional model for fostering twenty-first-century competencies in elementary education.

Keywords: Inquiry Learning; Scientific Literacy; Critical Thinking; Science Education; Elementary School Students

INTRODUCTION

The development of human resources has become one of the primary priorities in preparing future generations capable of competing in the era of globalization and the Industrial Revolution 4.0. In the context of Indonesia's vision toward the Golden Generation 2045, education is expected to produce individuals who possess not only strong academic competencies but also critical thinking abilities, problem-solving skills, creativity, collaboration, and scientific literacy. These competencies are categorized as essential twenty-first-century skills that enable students to adapt to rapidly changing social, technological, and scientific environments. Among these competencies, scientific literacy has gained increasing attention because it serves as a fundamental ability that allows individuals to understand scientific concepts, interpret evidence, make informed decisions, and respond effectively to issues encountered in everyday life (Fensham, 2007).

Scientific literacy has become an important indicator of educational quality worldwide. The Organisation for Economic Co-operation and Development (OECD) defines scientific literacy as an individual's capacity to engage with science-related issues, explain scientific phenomena, evaluate scientific investigations, and interpret scientific evidence for decision-making purposes (OECD, 2025). Students who possess adequate scientific literacy are expected to understand the relationship between scientific concepts and real-world phenomena, enabling them to participate actively and responsibly in society. Scientific literacy therefore extends beyond the mastery of scientific facts and encompasses the ability to think scientifically, evaluate information critically, and apply scientific reasoning in various contexts (Astria & Wardani, 2024).

Despite its importance, scientific literacy among Indonesian students remains relatively low. International assessment results indicate that Indonesia continues to face challenges in improving students' scientific competencies. The Programme for International Student Assessment (PISA) 2022 reported that Indonesia achieved a science literacy score of 383, which remains considerably below the OECD average score of 500 and demonstrates a decline compared to previous assessment cycles (PISA 2022 Technical Report, 2024). Similar findings were reported in the National Assessment conducted by the Ministry of Education, where students' literacy achievement was still below the expected standard. These results suggest that many students encounter difficulties in understanding scientific concepts, interpreting data, and applying scientific knowledge to solve contextual problems (Naura Ayu et al., 2025).

The issue of low scientific literacy is closely related to students' critical thinking abilities. Critical thinking is widely recognized as one of the most essential competencies required for meaningful learning and lifelong education. It enables students to analyze information systematically, evaluate arguments logically, identify relationships among ideas, and make rational decisions based on evidence (Samin, 2023). Critical thinking also encourages learners to become active participants in the learning process rather than passive recipients of information. Through critical thinking, students develop the capacity to question assumptions, investigate problems, and formulate reasoned conclusions that support effective problem-solving in both academic and real-life situations (Nadhiroh & Anshori, n.d.).

In elementary education, the development of critical thinking skills is particularly important because students begin to transition from concrete operational thinking toward more advanced cognitive processes. At this stage, learners gradually develop the ability to analyze information, evaluate evidence, and construct logical arguments. Therefore, educational practices should provide opportunities for students to engage actively in inquiry, exploration, and reasoning activities that support higher-order thinking skills. However, previous studies have revealed that critical thinking abilities among elementary school students remain relatively low due to instructional approaches that often emphasize memorization and teacher-centered learning (Kurniawan et al., 2023).

One factor contributing to the limited development of scientific literacy and critical thinking skills is the continued implementation of conventional teaching practices.

Traditional instruction frequently positions teachers as the primary source of knowledge while students assume passive roles during classroom activities. Such practices restrict opportunities for learners to investigate problems independently, formulate hypotheses, analyze information, and construct knowledge through meaningful experiences. Consequently, students often demonstrate limited engagement in scientific reasoning processes and encounter difficulties when solving contextual problems that require analytical thinking (Barokah, 2025). Given these challenges, educational researchers have increasingly emphasized the importance of implementing student-centered learning models capable of fostering active participation and higher-order thinking skills. One instructional approach that has received considerable attention is Inquiry Learning. Inquiry Learning is a pedagogical model that places students at the center of the learning process by encouraging them to formulate questions, investigate phenomena, collect evidence, analyze information, and construct conclusions independently (Syamsidah & Ratnawati, 2020). Through inquiry-based activities, students are actively involved in discovering knowledge rather than merely receiving information from teachers.

Inquiry Learning aligns closely with constructivist perspectives of learning, which emphasize that knowledge is actively constructed through interaction with experiences and the environment. According to this perspective, meaningful learning occurs when students engage in exploration, experimentation, and reflection. Inquiry-based learning therefore provides opportunities for learners to develop scientific reasoning, problem-solving abilities, and critical thinking skills through authentic learning experiences (Fauziah et al., 2025). Furthermore, Inquiry Learning encourages students to become responsible for their own learning while simultaneously promoting collaboration, communication, and self-confidence.

Several scholars have highlighted the advantages of Inquiry Learning in educational settings. Inquiry-based instruction supports the development of critical and analytical thinking because students are required to formulate questions, evaluate evidence, and justify conclusions throughout the learning process (Muhaimin et al., 2024). In addition, the model facilitates deeper conceptual understanding because learners actively construct knowledge through investigation rather than memorization. Inquiry Learning also increases student engagement and motivation by allowing learners to participate directly in meaningful scientific activities connected to real-life situations (Calesta et al., 2021). Theoretical explanations regarding Inquiry Learning suggest that its instructional stages naturally support the development of scientific literacy and critical thinking. During inquiry activities, students

begin by identifying problems and formulating questions based on observed phenomena. They subsequently develop hypotheses, collect and analyze data, evaluate evidence, and formulate conclusions. These stages correspond closely with the core dimensions of scientific literacy, including explaining scientific phenomena, evaluating scientific investigations, interpreting scientific evidence, and communicating scientific information (Astria & Wardani, 2024). Simultaneously, the inquiry process promotes critical thinking by encouraging students to analyze information, evaluate arguments, and make evidence-based decisions (Ennis, 1995).

Empirical studies have demonstrated the effectiveness of Inquiry Learning in enhancing students' learning outcomes. Research conducted by Amellia et al. (2024) found that guided inquiry significantly improved students' critical thinking skills in science learning. Similarly, Setiyawati et al. (2025) reported that inquiry-based learning positively influenced elementary students' scientific literacy achievement. Another study conducted by Silvi et al. (2024) revealed that Inquiry Learning contributed significantly to the improvement of scientific literacy among elementary school students. Additional findings also suggest that inquiry-oriented instruction enhances higher-order thinking skills, student engagement, and conceptual understanding across various educational contexts (Destrilia et al., 2021). Although previous studies have provided valuable evidence regarding the effectiveness of Inquiry Learning, several limitations remain. Most existing studies focus primarily on a single outcome variable, either scientific literacy or critical thinking skills. Consequently, limited empirical evidence is available regarding the simultaneous influence of Inquiry Learning on both scientific literacy and critical thinking among elementary school students. Moreover, differences in educational contexts, participant characteristics, and instructional implementation create the need for further investigation to validate previous findings in different school environments.

The present study addresses an important research gap identified in previous literature. Existing studies have generally examined the effect of Inquiry Learning on scientific literacy independently or investigated its influence on critical thinking skills as separate constructs. Few studies have simultaneously analyzed the impact of Inquiry Learning on both scientific literacy and critical thinking within the same educational setting, particularly among fifth-grade elementary school students. As a result, there remains insufficient empirical evidence explaining whether Inquiry Learning can concurrently improve these two essential twenty-first-century competencies in primary education. In

addition, previous research has predominantly focused on junior secondary or upper-level educational contexts, whereas studies involving elementary school students remain relatively limited. Considering that elementary education represents a crucial stage for cognitive development and the formation of scientific reasoning skills, further investigation is necessary to determine the effectiveness of Inquiry Learning during this educational phase. Therefore, this study contributes to addressing these empirical and contextual gaps by examining the implementation of Inquiry Learning among fifth-grade students at SDN Sukadanau 04.

The novelty of this research lies in its integrated examination of scientific literacy and critical thinking skills as simultaneous learning outcomes influenced by Inquiry Learning. Unlike previous studies that primarily investigated these variables separately, this study evaluates the effectiveness of Inquiry Learning in improving both competencies concurrently within a single experimental framework. Furthermore, the study focuses specifically on fifth-grade elementary school students, a population that has received relatively limited attention in previous inquiry-based learning research. Another aspect of novelty is the application of a quasi-experimental design to compare students' scientific literacy and critical thinking performance before and after the implementation of Inquiry Learning. Through this approach, the study provides empirical evidence regarding the extent to which inquiry-based instruction contributes to the development of essential competencies required in twenty-first-century education.

The theoretical foundation of this research is derived from constructivist learning theory and Inquiry Learning principles proposed by Eggen and Kauchak as well as subsequent inquiry-based instructional frameworks. These perspectives emphasize active student participation in knowledge construction through questioning, investigation, evidence analysis, and conclusion drawing. Scientific literacy theory serves as the basis for understanding students' ability to apply scientific knowledge and reasoning, while critical thinking theory provides a framework for evaluating students' analytical and evaluative thinking processes. Based on the issues, theoretical perspectives, and research gaps identified above, this study focuses on examining the influence of Inquiry Learning on scientific literacy and critical thinking skills among fifth-grade students at SDN Sukadanau 04. Specifically, the study seeks to determine whether the implementation of Inquiry Learning significantly improves students' scientific literacy and critical thinking abilities compared with conventional instructional approaches. The findings are expected to contribute theoretically

to the development of inquiry-based learning research and practically to the improvement of science education practices in elementary schools. Ultimately, the study aims to provide evidence-based recommendations for educators seeking effective instructional strategies capable of fostering scientific literacy and critical thinking as essential competencies for future generations.

METHODS

This study employed a quantitative approach using a quasi-experimental design to examine the effect of the Inquiry Learning model on students' scientific literacy and critical thinking skills. The research was conducted at SDN Sukadanau 04, Bekasi Regency, West Java, during the second semester of the 2025/2026 academic year. The study was carried out from January to May 2026, covering preparation, implementation, data analysis, and report writing stages. The study adopted a Non-Equivalent Control Group Design with a pretest-posttest control group structure. Two groups participated in the research: an experimental group receiving instruction through the Inquiry Learning model and a control group receiving conventional instruction. The independent variable was the Inquiry Learning model, while the dependent variables were scientific literacy and critical thinking skills. Scientific literacy indicators included the ability to understand, analyze, and apply scientific concepts in problem-solving situations. Critical thinking indicators involved analyzing information, evaluating arguments, drawing logical conclusions, solving problems, and formulating relevant questions.

The population consisted of all fifth-grade students at SDN Sukadanau 04, totaling 60 students divided equally into two classes. A saturated sampling technique was employed, meaning that all population members were included as research participants. Class V-A served as the experimental group, while Class V-B functioned as the control group. Data were collected through observation, interviews, tests, and documentation. Observation was conducted to monitor student participation during classroom activities. Interviews with teachers were used to obtain information regarding instructional practices and student learning conditions. The primary instrument was a set of pretest and posttest essay questions consisting of ten items designed based on scientific literacy and critical thinking indicators. Documentation, including photographs, instructional materials, and students' work, was used to support the research findings.

Prior to implementation, the instruments were tested for validity using the Product Moment correlation and for reliability using Cronbach's Alpha coefficient. The research procedure began with preliminary observations and the preparation of learning instruments, followed by pretesting. The experimental group then received Inquiry Learning instruction through the stages of problem formulation, hypothesis development, data collection, data analysis, and conclusion drawing, whereas the control group received conventional instruction. After the intervention, both groups completed the posttest. Data were analyzed quantitatively using SPSS software. The analysis procedures included validity and reliability testing, normality testing using the One-Sample Kolmogorov–Smirnov test, homogeneity testing using Levene's Test, and hypothesis testing using the Independent Samples t-test. In addition, regression analysis was employed to determine the direction and magnitude of the effect of the Inquiry Learning model on students' scientific literacy and critical thinking skills.

RESULTS

1. Instrument Testing

a. Observation Results of the Inquiry Learning Model Implementation

Observations were conducted in the experimental class to evaluate the implementation of the Inquiry Learning model. The observation focused on teacher and student activities during the learning process, including lesson delivery, discussion facilitation, student participation, collaboration, and learning reflection.

Table 1. Observation Results of Teacher and Student Activities

No	Component	Number of Indicators	Indicators achieved	Percentage	Category
1	Teacher	10	9	90%	Very good
2	Student	10	9	90%	Very good

source: Compiled by the researcher (2026)

Table 1. Observation Results of Teacher and Student Activities shows that both teacher and student activities achieved 90% of the expected indicators and were categorized as *very good*. These results indicate that the Inquiry Learning model was implemented effectively and that students actively participated in the learning process.

2. Prerequisite Analysis Test

Prerequisite tests were conducted to ensure that the data met the statistical assumptions required for hypothesis testing. The tests included normality and homogeneity analyses using IBM SPSS Statistics version 31.

a. Normality Test

Table 2. Normality Test Results

Data	Class	Shapiro-Wilk			Conclusion
		Statistics	Df	Sig.	
Pretest	Experiment	0.957	30	0.265	Normal
	Control	0.950	30	0.168	Normal
Posttest	Experiment	0.938	30	0.083	Normal
	Control	0.969	30	0.517	Normal

source: Compiled by the researcher (2026)

Table 2. Normality Test Results shows that all significance values were greater than 0.05, indicating that both pretest and posttest data in the experimental and control classes were normally distributed. Therefore, the data met the assumptions required for further statistical analysis.

b. Homogeneity Test

The homogeneity test was conducted using Levene's Test to determine whether the variances of the experimental and control groups were homogeneous.

Table 3. Homogeneity Test Results

Variables	Levene's Test	Sig.	Conclusion
Inquiry Model	0.208	0.650	Homogeneous

source: Compiled by the researcher (2026)

Table 3. Homogeneity Test Results shows a significance value of 0.650, which is greater than 0.05. This indicates that the variances of the two groups were homogeneous, confirming that the data met the assumptions required for further statistical analysis.

3. Hypothesis Testing (Independent Sample t-Test)

An independent sample t-test was conducted to determine whether there was a significant difference in critical thinking skills between the experimental and control groups.

Table 4. Independent Sample t-Test Results

Data	Information	Sig. (2-tailed)	Criteria	Conclusion
Posttest	Equal variances assumed	0,000	Sig < 0.05	H0 is rejected

source: Compiled by the researcher (2026)

Table 4. Independent Sample t-Test Results shows a significance value (Sig. 2-tailed) of 0.000, which is lower than 0.05. Therefore, H_0 was rejected, indicating a significant difference between the posttest scores of the experimental and control groups. These findings indicate that the Inquiry Learning model had a significant positive effect on students'

critical thinking skills, as students in the experimental group achieved higher learning outcomes than those in the control group.

4. Regression Analysis

A simple linear regression analysis was conducted to examine the effect of the Inquiry Learning model on students' scientific literacy and critical thinking skills.

Table 5. Regression Analysis Results

Variables	F count	Sig.(P-value)	T	R squre
Inquiry	68,813	0,000	17,822	0.707

source: Compiled by the researcher (2026)

Table 5. Regression Analysis Results shows that the regression model was statistically significant, with an F-value of 68.813 and a significance value of 0.000 (< 0.05). The coefficient of determination (R^2) was 0.707, indicating that the Inquiry Learning model explained 70.7% of the variance in students' scientific literacy and critical thinking skills. These findings demonstrate that the Inquiry Learning model had a significant positive effect on students' scientific literacy and critical thinking skills, confirming its effectiveness in enhancing higher-order thinking abilities among fifth-grade elementary school students.

DISCUSSION

The findings of this study demonstrate that the implementation of the Inquiry Learning model had a significant positive effect on both scientific literacy and critical thinking skills among fifth-grade students at SDN Sukadanau 04. Statistical analysis revealed that students in the experimental class who experienced Inquiry Learning achieved higher posttest scores in scientific literacy and critical thinking than students in the control class who received conventional instruction. The posttest mean score for scientific literacy in the experimental class reached 73.10, compared with 56.60 in the control class, while the mean score for critical thinking skills was 69.03 in the experimental class and 56.93 in the control class. Furthermore, the independent sample t-test indicated a significance value of 0.000 ($p < 0.05$), confirming that the observed differences were statistically significant. These results suggest that Inquiry Learning is more effective than conventional teacher-centered instruction in improving students' higher-order cognitive abilities, particularly scientific literacy and critical thinking.

The improvement in scientific literacy can be explained through the characteristics of Inquiry Learning, which actively engage students in constructing knowledge through observation, investigation, data collection, hypothesis formulation, and evidence-based reasoning. Unlike conventional approaches that emphasize information transmission, Inquiry Learning positions students as active participants in the learning process. Students are encouraged to identify problems, formulate questions, gather evidence, analyze information, and draw conclusions independently. Such learning experiences facilitate meaningful knowledge construction and help learners connect scientific concepts with real-life situations. As a result, students develop not only conceptual understanding but also the ability to apply scientific knowledge in solving problems and explaining phenomena scientifically.

The findings support the theoretical framework of scientific literacy proposed by the OECD and the PISA framework, which emphasizes the ability to explain scientific phenomena, evaluate and design scientific inquiries, interpret data and evidence scientifically, and communicate scientific information effectively. The results showed that students in the experimental group achieved higher scores across all scientific literacy indicators compared to those in the control group. This indicates that Inquiry Learning effectively develops multiple dimensions of scientific literacy simultaneously. Through inquiry activities, students become accustomed to questioning phenomena, conducting investigations, interpreting evidence, and communicating findings, which are essential competencies in contemporary science education.

The enhancement of scientific literacy observed in this study is also consistent with the principles of constructivist learning theory. Constructivism argues that knowledge is actively constructed by learners through interaction with their environment rather than passively received from teachers. In the context of Inquiry Learning, students build their own understanding through direct experiences, collaborative discussions, and reflective thinking. The teacher functions primarily as a facilitator who guides students during the investigation process while allowing them to discover concepts independently. This instructional approach creates opportunities for deeper cognitive engagement, enabling students to internalize scientific concepts more effectively than through conventional lecture-based methods. Consequently, scientific literacy develops as students actively construct and reconstruct their understanding based on evidence and experience.

The significant improvement in critical thinking skills further confirms the effectiveness of Inquiry Learning as a student-centered instructional model. Critical thinking involves the ability to interpret information, analyze arguments, evaluate evidence, draw conclusions, and provide logical explanations. These skills are inherently embedded within the inquiry process. During inquiry activities, students are required to formulate hypotheses, evaluate available evidence, analyze relationships among variables, and justify conclusions using scientific reasoning. Such cognitive processes naturally stimulate higher-order thinking and encourage students to move beyond memorization toward analytical and reflective thinking.

The findings revealed that students in the experimental class outperformed those in the control class across all critical thinking indicators, including interpretation, analysis, evaluation, inference, and explanation. This pattern suggests that Inquiry Learning not only improves academic achievement but also strengthens students' cognitive abilities required for problem-solving and decision-making. The inquiry process encourages learners to engage with complex problems, consider multiple perspectives, evaluate alternative explanations, and construct evidence-based arguments. Consequently, students become more capable of making reasoned judgments and solving problems systematically.

These findings can also be interpreted through the lens of cognitive learning theory, which emphasizes active mental processing in learning. Cognitive theory suggests that meaningful learning occurs when students actively organize, interpret, and integrate new information into existing cognitive structures. Inquiry Learning facilitates this process by providing opportunities for exploration, experimentation, and reflection. Students are not merely recipients of information; rather, they actively process information, formulate explanations, and test hypotheses. Such cognitive engagement contributes significantly to the development of critical thinking skills because learners must continuously evaluate and refine their understanding throughout the inquiry process.

The present findings are consistent with previous studies investigating the effectiveness of Inquiry Learning in enhancing higher-order thinking skills. Apriliyanti and Barokah (2025) reported that Inquiry Learning significantly improved elementary students' critical thinking skills, as evidenced by higher posttest scores in the experimental group compared with the control group. Similarly, Anggraeni and Khuzaeni (2025) found a significant influence of Inquiry Learning on students' critical thinking abilities, demonstrated

by statistically significant differences between pretest and posttest results. The current study extends these findings by demonstrating that Inquiry Learning can simultaneously improve both scientific literacy and critical thinking skills among elementary school students.

The results are also in agreement with the findings of Zain et al. (2022), who concluded that inquiry-based instruction significantly enhanced students' critical thinking abilities in social studies learning. Although conducted in a different subject area, their study highlights the versatility of inquiry-based approaches in fostering analytical and evaluative thinking across disciplines. Likewise, Hulwa et al. (2025) reported significant improvements in critical thinking among high school students learning fluid dynamics through guided inquiry. The consistency of findings across educational levels and subject domains suggests that Inquiry Learning possesses substantial potential as a pedagogical strategy for developing higher-order cognitive skills.

Regarding scientific literacy, the present study supports the findings of Kang (2022), who identified a positive relationship between inquiry-based learning and scientific literacy development. Kang emphasized that inquiry-oriented instruction provides students with opportunities to engage in authentic scientific practices, thereby strengthening their scientific understanding and reasoning abilities. Similarly, Destrilia et al. (2021) found that inquiry-based learning improved students' scientific literacy, higher-order thinking skills, and classroom engagement more effectively than conventional teaching approaches. The current study confirms these conclusions within the context of elementary education and demonstrates that inquiry activities contribute significantly to students' scientific literacy achievement.

Furthermore, the findings align with the study conducted by Wen et al. (2023), which reported that inquiry-based learning positively influenced scientific literacy and science achievement. Their research highlighted the importance of student engagement in scientific investigations as a mechanism for literacy development. In the present study, students actively participated in observing phenomena, discussing hypotheses, collecting evidence, and presenting findings, which likely contributed to their improved scientific literacy outcomes. These results reinforce the argument that scientific literacy develops most effectively when students experience science as a process of inquiry rather than as a collection of isolated facts.

An important contribution of this study lies in its simultaneous examination of scientific literacy and critical thinking skills. Previous studies generally focused on only one outcome variable, either scientific literacy or critical thinking. The present research demonstrates that both competencies can be enhanced concurrently through the implementation of Inquiry Learning. This finding is particularly important because scientific literacy and critical thinking are conceptually interconnected. Scientific literacy requires students to evaluate evidence, interpret data, and make informed decisions, all of which involve critical thinking processes. Likewise, critical thinking becomes more meaningful when applied within authentic scientific contexts. Therefore, the simultaneous improvement of these competencies suggests that Inquiry Learning creates a synergistic learning environment where scientific understanding and critical reasoning develop together.

Theoretically, this study contributes to the growing body of evidence supporting constructivist and cognitive learning perspectives. The findings confirm that learning environments emphasizing active exploration, problem-solving, and knowledge construction can significantly improve higher-order cognitive outcomes. The study also strengthens the argument that scientific literacy and critical thinking should not be treated as separate educational goals but rather as complementary competencies that can be developed through integrated instructional approaches. Consequently, the research provides empirical support for educational reforms promoting inquiry-based pedagogy in elementary science education.

From a practical perspective, the findings have important implications for teachers, schools, and educational policymakers. Teachers should consider incorporating Inquiry Learning strategies into regular classroom practice to foster students' scientific literacy and critical thinking skills. Rather than relying predominantly on lectures and rote memorization, educators should create learning environments that encourage questioning, investigation, discussion, and reflection. Schools can support this process by providing adequate learning resources, laboratory materials, and professional development opportunities that enhance teachers' ability to implement inquiry-based instruction effectively.

For curriculum developers and policymakers, the findings underscore the importance of integrating inquiry-oriented learning experiences into elementary education. As educational systems increasingly emphasize twenty-first-century competencies, instructional approaches that promote critical thinking, scientific reasoning, and problem-solving become essential. Inquiry Learning represents a practical and theoretically grounded strategy for

achieving these educational objectives. Therefore, curriculum frameworks should explicitly encourage inquiry-based pedagogies and provide guidance for their implementation in classroom settings.

Despite its significant contributions, this study has several limitations that should be acknowledged. First, the research was conducted in a single elementary school, which may limit the generalizability of the findings to broader educational contexts. Student characteristics, school culture, and instructional conditions may differ across institutions, potentially influencing the effectiveness of Inquiry Learning. Second, the sample size was relatively limited, involving only sixty students divided into experimental and control groups. Future studies involving larger and more diverse samples would provide stronger evidence regarding the effectiveness of Inquiry Learning across different contexts.

Third, the study focused exclusively on short-term learning outcomes measured through posttest assessments. Although significant improvements were observed, the long-term impact of Inquiry Learning on scientific literacy and critical thinking remains unclear. Future research should investigate whether these improvements are sustained over time and whether they influence students' academic performance in subsequent educational stages. Fourth, the research relied primarily on quantitative measures, which may not fully capture the complexity of students' learning experiences. Incorporating qualitative methods such as classroom observations, interviews, and reflective journals could provide deeper insights into how Inquiry Learning influences students' cognitive development.

In conclusion, the findings demonstrate that Inquiry Learning is an effective instructional approach for enhancing both scientific literacy and critical thinking skills among elementary school students. The model promotes active engagement, evidence-based reasoning, and meaningful knowledge construction, leading to significant improvements across multiple cognitive dimensions. The study confirms previous research findings while extending existing knowledge by demonstrating the simultaneous development of scientific literacy and critical thinking within an inquiry-based learning environment. Consequently, Inquiry Learning represents a valuable pedagogical strategy for preparing students to meet the demands of twenty-first-century education and fostering the competencies necessary for lifelong learning and informed citizenship.

CONCLUSION

This study aimed to examine the effect of the Inquiry Learning model on scientific literacy and critical thinking skills among fifth-grade students at SDN Sukadanau 04. The findings revealed that the implementation of Inquiry Learning had a significant positive effect on both variables. Students in the experimental group achieved higher outcomes than those in the control group in terms of scientific literacy and critical thinking performance. The improvement was reflected in higher posttest mean scores and supported by statistical analyses indicating significant differences between the two groups. These findings demonstrate that Inquiry Learning promotes a more active, exploratory, and student-centered learning environment, thereby facilitating the development of essential twenty-first-century competencies.

The results directly address the research objectives by confirming that Inquiry Learning contributes significantly to the enhancement of elementary students' scientific literacy and critical thinking skills. Through inquiry-based stages, including problem identification, hypothesis formulation, data collection, evidence analysis, and conclusion drawing, students were encouraged to construct knowledge independently while strengthening their analytical reasoning abilities. This study contributes theoretically to the growing body of literature on inquiry-based learning by providing empirical evidence of its effectiveness in improving scientific literacy and critical thinking at the elementary education level. Practically, the findings offer valuable guidance for teachers and schools in selecting instructional approaches that foster higher-order thinking skills. The study also highlights the potential of Inquiry Learning to improve overall learning quality and student achievement more effectively than conventional teaching methods.

The implications of this research suggest that Inquiry Learning should be integrated more consistently into classroom practice, particularly in learning contexts that require investigation, reasoning, and problem-solving activities. Schools are encouraged to provide adequate instructional support and professional development opportunities for teachers to ensure effective implementation. Future studies are recommended to involve larger and more diverse samples, explore different educational levels, and investigate the influence of Inquiry Learning on other competencies, such as creativity, problem-solving, collaboration, and communication skills.

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