

Science attitudes, scientific literacy, critical thinking skills, and academic performance of Grade IV pupils

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Abstract: In a world driven by scientific discovery and innovation, young learners' attitudes, literacy, and critical thinking skills shape their path toward academic success. This study was conducted to determine the relationships among science attitudes, scientific literacy, critical thinking skills, and academic performance in Science of Grade IV pupils in the District of Ivisan, for School Year 2024-2025. The study employed a descriptive-correlational research design involving 240 Grade IV pupils of 15 public elementary schools in the District of Ivisan, during School Year 2024-2025. The research instruments used were 15-item Likert scale survey questionnaires and a 15-item researcher-made test questionnaire. Academic performance was determined based on the pupils' science grades in the third quarter of School Year 2024-2025. Data were analyzed using frequency, percentage, means, and Pearson's r at a 0.05 significance level. The level of science attitudes of Grade IV pupils was found to be "positive". The level of scientific literacy of Grade IV pupils was found to be "good". The level of critical thinking skills of Grade IV pupils was found to be "high". The level of academic performance in Science of Grade IV pupils was found to be "very satisfactory". There were significant relationships between science attitudes and scientific literacy; between science attitudes and critical thinking skills; between scientific literacy and critical thinking skills; between scientific literacy and academic performance in Science; and between critical thinking skills and academic performance in Science of Grade IV pupils. However, there was no significant relationship between science attitudes and academic performance in Science of Grade IV pupils.

Keywords: Science Attitudes, Scientific Literacy, Critical Thinking Skills, Academic Performance

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INTRODUCTION

While global curriculum reforms advocate for inquiry-based and competency-driven science education, the Philippine context presents alarming challenges—evidenced by consistently low performances in international assessments like TIMSS and PISA, as well as in national evaluations such as the NAT. These results reflect a systemic crisis in science education, marked by disengagement and poor learner outcomes.

Studies highlight that academic performance in science is not solely dependent on cognitive abilities but is significantly influenced by attitudes toward science, scientific literacy, and critical thinking skills. Learners who possess positive attitudes toward science are more motivated, perform better academically, and are more inclined to pursue STEM-related paths. Similarly, scientific literacy empowers learners to understand and apply concepts, while critical thinking enables them to analyze and solve complex problems. These three factors—attitude, literacy, and thinking—are intricately linked and foundational to science learning.

In this context, the researcher, drawing from personal classroom observations, noted Grade IV pupils' reluctance to engage with science due to perceived difficulty and lack of relevance. This motivated the study, which seeks to explore the interrelationship among science attitudes, scientific

literacy, critical thinking skills, and academic performance. Aligned with SDG 4 (Quality Education) and Capiz State University's commitment to producing responsive educational research, the study aims to generate insights that can inform effective pedagogical strategies, curriculum improvement, and tailored interventions. Ultimately, it aspires to foster meaningful engagement and improved science learning outcomes among young learners, cultivating curiosity, motivation, and independent thinking at the foundational level of education.

Problem statement

The main purpose of this study was to determine the relationships among science attitudes, scientific literacy, critical thinking skills, and academic performance in Science of Grade IV pupils in the District of Ivisan, for School Year 2024-2025.

Specifically, this study sought to answer the following questions:

1. What is the level of science attitudes of the participants?
2. What is the level of scientific literacy of the participants?
3. What is the level of critical thinking skills of the participants?
4. What is the level of academic performance in Science of the participants?
5. Are there significant relationships among the level of science attitudes, scientific literacy, critical thinking skills, and academic performance in Science of the participants?

Theoretical framework

The study on science attitudes, scientific literacy, critical thinking skills, and academic performance in Science finds its foundation on the Constructivist Learning Theory developed by Jean Piaget (1976), which emphasizes that learners actively construct their understanding and knowledge of the world through experiences and reflection. This theory aligns with modern educational practices that prioritize student engagement and interaction. It supports the idea that learners create meaning based on their experiences rather than simply absorbing information. It offers a framework for designing instructional strategies that encourage critical thinking, problem-solving, and meaningful learning.

The constructivist learning theory possesses key features of active learning, prior knowledge integration, social interaction, reflection and critical thinking, and personalized learning paths. Here, the five features of constructivist learning theory are briefly described.

The first feature, active learning, emphasizes student engagement through hands-on activities, discussions, and real-world applications. The second feature, prior knowledge integration, highlights that the integration of new information with learners' existing knowledge is crucial, as activating prior knowledge facilitates the construction of new understanding and reduces cognitive load, thereby improving learning outcomes. The third feature, social interaction, posits that collaborative learning environments, where students interact with peers and educators, further deepen comprehension by allowing learners to articulate ideas and receive feedback, fostering a more profound grasp of the subject matter. The fourth feature, reflection and critical thinking, emphasizes that reflective practices, such as journaling and critical analysis, encourage learners to evaluate their experiences, promoting metacognition and the development of higher-order thinking skills. Lastly, the personalized learning paths, tailored to individual students' backgrounds and experiences, recognize that learning is subjective and that students construct knowledge differently.

In the context of this study, the constructivist view supports the idea that Grade IV pupils build their scientific knowledge and skills through interactive and meaningful learning

experiences. As they engage with science content, they are not only acquiring facts but are also shaping their attitudes towards science, enhancing their scientific literacy, and sharpening their critical thinking skills. These constructs are believed to play significant roles in shaping their academic performance.

To further support the analysis of key variables in this study, complementary theoretical perspectives are also considered. Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001) is relevant in understanding the development of critical thinking skills, especially within the cognitive domain. The higher-order thinking skills: analyzing, evaluating, and creating, are integral to science learning and are indicators of deep understanding. These skills enable pupils to approach scientific problems methodically and draw logical conclusions based on evidence.

In terms of scientific literacy, the study also draws on the framework provided by the Programme for International Student Assessment (PISA), which defines scientific literacy as the ability to engage with science-related issues, interpret data, and apply scientific knowledge in real-world contexts (OECD, 2016). This framework emphasizes not only content knowledge but also the competencies to evaluate and communicate scientific findings, which are essential for 21st-century learners. Furthermore, the Theory of Planned Behavior by Ajzen (1991) supports the examination of attitudes toward science. This theory suggests that learners' attitudes influence their intentions and behaviors, including their willingness to engage in science-related tasks. A positive attitude towards science is therefore expected to increase motivation, engagement, and ultimately improve academic achievement.

Together, these theories provide a comprehensive foundation for understanding how science attitudes, scientific literacy, and critical thinking skills interact and contribute to the academic performance of Grade IV pupils. By situating these variables within a constructivist framework and supporting them with domain-specific theories, this study aims to determine the relationships among the level of science attitudes, scientific literacy, critical thinking skills, and academic performance in Science of Grade IV pupils.

METHODOLOGY

This study used the descriptive-correlational research design, which sought to determine the relationships among the level of science attitudes, scientific literacy, critical thinking skills, and academic performance in Science of Grade IV Pupils in 15 public elementary schools within the District of Ivisan, for School Year 2024-2025.

The participants of the study were 240 out of 634 Grade IV Pupils of the District of Ivisan selected through a stratified random sampling technique to ensure that specific subgroups (strata) within a population are fairly represented. The total number of participants was determined using the Raosoft sample size calculator.

Data for this study were collected using structured surveys and test questionnaires. Science Attitudes were measured using a 15-item Likert scale survey questionnaire adapted from Francisco (2010). Scientific Literacy was assessed through a 15-item test-type questionnaire developed by the researcher based on the Science competencies aligned with the curriculum of the Department of Education from the first to third quarter. Critical Thinking Skills were measured using a researcher-made 15-item Likert scale survey designed to capture the pupils' reasoning, analysis, and evaluation abilities. Academic performance was determined based on the pupils' Science grades in the third quarter of School Year 2024-2025, as recorded in their official school records.

This study focused on Grade IV pupils within the District of Ivisan, Schools Division of Capiz. The research was limited to this specific grade level to maintain a focused examination of attitudes, literacy, critical thinking, and academic performance. While the study aims to provide comprehensive insights, it may not account for the influence of external factors such as socioeconomic status and parental involvement, which could also play significant roles in academic performance.

The statistical tools used to analyze and interpret the gathered data were: frequency, percentage, means, and Pearson's product-moment correlation coefficient, with the inferential test set at a 0.05 alpha level.

DISCUSSION OF FINDINGS

Science attitudes of Grade IV pupils

The level of science attitudes of Grade IV pupils as a whole had a grand mean of 3.96. This grand mean implies that Grade IV pupils had a "positive" level of science attitudes. This further suggests that at the elementary level, learners are still open and receptive to science learning, which provides a valuable window of opportunity for educators to build foundational scientific literacy and enthusiasm. This high level of positive attitude is critical, as early engagement in science is strongly correlated with long-term interest, achievement, and potential career pathways in STEM fields. At this developmental stage, pupils exhibit natural curiosity and a willingness to explore, which are key ingredients for fostering inquiry-based learning. Their receptiveness implies that they are more likely to embrace new scientific concepts, ask questions, and participate actively in experiments and discussions when properly guided. Hence, educators play a pivotal role in nurturing this enthusiasm by designing lessons that are not only aligned with the curriculum but also cognitively stimulating and emotionally engaging. Integrating real-world problem-solving activities, hands-on experiments, and collaborative group tasks can deepen understanding and reinforce a sense of relevance and enjoyment in learning science.

Furthermore, the data revealed that the grand mean of Grade IV pupils' level of science attitudes ranged from 2.03 to 4.38. The highest mean of 4.38 interpreted as "very positive" was on the statements "I like science a lot, it is not a difficult subject for me", and "Science is important to everyday activities". This result implies that students' perceptions of science reflect a strong affinity for the subject and its relevance to daily life. This is crucial for fostering positive attitudes towards science education, as it indicates that students find science both enjoyable and applicable. This conforms to the study of Malike et al. (2020), which states that students express a strong liking for science, which can enhance their motivation and engagement in learning activities. Likewise, Kervinen et al. (2020) emphasized that science is important for everyday activities, suggesting that students can connect theoretical knowledge to practical applications, reinforcing their interest.

On the other hand, the lowest mean of 2.03 interpreted as "negative" attitude was on the statement "I feel that Science is a boring subject". This result implies that pupils generally do not find science boring. Such a finding is particularly encouraging, as it indicates a favorable disposition toward science content and learning experiences at the elementary level. This perception can be influenced by several factors, including engaging teaching methods, learner-centered classroom environments, relevant instructional materials, and students' prior experiences or initial competencies in science. This is in consonance with the study of Hernaya & Razak (2022), which states that the Contextual Teaching and Learning (CTL) model, for instance, has been shown

to enhance students' critical thinking skills in science, which could contribute to a more engaging and less boring experience for students.

Scientific Literacy of Grade IV Pupils

The grand mean of the level of scientific literacy of Grade IV pupils was 7.93. The grand mean implies that the level of scientific literacy of Grade IV pupils was "Good". This further suggests that students possess a foundational grasp of scientific concepts, which is crucial at this educational stage. Scientific literacy at the elementary level serves as the bedrock for critical thinking, informed decision-making, and meaningful participation in societal issues involving science and technology. This result corroborates the study of Kesik (2016), which reported that Grade IV pupils exhibit high levels of scientific literacy across various domains, including knowledge and skills related to scientific inquiry. It indicates that early science education is meeting some of its objectives in developing learners who are not only knowledgeable but also capable of engaging with science in practical and reflective ways. Conversely, Widiasari and Hermanto (2023) discussed that while the average score reflects a good level of literacy, it is essential to recognize that 72.6% of science literacy is influenced by factors beyond cognitive ability, suggesting that continuous improvement and support are necessary for all students. This finding underscores the importance of providing holistic support systems for learners.

Critical thinking skills of Grade IV pupils

The level of critical thinking skills of Grade IV pupils as a whole had a grand mean of 4.05. This grand mean implies that Grade IV pupils had a "high" level of critical thinking skills. This further implies that learners are not only acquiring knowledge but are also beginning to analyze, evaluate, and apply information in meaningful ways.

Furthermore, the data disclosed that the grand mean of Grade IV pupils' level of critical thinking skills ranged from 3.83 to 4.32. The highest mean of 4.32 interpreted as "very high," was on the statements "I remember and apply the lessons I learned in science class to real-world situations". This conforms to the findings of the study of Yanik & Serin (2016), emphasizing the use of real-world situations in science lessons. On the other hand, the lowest mean of 3.83 interpreted as "high" was on the statement "I analyze what went wrong when my experiment does not work". This is in contrast to the study of Goldstein (2015), which indicates that analyzing failures can lead to improved methodologies and outcomes. This study emphasizes the necessity of accounting for measurement errors, which can significantly affect conclusions drawn from experiments. The result of this study also negates the study of Reynolds (2024) that emphasizes the importance of reflective practices in experimental design. This implies that while students are proficient at applying knowledge in familiar, real-life contexts, they may struggle with more abstract or metacognitive aspects of critical thinking, such as evaluating and reflecting on their own mistakes. This suggests a potential gap in Science instruction where the emphasis may lean more heavily toward knowledge application than reflective problem-solving.

Academic Performance in Science of Grade IV Pupils

The level of academic performance in Science of Grade IV pupils with the grand mean of all the grades in Science of Grade IV pupils was 86.06. This grand mean implies that the level of academic performance of Grade IV pupils was "very satisfactory". This suggests that, overall, the pupils have acquired a strong foundational understanding of Science concepts as expected at their grade level. This further implies that the teaching strategies, learning materials, and school environment may have effectively supported students' learning in Science. Moreover, this result implies that the current Science curriculum is appropriately aligned with the learners'

developmental stages and learning needs. These implications point to the value of holistic, student-centered approaches in education and the importance of maintaining a well-rounded support system to ensure continued high performance in Science.

Relationships among science attitudes, scientific literacy, critical thinking skills and academic performance in Science of Grade IV pupils

The result reveals that there was a significant relationship between science attitudes and scientific literacy because the r-value of 0.180 had a p-value of 0.005, which was less than 0.05 alpha. The result implies that the higher the science attitudes of learners, the higher their scientific literacy. This conforms to the study of Sargioti & Emvalotis (2020), which indicates that students' beliefs about science and their educational experiences significantly influence their scientific literacy. Likewise, Harefa (2019) states that positive science attitudes foster an environment conducive to developing scientific literacy, as seen in students' optimistic and critical approaches to scientific inquiry.

Furthermore, there was a significant relationship between science attitudes and critical thinking skills of Grade IV pupils because the r-value of 0.615 had a p-value of 0.000, which was less than 0.05 alpha. The result implies that the higher the science attitudes of pupils, the higher their critical thinking skills. This finding affirms the study of Sekaringtyas et al. (2024), which indicates that students with positive scientific attitudes tend to exhibit better critical thinking skills, as seen in studies where improved scientific literacy and understanding of concepts directly influenced students' attitudes and critical thinking abilities. The result also supports the study of Mawardi et al. (2024), which states that innovative teaching methods, such as the STEM approach, have been shown to significantly enhance critical thinking skills, reinforcing the idea that a positive attitude towards science can lead to better cognitive outcomes.

On the other hand, there was no significant relationship between science attitudes and academic performance in Science of Grade IV pupils because the r-value of 0.080 had a p-value of 0.214, which was greater than 0.05 alpha. The result implies that regardless of the level of science attitudes of learners, the level of academic performance in Science is not influenced. This corroborates the study of Zia et al. (2023), which highlighted that attitudes significantly impacted academic performance for certain demographics, such as urban students, but not for rural ones, indicating that contextual factors can influence the relationship between attitudes and performance. However, it negates the study of Pongsophon (2023), which indicates that students' attitudes towards science are strong predictors of their academic success. Pongsophon found that students' confidence and positive attitudes were among the strongest predictors of science achievement.

There was a significant relationship between scientific literacy and critical thinking skills of Grade IV pupils because the r-value of 0.449 had a p-value of 0.000, which was lower than 0.05 alpha. The result implies that the higher the scientific literacy of learners, the higher their critical thinking skills. This also implies that enhancing scientific literacy is not only essential for academic success but also serves as a foundational pathway to cultivating higher-order thinking skills such as analysis, evaluation, and logical reasoning. This suggests that educational programs aiming to improve critical thinking should deliberately integrate scientific literacy components into classroom instruction, particularly in the early grades, where cognitive and reasoning skills are still being developed. This conforms to the study of Apriliana & Anggrella (2024), which highlighted that scientific literacy involves understanding scientific concepts and applying them to problem-solving and decision-making, which are crucial for developing critical thinking skills. This also supports the study of Sekaringtyas et al. (2024), which mentioned that implementing

educational strategies that focus on scientific literacy can foster critical thinking, as seen in the positive influence of scientific literacy on students' scientific attitudes and achievements.

Likewise, there was a significant relationship between scientific literacy and academic performance in Science of Grade IV pupils because the r -value of 0.483 had a p -value of 0.000, which was less than the 0.05 alpha. The result implies that the higher the scientific literacy of learners, the higher their academic performance. This also implies that fostering scientific literacy at an early stage is essential for academic success in Science. Scientific literacy, in other words, serves as a foundational skill for navigating and excelling in Science subjects. This result affirms the study of Avikasari et al. (2018), which indicates a strong positive relationship between scientific literacy and academic performance, with studies showing that improved scientific literacy leads to higher science achievement scores. In the same manner, the study of Widyasari & Hermanto (2023) posits that cognitive skills also play a role, with studies indicating that cognitive ability can influence science literacy, thereby affecting academic performance.

Also, there was a significant relationship between critical thinking skills and academic performance in Science of Grade IV pupils because the r -value of 0.268 had a p -value of 0.000, which was lower than the 0.05 alpha. The result implies that the higher the level of critical thinking skills of learners, the higher their level of academic performance in Science. This finding further implies that integrating activities and strategies that foster critical thinking, such as problem-solving tasks, scientific investigations, and open-ended questioning, can be vital to improving Science learning outcomes. This result aligns with the study of Farillon (2022), which revealed that critical thinking skills significantly influence academic performance in Science. The result is also in consonance with the results of Mawardi et al. (2024) and Sunarti et al. (2023), which show that specific learning models, such as STEM and Guided Inquiry, effectively enhance critical thinking skills, leading to better academic results.

The results indicated significant relationships among science attitudes and scientific literacy, science attitudes and critical thinking skills, scientific literacy and critical thinking skills, scientific literacy and academic performance, and critical thinking skills and academic performance of Grade IV pupils. Thus, the null hypothesis stating that there are no significant relationships among the level of science attitudes, scientific literacy, critical thinking skills, and academic performance in Science of Grade IV pupils was rejected. However, it is acknowledged that the relationship between science attitudes and academic performance was not significant; therefore, the result failed to reject the null hypothesis for this specific relationship. This implies that improving scientific literacy and critical thinking skills has a strong influence on pupils' academic performance in Science. While science attitudes alone may not directly impact academic achievement, they play a crucial role in developing scientific literacy and critical thinking skills, which, in turn, positively affect performance. This is aligned with the attitudinal and behavioral domains mentioned by Benjamin et al. (2015) and Fasce & Picó (2019), who stated that attitudes toward science and behaviors such as trust in science and openness to evidence are also important for scientific literacy. Therefore, it is essential for teachers and curriculum planners to design learning activities that promote critical thinking and scientific literacy while also fostering positive attitudes towards Science. As Crédé, Roch, and Kieszczynka (2017) emphasized, academic performance is influenced by a variety of cognitive, emotional, and behavioral factors, highlighting the importance of a holistic approach to science education.

CONCLUSION

The findings of this study underscore the pivotal role of science attitudes, scientific literacy, and critical thinking skills in shaping the academic performance of Grade IV pupils in Science. The data revealed that learners generally exhibited a positive attitude toward science, a good level of scientific literacy, and a high degree of critical thinking skills. These results indicate that young learners are receptive and cognitively prepared for meaningful science learning when instructional approaches are engaging, relevant, and supportive.

Despite the non-significant relationship between science attitudes and academic performance, significant positive relationships were found between: (1) science attitudes and scientific literacy, (2) science attitudes and critical thinking skills, (3) scientific literacy and critical thinking skills, (4) scientific literacy and academic performance, and (5) critical thinking skills and academic performance. These results suggest that while science attitudes may not directly influence grades, they play a crucial mediating role in the development of the competencies that do—namely scientific literacy and critical thinking.

In light of these findings, it becomes clear that academic success in Science is best achieved through an integrated approach that cultivates not only knowledge acquisition but also students' cognitive and affective domains. The results advocate for instructional designs that incorporate inquiry-based learning, real-world problem-solving, reflective thinking, and hands-on experiences to develop students' reasoning abilities and deepen conceptual understanding.

Ultimately, this study contributes valuable insights to science education at the elementary level. It calls on educators, curriculum developers, and policymakers to focus on holistic and learner-centered pedagogical strategies that reinforce scientific literacy and critical thinking while nurturing students' curiosity and enthusiasm toward science. By doing so, the foundations for lifelong scientific engagement and future success in STEM fields can be laid early in learners' academic journeys.

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