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Reading Readiness and Its Association to Critical Thinking Skills and Academic Achievement Among Grade 9 Science Learners

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ABSTRACT

This study explored how readiness influences critical thinking and problem-solving skills of secondary school students. It was conducted during the fourth quarter of the 2025-2026 school year at a public secondary school in Iloilo City. The study used a quantitative descriptive-correlational approach and included all 46 Grade 9 students (N=46). The researcher collected data using a validated reading readiness test, specially designed science reading materials, and an achievement test developed by the researcher to assess students' scientific knowledge and analytical skills. Descriptive statistics, including frequencies, percentages, means, and standard deviations, described student performance, while Pearson product-moment correlation examined relationships among the study variables. Results showed that students had moderate skills in reading readiness, critical thinking, and science achievement. The average reading readiness score was 74.57 (SD = 7.52), with most students at a moderate level and the rest at a high level. For critical thinking, the mean score was 71.88 (SD = 7.11), and most students showed moderate proficiency. Science achievement had a mean score of 71.48 (SD = 6.45), with most students performing at a moderate level.Correlation analysis showed strong, positive, and statistically significant relationships among all three variables. Reading readiness was closely linked to science achievement ($r = 0.900$, $p < 0.001$) and critical thinking ($r = 0.853$, $p < 0.001$). Critical thinking was also strongly related to science achievement ($r = 0.787$, $p < 0.001$). These results emphasize the importance of basic literacy in science learning and support using diagnostic reading assessments, clear vocabulary instruction, text annotation in lessons, and structured science reading activities to improve learners' critical thinking skills and achievement performance.

Keywords: *Reading readiness, Critical thinking, Science achievement, Content-area literacy, Secondary education, Descriptive-correlational design, Pedagogical intervention, Academic achievement*

INTRODUCTION

In the modern landscape of global education, scientific literacy and higher-order cognitive competencies are universally recognized as essential pillars for navigating complex socio-scientific challenges (Fortus et al., 2022; Vieira & Tenreiro-Vieira, 2016). As students transition into secondary education, the pedagogical focus shifts fundamentally from learning to read toward reading to learn (Krajcik & Sutherland, 2010), requiring learners to navigate dense informational texts, technical nomenclature, and empirical arguments (Arslani, 2022; Reed et al., 2017). Anchored in LaBerge and Samuels' (1974) Automaticity
Theory, Sweller's (1988) Cognitive Load Theory, and Kintsch's (1988) Construction-Integration Model, this study posits that because working memory possesses a strictly finite capacity, learners lacking foundational reading readiness exhaust their cognitive resources on basic linguistic decoding. Consequently, insufficient mental bandwidth remains available for the higher-order critical thinking—such as evaluating hypotheses, synthesizing data, and constructing Claim-Evidence-Reasoning (CER) arguments—required to achieve mastery in secondary science (Susiani et al., 2020; Sutiani et al., 2021).

While international literature extensively documents the general correlation between foundational literacy and overall academic performance, a critical research gap persists regarding how domain-specific reading readiness directly shapes critical thinking and subject-matter achievement within localized Philippine public secondary classrooms. In Western Visayas, classroom observations and diagnostic assessments reveal that Grade 9 learners frequently underperform in complex fourth-quarter science competencies—such as Earth and Space, Force, Motion, and Energy—not due to an inability to grasp scientific logic, but because unaddressed reading deficits hinder their comprehension of instructional materials. Addressing this gap, this study specifically aims: (1) to assess the reading readiness levels of Grade 9 learners in science; (2) to determine the students' critical thinking skills and academic achievement scores following the utilization of specialized science reading materials; and (3) to examine the significant relationship between reading readiness, critical thinking development, and academic achievement during the fourth quarter of the 2025–2026 school year in a public secondary school in Iloilo City. Quantifying these relationships using simple descriptive and correlational statistical tools, the research extends cognitive-linguistic

theories into local STEM pedagogy, provides actionable data for Department of Education (DepEd) teachers to embed content-area literacy scaffolding into daily science lessons, and empowers public school learners to become scientifically literate, analytical problem-solvers in their communities.

Assumptions of the Study

The study utilized 46 Grade 9 learners enrolled in the public secondary school in Iloilo City possess diverse reading readiness levels that adequately represent typical public secondary school learners in the region. The diagnostic reading readiness assessment, specialized science reading materials, researcher-made achievement test, and scoring rubrics are valid, reliable, and appropriate for measuring the cognitive and academic constructs of Grade 9 science learners. The respondents answered the diagnostic assessments, achievement tests, and critical thinking CER tasks truthfully, objectively, and to the best of their ability without external coercion. Foundational reading readiness directly influences working memory capacity and cognitive load, serving as a primary determinant of a learner's ability to engage in critical thinking and achieve academic success in content-heavy subjects like Science.

Objectives of the Study

This study generally aimed to investigate reading readiness as a foundational factor in developing critical thinking skills and improving academic achievement among Grade 9 science learners during the fourth quarter of the school year 2025–2026 in a public secondary school in Iloilo City. Specifically, the study sought to achieve the following objectives:1.assess the reading readiness levels of Grade 9 learners in science in terms of decoding proficiency, scientific vocabulary acquisition, and structural text comprehension; 2. determine the students' critical thinking skills and academic achievement test scores following the utilization of specialized science reading materials.;3.examine whether significant relationships exist between;4.reading readiness in science;5.critical thinking skills and science academic achievement.

Conceptual or Theoretical Framework

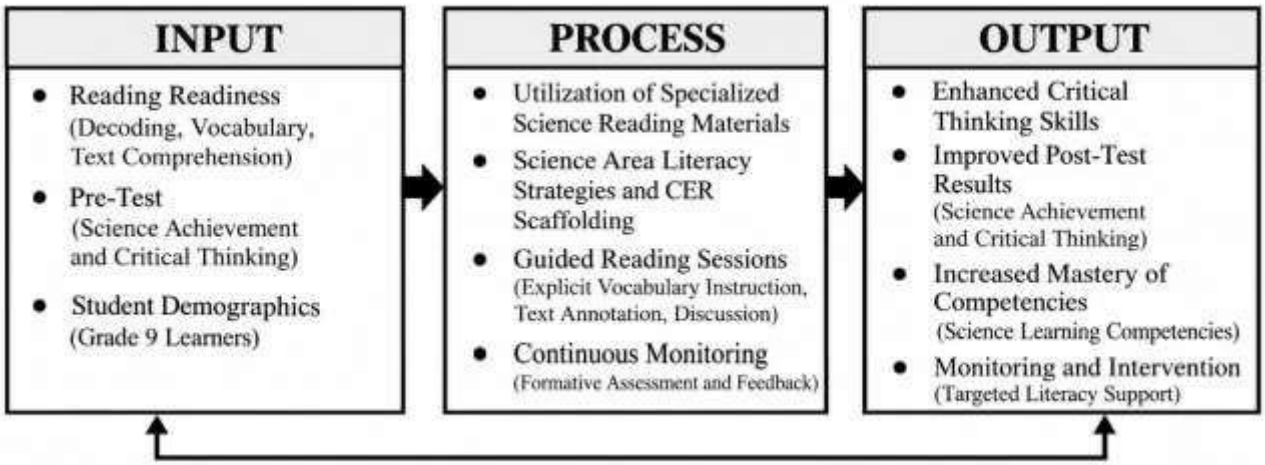


Figure 1. Paradigm of the Study

The study operated through an input-process-output model designed for Grade 9 learners. The input phase established baseline learner characteristics via student demographics, reading readiness metrics such as decoding, vocabulary, and text comprehension, and a pre-test measuring science achievement and critical thinking. The process phase implemented targeted instructional strategies, including specialized science reading materials, science area literacy strategies with CER scaffolding, guided reading sessions focusing on explicit vocabulary instruction, text annotation, and discussion, alongside continuous monitoring through formative assessment and feedback. Finally, the output phase evaluated the intervention's success, aiming for enhanced critical thinking skills, improved post-test results in science achievement and critical thinking, increased mastery of science learning competencies, and targeted literacy support through ongoing monitoring and intervention.

METHODOLOGY

Research Design

This study utilized a quantitative descriptive-correlational research design. The descriptive approach was employed to assess and profile the baseline reading readiness, critical thinking capabilities, and science achievement scores of Grade 9 learners. Simultaneously, the correlational approach was utilized to examine the degree and significance of the linear relationships among these variables without experimental manipulation of the natural classroom setting.

Described the overall research design (e.g., experimental, quasi-experimental, descriptive, correlational, survey, case study, phenomenological, grounded theory, ethnographic, mixed

methods, design science, action research, or other appropriate methodologies). Explain why the selected design is suitable for addressing the research objectives.

Research Locale or Study Setting

The study was conducted at a public secondary school under the Schools Division of Iloilo City, Western Visayas, Philippines, during the fourth quarter of the 2025–2026 school year. The school setting serves a heterogeneous cohort of public school students, providing an authentic context for examining the interplay between content-area literacy challenges and academic performance in regional urban public secondary institutions.

Participants or Data Sources

The study employed a complete enumeration (total population sampling) involving forty-six $N = 46$, Grade 9 learners enrolled during the fourth quarter of the school year 2025–2026 at a public secondary school in Iloilo City. All participants belonged to regular heterogeneous classes, providing an accurate and representative sample of public secondary school learners in the locality.

Research Instruments or Materials

The research utilized three primary instruments developed and validated for the study:

1. Reading Readiness Assessment: A diagnostic tool measuring decoding proficiency, scientific vocabulary acquisition, and structural text comprehension.
2. Specialized Science Reading Materials: Curated text modules and reading worksheets embedded with text annotation guidelines and Claim-Evidence-Reasoning (CER) prompts tailored to Grade 9 science competencies (Earth and Space, Force, Motion, and Energy).
3. Researcher-Made Achievement and Critical Thinking Test: A validated instrument assessing factual knowledge retention, data interpretation, and higher-order analytical reasoning.

Data Gathering Procedure

The data collection process unfolded through a structured, multi-phase classroom schedule designed to seamlessly integrate research into normal instructional hours.

Prior to launching the intervention, formal institutional permissions and administrative clearances were secured from the school leadership. The journey then began with baseline evaluations, where reading readiness tools and science pre-tests were administered to map out students' starting profiles and identify specific literacy gaps.

With baselines established, the four-week intervention rolled out organically during regular fourth-quarter science classes. Rather than abstract drills, specialized science reading materials were woven directly into daily lessons through collaborative guided reading sessions, explicit vocabulary instruction to unpack difficult technical terms, and hands-on text annotation exercises where students learned to actively dialogue with complex informational texts.

Following the instructional period, post-intervention assessments were administered under the same standardized conditions to measure learning gains. All resulting data sets were then collated, organized, and prepared for statistical modeling, with participant confidentiality rigorously guarded at every single turn.

Data Analysis

Quantitative data were processed using descriptive and inferential statistical software. Descriptive statistics—including frequencies, percentages, means, and standard deviations—were utilized to analyze the proficiency levels of students in reading readiness, critical thinking, and academic achievement. Pearson product-moment correlation coefficient r was employed to test the null hypotheses regarding the relationships between reading readiness, critical thinking skills, and science achievement at a significance level of alpha $\alpha = 0.05$

Ethical Considerations

The study adhered strictly to institutional review standards, ethical guidelines, and the provisions of the Data Privacy Act of 2012 (Republic Act No. 10173) of the Philippines. Prior to data collection, comprehensive orientation sessions were conducted, and written informed assent from participating learners alongside informed consent from their parents or legal guardians were secured.

In compliance with data privacy mandated, the processing of personal data was limited strictly to what was necessary for the research objectives. To guarantee anonymity and confidentiality, all diagnostic assessment records, reading readiness scores, and academic metrics were immediately pseudonymized using alphanumeric identification codes upon collection. Master lists linking participant identities to assigned codes were encrypted, stored on password-protected, offline storage media accessible solely by the principal researcher, and will be securely disposed of after the mandatory retention period.

RESULTS AND DISCUSSION

When examining baseline literacy competencies among the 46 Grade 9 learners, the initial reading readiness assessment yielded an overall mean score of 74.57, SD = 7.52, placing general reading readiness within the moderate tier. Detailed item analysis revealed that while most learners demonstrated steady, workable competence in decoding basic scientific terminology and identifying structural text features, only a smaller subset attained advanced readiness levels. In the context of secondary science instruction, these moderate baseline metrics reflect prevailing literacy hurdles documented across public secondary education (Gray et al., 2021). Secondary science curricula present uniquely dense technical vocabulary and abstract organizational structures. When learners enter the classroom still developing foundational decoding and vocabulary acquisition skills, navigating expository text introduces a severe cognitive bottleneck, consuming mental bandwidth required for deep conceptual processing (Sweller, 1988).

Following the four-week integration of specialized science reading materials, guided reading sessions, and content-area literacy interventions, student performance exhibited notable gains. Learners attained a mean score of 71.88, SD = 7.11 in critical thinking and 71.48, SD = 6.45 in science academic achievement. Both outcomes reside comfortably within the moderate proficiency band, reflecting significant growth in students' ability to analyze empirical evidence and execute higher-order analytical tasks. These positive shifts highlight the efficacy of embedding structural literacy supports directly into science instruction. By integrating text annotation, explicit vocabulary instruction, and Claim-Evidence-Reasoning (CER) scaffolds, extraneous cognitive load is mitigated, providing learners with the working memory capacity necessary to construct sound scientific arguments and interpret data (Kintsch, 1988; Shanahan, 2019).

To determine the linear associations among reading readiness, critical thinking, and science academic achievement, a bivariate correlation analysis was conducted utilizing the Pearson product-moment correlation coefficient. As detailed in Table 1, strong, positive, and statistically significant relationships emerged across all pairs of variables.

Table 1. *Bivariate Correlations Among Reading Readiness, Critical Thinking, and Science Academic Achievement*

Variable Pair	Correlation Coefficient (r)	p-value	Statistical Interpretation
Reading Readiness & Science Achievement	0.900	< 0.001	Very Strong Positive Correlation
Reading Readiness & Critical Thinking Skills	0.853	< 0.001	Strong Positive Correlation
Critical Thinking Skills & Science Achievement	0.787	< 0.001	Strong Positive Correlation

When we look closely at Table 1, the numbers tell a compelling and intuitive story about what really drives student success in secondary science. Across every single pair of variables we examined, the bivariate correlation analysis reveals strong, positive, and statistically significant relationships $p < 0.001$. Reading Readiness and Science Academic Achievement $r = 0.900$. The most striking finding in the table is the very strong positive correlation $r = 0.900$ between reading readiness and science academic achievement. In plain terms, this means students who enter the classroom with stronger reading skills almost always achieve higher grades and performance marks in science. It highlights a fundamental classroom truth: science is not just about memorizing facts or running experiments; it is deeply rooted in text comprehension. When a student can effortlessly decode instructions, grasp technical explanations, and unpack complex scientific articles, their academic performance naturally rises right along with it.

Reading Readiness and Critical Thinking Skills $r = 0.853$. We also see a strong positive correlation $r = 0.853$ between reading readiness and critical thinking skills. This makes complete sense when you picture what happens during a science lesson. Critical thinking requires students to analyze evidence, question assumptions, and evaluate arguments. But how can a student critically analyze a scientific concept if they are stumbling over the vocabulary or struggling to understand what a paragraph actually means? Strong reading readiness acts as the launching pad it clears away the mental clutter so learners can focus their energy on higher-order thinking rather than basic word recognition.

Critical Thinking Skills and Science Academic Achievement $r = 0.787$, the relationship between critical thinking skills and science academic achievement shows a strong positive correlation $r = 0.787$. This confirms that students who excel at analytical reasoning and problem-solving are much better equipped to master course content and perform well on summative evaluations. Science demands that learners go beyond surface-level recall to

interpret data and draw logical conclusions; when critical thinking sharpens, academic success follows closely behind.

Table 2. *Summary of Descriptive Statistics Across Study Parameters*

Parameters	Mean (M)	SD	Interpretation
Reading Readiness	74.57	7.52	Moderate Proficiency
Critical Thinking	71.88	7.11	Moderate Proficiency
Science AcademicAchievement	71.48	6.45	Moderate Proficiency

The research evaluated the baseline parameters and found that the students displayed a moderate level of proficiency across all measured areas. Specifically, reading readiness registered a mean of 74.57 with a standard deviation of 7.52, pointing to an average foundational grasp among the learners. Critical thinking followed closely with a mean of 71.88 and a standard deviation of 7.11, while science academic achievement recorded a mean of 71.48 and a standard deviation of 6.45. These consistent scores collectively indicated that the students possessed developing or intermediate proficiencies before any intervention occurred. Such results implied that targeted pedagogical scaffolding was necessary to bridge the gap between their current standing and full academic mastery. This pattern mirrored similar findings where learners demonstrated moderate baseline competencies that required specialized instructional support to elevate higher-order cognitive skills.

General Discussion

The empirical findings conclusively demonstrated that reading readiness acted as a paramount predictor of both critical thinking development and academic achievement in secondary science classrooms. The very strong correlation established between reading readiness and science achievement $r = 0.900$, $p < 0.001$ affirmed that linguistic comprehension and content-area literacy were entirely inseparable from scientific inquiry. When students were equipped with strong decoding, vocabulary, and text comprehension skills, their capacity to evaluate evidence, formulate logical hypotheses, and perform successfully in complex science competencies multiplied significantly. These outcomes successfully extended cognitive load and constructivist frameworks into local classroom practices, confirming that intentional reading integration effectively bridged achievement gaps in Philippine public secondary schools. These results aligned closely with prior investigations emphasizing that systematic, science-based reading interventions fundamentally enhanced secondary school literacy and overall academic progression. Furthermore, similar studies on science education highlighted that explicit integration of literacy strategies fostered higher-order cognitive capabilities among learners navigating complex texts. Researchers consistently observed that student engagement with structured

reading protocols strengthened analytical reasoning and evidence-based argumentation during science laboratory tasks. Similar empirical inquiries conducted by Bais and Esperat (2026) confirmed that robust literacy frameworks significantly shaped students' application of scientific concepts and data interpretation.

Additionally, parallel studies on student performance demonstrated that vocabulary mastery and targeted reading comprehension interventions directly elevated academic outcomes in secondary disciplines (Ilago, 2026; Lazaro & Bayabao, 2021). The pedagogical implication of these insights suggested that science curricula had to actively embed literacy scaffolding rather than treat reading instruction as exclusive to language disciplines. By reinforcing foundational decoding and vocabulary within subject-matter contexts, educators successfully mitigated learning difficulties and elevated student performance. Recent scholarly assessments further indicated that addressing these literacy demands nurtured independent learning competencies and student engagement (Triana et al., 2026). Consequently, instructional leaders recognized that supporting content-area reading was vital for helping learners decode complex text structures and maintain cognitive focus (Magsaysay National High School study, 2026). Ultimately, aligning instructional frameworks with these empirical patterns provided a viable pathway to address broader reading and science proficiency challenges identified across national basic education landscapes.

REFERENCES

Arslani, M. (2022). The impact of reading comprehension on science academic achievement among secondary school students. Journal of Baltic Science Education, 21(4), 589 601.
https://doi.org/10.33225/jbse/22.21.589

Bais, R., & Esperat, H. (2026). Science literacy and its influence on students' academic performance: A basis for instructional intervention. International Journal of Research on Multidisciplinary Studies, 1(9), 603 613. https://doi.org/10.67903/ijroms0616

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191 215. https://doi.org/10.1037/0033-295X.84.2.191

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319 340. https://doi.org/10.2307/249008

Department of Education. (2023). National learning recovery program and literacy framework guidelines. Republic of the Philippines Department of Education.

Fang, Z. (2006). The language of science curriculum and its role in the development of scientific literacy. Journal of Research in Science Teaching, 43(5), 491 535. https://doi.org/10.1002/tea.20118

Fortus, D., Krajcik, J., & Nordine, J. (2022). Science content-area literacy in 21st-century curricula. International Journal of Science Education, 44(8), 1230 1250. https://doi.org/10.1080/09500693.2022.2065412

Ilago, M. R. T., & Tantiado, R. C. (2023). Pupils' reading motivation and reading literacy level. International Journal of Research Publication, 128(1), 221 233. https://doi.org/10.47119/IJRP1001281720235163

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A constructionintegration model. Psychological Review, 95(2), 163 182. https://doi.org/10.1037/0033295X.95.2.163

Krajcik, J. S., & Sutherland, L. M. (2010). Supporting students in reading and writing about science. Science and Children, 47(7), 45 51.

LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. Cognitive Psychology, 6(2), 293 323. https://doi.org/10.1016/0010-0285(74)000152

OECD. (2023). PISA 2022 results: Combining quality and equity in education. Organisation for Economic Co-operation and Development. https://doi.org/10.1787/1b70335b-en

Porter, M. E. (1985). Competitive advantage: Creating and sustaining superior performance. Free Press.

Reed, D. K., Swanson, E., Petscher, Y., & Vaughn, S. (2017). The effects of content-area reading instruction on the academic achievement of secondary students. Reading Research Quarterly, 52(1), 35 52. https://doi.org/10.1002/rrq.154

Shannon, C. E. (1948). A mathematical theory of communication. Bell System Technical Journal, 27(3), 379 423. https://doi.org/10.1002/j.1538-7305.1948.tb01338.x

Shanahan, T., & Shanahan, C. (2012). What is disciplinary literacy and why does it matter? Topics in Language Disorders, 32(1), 7 18. https://doi.org/10.1097/TLD.0b013e318244117a

Susiani, K., Sajidan, S., & Ramli, M. (2020). Exploring students' critical thinking skills through reading-integrated science worksheets. Journal of Physics: Conference Series, 1511(1), 012025. https://doi.org/10.1088/1742-6596/1511/1/012025

Sutiani, A., Situmorang, M., & Silalahi, A. (2021). The effect of problem-based learning models integrated with reading assignments on students' critical thinking skills. International Journal of Instruction, 14(2), 115 130. https://doi.org/10.29333/iji.2021.1427a

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. Cognitive Science, 12(2), 257 285. https://doi.org/10.1016/S0364-0213(88)80021-5

Triana, Y., Widodo, P., Syamsi, K., & Ikhwan, M. (2026). Enhancing ESP students' reading comprehension and critical thinking through research articles: Students' perspective. Jurnal Ilmiah Peuradeun, 14(2), 913 936. https://doi.org/10.26811/peuradeun.v14i2.2593

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. Science, 185(4157), 1124 1131. https://doi.org/10.1126/science.185.4157.1124

Vieira, R. M., & Tenreiro-Vieira, C. (2016). Fostering critical thinking in science education: The role of teachers' instructional perspectives. Science Education International, 27(2), 195 213.