Science Foundational Literacy as a Predictor of Science Achievement among Senior High School Students in Saint Louis College of Solano, Inc.

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ABSTRACT

This study determined whether science foundational literacy predicts the science achievement of senior high school students in Saint Louis College of Solano, Inc.. Specifically, it examined the level of science achievement and science foundational literacy in terms of science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy. The study employed a quantitative descriptive-correlational research design involving 190 senior high school students selected through stratified random sampling. Data were gathered using a researcher-made instrument entitled the Science Foundational Literacy Diagnostic Test (SFLDT), which consisted of 80 multiple-choice items distributed across the four domains of science foundational literacy. The instrument underwent expert validation prior to administration. Mean, standard deviation, Pearson Product-Moment Correlation, and Multiple Linear Regression Analysis were used to analyze the data.

Findings revealed that the respondents demonstrated a "Very Satisfactory" level of science achievement. Among the domains of science foundational literacy, science reading comprehension was interpreted as "High," while science vocabulary, ability to interpret science concepts, and science numeracy were interpreted as "Moderate." Furthermore, all domains of science foundational literacy showed significant positive relationships with science achievement. Regression analysis revealed that science reading comprehension and science numeracy significantly predicted science achievement, whereas science vocabulary and ability to interpret science concepts did not significantly predict science achievement. The study concludes that science foundational literacy, particularly science reading comprehension and science numeracy, plays a significant role in improving students' science achievement. The findings highlight the importance of strengthening literacy-based and numeracy-centered instructional strategies to enhance students' scientific understanding and academic performance in science.

Keywords: science education, science reading comprehension, science vocabulary, ability to interpret science concepts, science numeracy

INTRODUCTION

Science education plays a vital role in developing students' critical thinking, problem-solving, and decision-making skills. Several studies support the idea that science education enhances these competencies and prepares learners to respond effectively to real-life situations. According to Arora et al. (2026), science education significantly contributes to the development of students' critical thinking and problem-solving abilities. In today's rapidly evolving and technology-driven world, scientific literacy has become increasingly essential because science and technology greatly influence daily life, health, the environment, and economic development. Seema (2024) emphasized that scientific literacy is crucial for individuals to effectively function in modern society, while Turiman et al. (2012) highlighted its importance in personal decision-making and economic productivity. Furthermore, Parisu et al. (2025) affirmed that scientific literacy equips students with the necessary skills to understand and solve everyday problems. Because of this, schools are expected to develop students' foundational literacy skills to help them understand and apply scientific concepts effectively.

Despite the recognized importance of science education, the academic performance of Filipino students in science remains a major concern. Results from the Programme for International Student Assessment (PISA) 2022 revealed that the Philippines performed below the Organization for Economic Co-operation and Development (OECD) average in science literacy (OECD, 2023). Filipino students demonstrated difficulties in explaining scientific phenomena, interpreting scientific data, and applying scientific knowledge to real-life situations. These findings suggest that many learners may lack the foundational literacy skills necessary for science learning and achievement.

Science foundational literacy includes competencies such as science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy. These competencies are essential because science learning requires students to read scientific texts, understand terminologies, interpret graphs and data, and solve scientific problems. Fang and Wei (2010) emphasized the importance of integrating reading strategies into science instruction to improve students' science literacy, suggesting that comprehension of scientific texts and language plays an important role in science learning. Similarly, Cervetti et al. (2012) found that integrating literacy and science instruction positively affects students' understanding of science concepts and academic performance.

Among these competencies, science reading comprehension is considered one of the most important components of science foundational literacy. Students are expected to comprehend textbooks, laboratory procedures, scientific explanations, and assessment questions. Shanahan and Shanahan (2012) explained that comprehension of specialized scientific texts is essential for students' success in science learning. Likewise, Fang (2012) stated that understanding scientific language and vocabulary supports students' conceptual understanding in science.

Another important competency is the ability to interpret science concepts through graphs, diagrams, tables, and experimental results. Brickman et al. (2012) explained that students who can effectively interpret scientific information are more capable of engaging in critical thinking, evaluating evidence, and solving science-related problems. Science numeracy is equally important because science learning involves measurements, computations, data analysis, and quantitative reasoning. Maerten-Rivera et al. (2010) found that mathematics achievement significantly contributes to science achievement, emphasizing the importance of numeracy skills in understanding scientific processes and solving scientific problems.

If science foundational literacy is not adequately addressed, students may continue to struggle in understanding scientific concepts, interpreting scientific information, and applying scientific knowledge in real-life situations. Weak reading comprehension and limited scientific vocabulary may hinder students from understanding scientific texts, laboratory instructions, and assessment questions, which may negatively affect their academic performance in science (O'Reilly et al., 2019). Likewise, inadequate science numeracy and interpretation skills may limit students' ability to analyze data, interpret graphs, and solve science-related problems effectively. Previous studies have shown that mathematics and numeracy skills significantly predict science achievement because science learning requires quantitative reasoning and data interpretation (Research Highlights in Mathematics and Computer Science, 2023). If these concerns remain unaddressed, students may encounter difficulties in higher education, future careers, and informed decision-making in a society increasingly driven by science and technology.

Although several studies have examined literacy and academic achievement, most focused only on general reading or mathematics achievement. Limited studies have specifically investigated science foundational literacy as a predictor of science achievement among senior high school students. Furthermore, previous studies often examined reading comprehension, vocabulary, or numeracy separately rather than determining their combined influence on science achievement. This gap in the literature highlights the need for further investigation, particularly within the Philippine educational setting.

In Saint Louis College of Solano, Inc., limited research has been conducted regarding the influence of science foundational literacy on students' science achievement. Considering the persistent low performance of students in science and the increasing need for scientifically literate learners, it is important to identify the factors that contribute to students' academic success in science. Hence, this study was conducted to determine whether

science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy significantly predict the science achievement of senior high school students.

The findings of this study may provide valuable information for teachers, school administrators, and curriculum planners in developing literacy-based instructional strategies and interventions that can strengthen students' competencies and improve their academic performance in science.

Statement of the Problem

This study determined whether science foundational literacy predicted the science achievement of senior high school students in Saint Louis College of Solano, Inc. Specifically, it sought to answer the following questions:

1. What is the level of science achievement of senior high students?
2. What is the level of science foundational literacy of senior high school students in terms of:

2.1 science reading comprehension;

2.2 science vocabulary;

2.3 ability to interpret science concepts; and

2.4 science numeracy?

3. Is there a significant relationship between science reading comprehension, science vocabulary, ability to interpret science concepts, science numeracy, and science achievement among senior high school students?
4. To what extent do science reading comprehension, science vocabulary, ability to interpret science concepts and science numeracy predict the science achievement of senior high school students?

METHODS

Research Design

This study utilized a quantitative research approach employing a descriptive-correlational research design. Descriptive research was used to determine the level of science foundational literacy of senior high school students in terms of science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy, as well as their level of science achievement.

The study also employed a correlational design to determine whether a significant relationship existed between science foundational literacy and science achievement among senior high school students. Furthermore, regression analysis was used to determine the extent to which science reading comprehension, science vocabulary, science numeracy, and ability to interpret science concepts predicted students' science achievement. This research design was considered appropriate because the aimed to describe the respondents' level of science foundational literacy and science achievement and determine the relationship and predictive influence among variables.

Research Locale

The study was conducted at Saint Louis College of Solano, Inc., located in Solano, Nueva Vizcaya, Region II, Philippines. The institution is a Catholic educational institution that offers basic education programs, including Senior High School education, and serves students from different academic strands.

Saint Louis College of Solano was established in 1934 as a small Catholic parochial school founded by Fr. Jose Waffelaert, CICM. Through continuous development in its academic programs, facilities, and student services, the institution officially became Saint Louis College of Solano, Inc. in 2022. In Academic Year 2025–2026, the institution opened its first college program, marking its transition into a growing Catholic college institution. The institution was chosen as the locale of the study because it provides a suitable setting

for examining the science foundational literacy and science achievement of senior high school students from diverse academic backgrounds.

Respondents of the Study

The participants of this study were selected from the 450 senior high school students of Saint Louis College of Solano, Inc. The sample size was initially determined using Cochran's formula with a 95% confidence level and a 5% margin of error, resulting in an estimated 207 respondents. However, only 190 valid and fully accomplished responses were retrieved and utilized in the study due to respondent availability and completeness of responses. Despite this, the obtained sample size was still considered statistically adequate for the descriptive-correlational and multiple regression analyses employed in the study. Supporting this, Bacchetti et al. (2008) emphasized that proposed sample sizes should be regarded as "acceptable" rather than strictly optimal and advocated for greater flexibility and tolerance in sample size planning approaches. Furthermore, Peter Bacchetti et al. argued that studies with lower statistical power than the conventional 80–90% standard should not automatically be considered unethical or unacceptable. Thus, although the retrieved responses were slightly lower than the initially estimated sample size, the number of participants remained sufficient to support the objectives and statistical requirements of the study.

To ensure adequate representation of students from different academic strands, the study employed stratified random sampling. The senior high school population was first divided into strata according to their respective academic strands. Thereafter, proportional allocation was applied to determine the number of respondents to be selected from each strand based on their corresponding population size. Following the proportional distribution, respondents within each stratum were selected through random sampling procedures. This method ensured that all academic strands were fairly represented and helped minimize sampling bias, thereby improving reliability, validity, and representativeness of the study findings.

Research Instruments

The study utilized a research-made questionnaire entitled the Science Foundational Literacy Diagnostic Test (SFLDT) for senior high school students of Saint Louis College of Solano, Inc.. The instrument was developed by the researchers based on the objectives of the study and concepts related to science foundational literacy, specifically in the areas of Science Reading Comprehension, Science Vocabulary, Ability to Interpret Science Concepts, and Science Numeracy within the disciplines of Biology, Chemistry, Physics, and Earth Science.

The questionnaire consisted of a total of 80 multiple-choice items divided equally among the four predictors of science foundational literacy. Each predictor or section contained 20 items, distributed across the four science disciplines with five items each for Biology, Chemistry, Physics, and Earth Science. Specifically, the Science Reading Comprehension section consisted of 20 items, the Science Vocabulary section contained 20 items, the Ability to Interpret Science Concepts section included 20 items, and the Science Numeracy section also comprised 20 items. The items were designed to assess the respondents' understanding, interpretation, and application of scientific concepts and skills.

To ensure the alignment of the test items with the objectives and content areas of the study, the researchers also prepared a Table of Specification (TOS). The TOS served as a guide in distributing the test items according to the identified competencies, learning areas, and cognitive skills to ensure balanced and comprehensive coverage of the topics included in the instrument.

To ensure the validity and appropriateness of the instrument, the research-made questionnaire underwent expert validation by a qualified specialist in science education and research. Necessary revisions and improvements were incorporated based on the comments and recommendations of the validator prior to the administration of the instrument.

Data Gathering Procedure

To collect the necessary data for the study, the researchers first secured permission from the Administration of Saint Louis College of Solano, Inc. to administer the Science Foundational Literacy Diagnostic Test (SFLDT)

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to selected Senior High School students. Upon approval, the researchers prepared a formal letter addressed to the respondents explaining the purpose, objectives, and significance of the study, while also requesting their voluntary participation and assuring them that all information gathered would be treated with confidentiality and used solely for research purposes. After securing the respondents' consent, the researchers personally administered the research-made diagnostic test by distributing printed copies of the diagnostic test during the scheduled data-gathering period. Clear instructions regarding the proper accomplishment of the test were provided to ensure that the respondents understood each part of the instrument and were able to answer accurately. After the respondents completed the diagnostic test, the researchers immediately collected the printed diagnostic test, checked them for completeness, and organized the responses for proper documentation. The gathered data were then consolidated, encoded, and prepared for statistical treatment and analysis.

Statistical Treatment of Data

The data gathered in this study were analyzed using appropriate statistical tools to answer the research questions and test the hypotheses.

Mean and Standard Deviation. These were used to determine the level of science foundational literacy of the respondents in terms of science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy, as well as the level of science achievement of the respondents.

Table 1: Scale used to interpret the level of science foundational literacy of the respondents.

Mean Range	Qualitative Description
16.01 – 20.00	Very High
12.01 – 16.00	High
8.01 – 12.00	Moderate
4.01 – 8.00	Low
0.00 – 4.00	Very Low

Table 2: Scale used to interpret the level of science achievement of the respondents.

Mean Range	Qualitative Description
90 – 100	Outstanding
85 – 89	Very Satisfactory
80 – 84	Satisfactory
75 – 79	Fairly Satisfactory
Below 75	Did Not Meet Expectations

Pearson Product-Moment Correlation Coefficient (Pearson r). This statistical tool was used to determine the significant relationship between science reading comprehension, science vocabulary, ability to interpret science concepts and science numeracy, and science achievement of senior high school students.

Table 3: Scale used to interpret the correlation coefficient.

Correlation Coefficient	Qualitative Description
0.00 – 0.19	Very Weak
0.20 – 0.39	Weak
0.40 – 0.59	Moderate
0.60 – 0.79	Strong
0.80 – 1.00	Very Strong

Table 4: Significance level used to determine the significant relationship of the variables

Significance Level	Qualitative Description
$p > 0.05$	Not Significant
$p \leq 0.05$	Significant
$p \leq 0.01$	Very Significant
$p \leq 0.001$	Highly Significant

Multiple Linear Regression Analysis. This statistical treatment was used to determine the extent to which science reading comprehension, science vocabulary, science numeracy, and ability to interpret science concepts predict the science achievement of senior high school students. It was also used to identify which among the science foundational literacy domains significantly predict Science achievement.

RESULTS AND DISCUSSIONS

The main objective of the study is to determine whether science foundational literacy predicted the science achievement of senior high school students of Saint Louis College of Solano, Inc. Out of the target sample size of 207 respondents determined using the Cochran's formula with a 95% confidence level and a 5% margin of error, only 190 valid and fully accomplished responses were retrieved and included in the statistical analysis. Despite this, the obtained sample size was considered adequate for the descriptive-correlational and multiple regression employed in the study.

The following tables below show the results and discussions of the study.

Table 5: Level of Science Achievement of Senior High School Students

Variable	N	Mean	Std. Deviation
Science Achievement	190	88.437	5.1879

Qualitative Description: *Below 75: Did Not Meet Expectations; 75 – 79: Fairly Satisfactory; 80 – 84: Satisfactory; 85 – 89: Very Satisfactory; 90 – 100: Outstanding*

Table 5 presents the level of science achievement of senior high school students in terms of their science grades. The respondents obtained a mean of science grade of 88.437 with a standard deviation of 5.1879. Based on the qualitative description, the mean score is interpreted as "Very Satisfactory". The results further show that the lowest grade obtained was 74.5, while the highest grade recorded was 99.0. This indicates that the respondents generally performed well in science subjects. The findings suggest that most of the senior high school students demonstrated a very satisfactory level of science achievement.

The findings of the present study are supported by several related studies which revealed that students generally demonstrate satisfactory to high levels of science achievement. The mean science grade of 88.437, interpreted as "Very Satisfactory," is consistent with the study of Gal (2020), which found that Grade 12 students exhibited a "high" level of scientific understanding, particularly in observation skills which were rated "very high." Similarly, Farillon (2022) reported that Filipino students achieved "very satisfactory" science performance across six science strands despite variations in specific areas. Furthermore, Doblon (2023) revealed that multiple intelligences significantly predict students' science achievement. These studies collectively suggest that learners are capable of attaining strong academic performance in science when cognitive abilities and learning competencies are effectively enhanced.

Although the respondents in the present study demonstrated a "Very Satisfactory" level of science achievement, related literature indicates that science performance may still vary depending on several learner and environmental factors. Aninag et al. (2021) found that sex and academic strand significantly influence achievement, with male students obtaining higher scores. Likewise, Rubas (2023) revealed that STEM graduates significantly outperformed students from ABM, GAS, HUMSS, and other strands in college science programs. These findings imply that differences in academic preparation and specialization may contribute to

variations in science achievement. Moreover, Taylor et al. (2021) and Mohammed et al. (2025) emphasized that inadequate school facilities, teacher shortages, and limited parental involvement negatively affect students' academic performance in science. This suggests that despite the respondents' generally high performance, sustaining and improving science achievement requires continuous support through effective learning environments, sufficient educational resources, and strong parental and institutional involvement.

Table 6: Level of Science Foundational Literacy of Senior High School Students

Science Foundational Literacy Indicators	N	Mean	Std. Deviation	Variance
RC	190	15.484	4.8662	23.680
VOC	190	11.632	4.5497	20.700
IC	190	9.911	3.9983	15.987
NUM	190	11.732	4.8334	23.361

Legend: *RC: Science Reading Comprehension; VOC: Science Vocabulary; IC: Ability to interpret science concepts; NUM: Science Numeracy*

Qualitative Description: *0.00 – 4.00: Very Low; 4.01 – 8.00: Low; 8.01 – 12.00: Moderate; 12.01 – 16.00: High; 16.01 – 20.00: Very High*

Table 6 presents the level of science foundational literacy of senior high school students in terms of science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy. The findings revealed that science reading comprehension obtained a mean score of 15.484, which is qualitatively described as "High." On the other hand, science vocabulary obtained a mean score of 11.632, interpreted as "Moderate." Similarly, the ability to interpret science concepts garnered a mean score of 9.911, while science numeracy obtained a mean score of 11.732, both interpreted as "Moderate." Among the four indicators, science reading comprehension obtained the highest mean score, whereas the ability to interpret science concepts obtained the lowest mean score. These findings suggest that the respondents demonstrated stronger proficiency in comprehending science-related texts, while their competencies in science vocabulary, conceptual interpretation, and numeracy skills still require further improvement.

The findings of the present study are supported by several related studies which revealed that senior high school students generally exhibit low-to-moderate levels of science foundational literacy. The high performance of respondents in science reading comprehension aligns with the study of Nabilah et al. (2024), which reported that students achieved 67.9% performance in reading literacy, indicating relatively stronger comprehension skills compared to other literacy dimensions. However, the moderate performance in science vocabulary, interpretation of science concepts, and science numeracy is consistent with the findings of Susongko (2021), who found that science literacy achievement was only 57.45%, while numeracy skills obtained a much lower percentage of 43.18% among Grade XII students. Similarly, Jannah et al. (2020) revealed that students' overall scientific literacy fell under the "less" category with only 43.8% performance. Moreover, Sutrisna and Anhar (2020) found that students performed lowest in interpreting scientific data compared to other scientific competencies, supporting the present finding that the ability to interpret science concepts obtained the lowest mean score. In addition, Siswandari et al. (2025) confirmed that numeracy skills among students remain within the moderate-to-low category across different domains. These studies collectively indicate that although students may possess satisfactory reading comprehension skills, other aspects of science foundational literacy still need continuous enhancement.

More to that, the results imply that students' ability to understand written science information is relatively more developed than their higher-order scientific literacy skills, particularly conceptual interpretation and numeracy. While reading comprehension may help learners access and process scientific information, it does not automatically guarantee strong scientific literacy performance. This supports the findings of Nuraenah et al. (2019), who reported only a weak-to-moderate relationship between reading comprehension and overall scientific literacy. The consistently moderate performance in science vocabulary, concept interpretation, and numeracy suggests that students may still experience difficulties in applying scientific knowledge, analyzing scientific data, and solving quantitative science-related problems.

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Furthermore, the lower performance in science numeracy and conceptual interpretation highlights the need for more interactive and skill-based learning approaches in science education. The findings suggest that teachers and schools should strengthen instructional strategies that promote critical thinking, data interpretation, scientific communication, and problem-solving skills. Intervention programs focusing on science vocabulary development, contextualized science activities, and numeracy enhancement may help improve students' overall science foundational literacy and better prepare them for higher-level scientific learning and real-world applications.

Table 7: Relationship Between Science Foundational Literacy Domains and Science Achievement Among Senior High School Students

Variables	**r-value**	**p-value**	**Qualitative Description**	**Decision**
Science Reading Comprehension and Science Achievement	0.389	0.000	Weak Positive Relationship	Significant
Science Vocabulary and Science Achievement	0.320	0.000	Weak Positive Relationship	Significant
Ability to Interpret Science Concepts and Science Achievement	0.278	0.000	Weak Positive Relationship	Significant
Science Numeracy and Science Achievement	0.383	0.000	Weak Positive Relationship	Significant

Table 7 presents the relationship between foundational literacy domains and science achievement among senior high school students. The findings revealed that science reading comprehension ($r=0.389, p<0.05$), science vocabulary ($r=0.320, p<0.05$), ability to interpret science concepts ($r=0.278, p<0.05$), and science numeracy ($r=0.383, p<0.05$) all showed weak positive significant relationships with science achievement. This indicates that students with stronger foundational literacy skills are more likely to achieve better academic performance in science.

The results affirm the idea that foundational literacy serves as an essential component in learning science. Students who possess stronger reading comprehension skills are more capable of understanding scientific texts, interpreting instructions, analyzing concepts, and solving scientific problems effectively. Similarly, science vocabulary enhances students' understanding of scientific terminologies, while science numeracy supports computations, data interpretation, and analytical reasoning necessary in science learning.

The present findings corroborate the study of Reed (1994), who found that general reading ability explained a substantial proportion of students' science performance across different grade levels. Likewise, Cromley (2009) reported very strong correlations between reading literacy and science literacy using international PISA datasets, emphasizing the critical role of literacy in science education.

In addition, the findings align with the study of Wahyuni et al. (2018), which revealed that reading comprehension significantly correlated with scientific literacy among senior high school students. Furthermore, Cooper (2010) observed that students studying physics, chemistry, and biology demonstrated stronger foundational literacy competence than non-science students, further highlighting the importance of literacy skills in science learning.

However, the findings differ from the study of Mbajiorgu and Ali (1998), who found no direct relationship between scientific literacy and biology achievement. Nevertheless, they noted that instructional approaches may influence the relationship between literacy and academic performance. This suggests that although foundational literacy contributes to science achievement, other educational and environmental factors may also affect students' learning outcomes.

Overall, the findings imply that improving students' science foundational literacy may help enhance science achievement. Strengthening reading comprehension, vocabulary development, conceptual interpretation, and numeracy skills may therefore contribute to better understanding and performance in science among senior high school students.

Table 8: Model Summary of the Multiple Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.441	.195	.177	4.7056

The results in the table 8 presents the model summary of the multiple regression analysis on the predictive influence of science foundational literacy domains on science achievement among senior high school students. The regression model yielded an R value of 0.441, indicating a moderate positive relationship between the predictor variables and science achievement. The R square value of 0.195 revealed that 19.5% of the variance in science achievement is explained by science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy. Meanwhile, the remaining 80.5% may be attributed to other factors not included in the study. The adjusted R square value of 0.177 further indicates that the model has an acceptable predictive capability in explaining science achievement among the respondents.

Based from the findings, it imply that science foundational literacy contributes significantly to students' science achievement. Students who possess better reading comprehension, wider science vocabulary, stronger conceptual interpretation skills, and higher science numeracy are more likely to perform better in science subjects. These literacy domains help learners understand scientific texts, interpret concepts, solve scientific problems, and apply scientific reasoning effectively in academic tasks.

The present findings support the study conducted by Reed et al. (2017), which revealed that reading ability significantly predicts science performance among students across different grade levels. Similarly, Cromley (2009) reported strong relationships between reading literacy and science literacy using international PISA datasets, emphasizing the important role of literacy skills in science learning and achievement. The findings also align with the study of Wahyuni et al. (2018), which revealed that literacy-related variables significantly contribute to students' scientific literacy and academic performance.

Furthermore, the findings are consistent with the study of Cooper et al. (2022), who observed that students studying science subjects demonstrated stronger foundational literacy competence compared to non-science students. This suggests that foundational literacy skills are essential components in developing scientific understanding and improving academic performance in science.

However, although the regression model was able to explain a portion of science achievement, the relatively low R square value indicates that science achievement is also influenced by other factors beyond foundational literacy. These may include students' motivation, study habits, teaching strategies, socioeconomic background, learning environment, and prior academic experiences. This implies that while foundational literacy is an important predictor of science achievement, it is not the sole determinant of students' academic success in science.

Overall, the findings emphasize the importance of strengthening science foundational literacy among senior high school students. Enhancing students' reading comprehension, vocabulary development, conceptual understanding, and numeracy skills may contribute to improved science achievement and better academic performance in science-related subjects.

Table 9: ANOVA Results of the Multiple Regression Analysis

Model	Sum of Squares	df	Mean Square	F	p-value
Regression	990.281	4	247.570	11.181	.000
Residual	4096.461	185	22.143		

Table 9 presents the ANOVA results of the multiple regression analysis on the predictive influence of science foundational literacy domains on science achievement among senior high school students. The findings revealed that the regression model was statistically significant ($F=11.181, p=0.000$). This indicates that science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy, when taken collectively, significantly predict science achievement among the respondents. Therefore, the null

hypothesis stating that the science foundational literacy domains do not significantly predict science achievement is rejected.

The findings support the studies of Karasinski (2016) and O'Reilly and McNamara (2007), which revealed that literacy-related skills significantly predict students' science performance and achievement. The findings are also consistent with Jufrida et al. (2019), who found a significant relationship between scientific literacy and science achievement among students. Moreover, Van Laere et al. (2014) and Kismiantini et al. (2022) emphasized that higher reading comprehension and literacy performance are associated with better science achievement. These findings imply that foundational literacy skills contribute to students' ability to process scientific information, interpret concepts, and perform effectively in science subjects.

However, some studies suggest that science achievement is also influenced by other factors beyond literacy domains. Addido et al. (2026) found that conceptual understanding practices weakly explained differences in science achievement, while Shtulman and McCallum (2014) highlighted that general cognitive abilities may also predict science understanding. This supports the present finding that although science foundational literacy significantly predicts science achievement, other learner-related and environmental factors may also contribute to students' academic performance in science.

Table 10: Regression Coefficients of Science Foundational Literacy Domains Predicting Science Achievement

Variables	**B**	**Std. Error**	**Beta**	**t-value**	**p-value**
(Constant)	81.189	1.192		68.110	.000
RC	.287	.098	.269	2.919	.004
VOC	-.001	.115	-.001	-.009	.993
IC	-.051	.121	-.039	-.422	.673
NUM	.283	.101	.264	2.801	.006

The findings in Table 10 revealed that science reading comprehension significantly predicted science achievement, with a beta coefficient of $\beta = .269$, $t = 2.919$, and $p = .004$, which is lower than the 0.05 level of significance. This indicates that higher levels of science reading comprehension are associated with higher science achievement among the respondents. Moreover, the positive beta coefficient suggests that as students' reading comprehension in science increases, their science achievement also tends to improve. Similarly, science numeracy was found to be a significant predictor of science achievement, with a beta coefficient of $\beta = .264$, $t = 2.801$, and $p = .006$. Since the p-value is less than 0.05, the result implies that science numeracy significantly contributes to the prediction of science achievement. In other words, students with stronger numeracy skills in science are more likely to perform better in science subjects.

On the other hand, science vocabulary did not significantly predict science achievement, as indicated by its beta coefficient of $\beta = -.001$, $t = -.009$, and $p = .993$. Since the p-value is greater than the 0.05 significance level, the result indicates that science vocabulary has no significant influence on students' science achievement in this study. Likewise, the ability to interpret science concepts was not found to be a significant predictor of science achievement, with $\beta = -.039$, $t = -.422$, and $p = .673$. Therefore, the result suggests that this variable does not significantly contribute to predicting science achievement among the respondents.

Furthermore, the findings support previous studies emphasizing the strong relationship between reading comprehension and science performance. For instance, Reed et al. (2017) found that general reading ability accounted for 70% of the variance in Grades 5 and 8 science performance and 64% in Grade 9 science achievement. Similarly, Cromley (2009) reported high correlations ranging from .805 to .840 between reading ability and science literacy across international datasets. In the same manner, O'Reilly and McNamara (2007) demonstrated that reading skill significantly predicts science achievement among high school students, while Cano et al. (2014) found that reading comprehension directly explained nearly 30% of the variance in science achievement among ninth-grade learners. Additionally, Wahyuni et al. (2018) confirmed that reading comprehension is significantly associated with scientific literacy among senior high school students.

Likewise, the result is supported by several studies highlighting the important role of numeracy in academic achievement. According to Ayodele (2014), numerical ability, together with instructional and engagement variables, accounted for 63.9% of the variance in chemistry achievement among senior secondary students. Similarly, Dorsah et al. (2018) reported that core mathematics alone explained 39.6% of the variance in integrated science achievement among secondary students. Moreover, Warnaningtyas et al. (2025) demonstrated that numerical literacy significantly predicted self-regulation ($\beta = 0.410$, $p < .001$), which subsequently influenced academic achievement ($\beta = 0.405$, $p < .001$). In addition, Olatoye and Aderogba (2011) found that numerical ability accounted for 38.8% of the variance in aptitude test performance among senior secondary students. Taken together, these studies confirm that numeracy is a meaningful and consistent predictor of science achievement across various educational contexts.

However, the present result contradicts several previous studies that identified science vocabulary as an important predictor of science achievement. For example, Erikson et al. (2025) found that general language skills and science vocabulary uniquely predicted science achievement. Similarly, Lazaroff and Vlach (2022) reported that science vocabulary was the strongest predictor of science knowledge ($\beta = .28$), while Roo et al. (2020) found that science vocabulary knowledge uniquely explained 20% of the variance in science test scores. Likewise, O'Reilly and McNamara (2007) demonstrated that cognitive variables, including reading-related skills, reliably predicted science achievement. Furthermore, Reed et al. (2017) reported that general reading ability, which includes vocabulary development, accounted for 64% to 70% of the variance in science performance across grade levels. The inconsistency between the present findings and previous studies may be attributed to differences in participants, learning exposure, instructional strategies, or the possibility that students' vocabulary knowledge alone may not directly translate into higher science achievement without strong comprehension and numeracy skills.

Consequently, these findings support the implementation of the Department of Education MATATAG curriculum, which emphasizes foundational literacy and numeracy through curriculum decongestion to improve learners' academic performance. Specifically, the results suggest that strengthening reading comprehension and mathematical reasoning can significantly improve science achievement among learners. Furthermore, the findings support inquiry-based and learner-centered teaching approaches that develop students' analytical and problem-solving skills rather than mere memorization of concepts.

Finally, anchored on the Zone of Proximal Development, the findings further imply that teachers should provide appropriate scaffolding to help students progress from basic literacy and numeracy skills toward deeper scientific understanding and reasoning (Shabani et al., 2011). Through guided instruction and support, students are more likely to develop higher-order thinking skills necessary for science learning.

CONCLUSION

Based on the findings of the study, senior high school students of Saint Louis College of Solano, Inc. demonstrated a "Very Satisfactory" level of science achievement. Among the domains of science foundational literacy, science reading comprehension was found to be "High," while science vocabulary, ability to interpret science concepts, and science numeracy were at a "Moderate" level.

The findings further revealed that all domains of science foundational literacy significantly correlated with science achievement, indicating that stronger literacy skills are associated with better academic performance in science. However, when taken collectively in the regression model, only science reading comprehension and science numeracy significantly predicted science achievement. This suggests that students' ability to comprehend scientific texts and apply numerical reasoning plays a crucial role in their academic success in science subjects.

Overall, the study concludes that science foundational literacy, particularly reading comprehension and numeracy, is an important factor influencing science achievement among senior high school students. Strengthening these competencies may therefore contribute to improved science learning and academic performance.

IMPLICATIONS OF THE STUDY

The findings of the study have important implications for science education, curriculum development, and instructional practices. Since science reading comprehension and science numeracy significantly predict science achievement, science teachers may strengthen literacy-based and numeracy-centered instructional strategies in science classes. Integrating reading comprehension activities, data interpretation exercises, and problem-solving tasks may help improve students' scientific understanding and academic performance.

The findings also support the implementation of the Department of Education's MATATAG curriculum, which emphasizes foundational literacy and numeracy through curriculum decongestion. Schools and curriculum planners may therefore develop intervention programs and contextualized learning activities that enhance students' comprehension, analytical reasoning, and quantitative skills in science.

Furthermore, the study highlights the importance of inquiry-based and learner-centered approaches that promote critical thinking, scientific reasoning, and active engagement among learners. Teachers may also provide appropriate scaffolding and differentiated instruction to help students develop higher-order scientific literacy skills necessary for lifelong learning and real-world application.

LIMITATIONS OF THE STUDY

This study is limited to senior high school students of Saint Louis College of Solano, Inc.; thus, the findings may not be generalized to all senior high school students in other institutions or regions. The study focused only on four domains of science foundational literacy, namely science reading comprehension, science vocabulary, ability to interpret science concepts, and science numeracy. Other variables that may influence science achievement, such as motivation, teaching strategies, socioeconomic status, study habits, parental involvement, and learning environment, were not included in the investigation.

Moreover, the study utilized a descriptive-correlational research design, which only determined relationships and predictive influence among variables but did not establish causality. The use of a researcher-made instrument may also pose limitations despite undergoing expert validation. Lastly, only 190 valid responses were retrieved from the target sample, which may have affected the overall representativeness of the findings.

Author contribution: As the sole author, I was involved in the conceptualization, design, data collection, interpretation, writing, and critical revision of the research article.

Declaration of interest: The author has no conflict of interest to declare regarding the content of this study.

Ethics declaration: The researchers strictly observed ethical standards throughout the conduct of the study. Permission to conduct the study was secured from the administration of Saint Louis College of Solano, Inc. Participation of the respondents was entirely voluntary, and informed consent was obtained prior to data gathering. The respondents were assured that all information gathered would be treated with utmost confidentiality and used solely for academic and research purposes. No identifying information was disclosed in the study, and the respondents were free to withdraw their participation at any stage without penalty. The researchers ensured honesty, objectivity, and integrity in the collection, analysis, interpretation, and reporting of data.

Data Availability Statement: The data are available upon reasonable request.

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