Indonesian Journal of Educational Innovation (IJEI)

P-ISSN: 3109-0176 — E-ISSN: 3109-0168

https://journals.widhatulfaeha.id/index.php/jpkjl/index

Science Reading Habits, Learning Interest, and Their Effect on Students' Academic Achievement

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Article Info

Article History
Received: April 1, 2026
Revised: April 17, 2026
Accepted: April 29, 2026
Published: April 30, 2026

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Abstract

Academic achievement in elementary science is influenced by multiple cognitive and motivational factors that interact within the learning process. This study aims to examine the relationships and predictive roles of reading frequency and students' interest in science learning on academic achievement in the topic of animal reproduction among sixth-grade students. The study employed a quantitative survey design involving 37 students, with data collected through questionnaires and achievement tests and analyzed using correlational and regression approaches. The findings indicate that reading frequency and learning interest do not show significant relationships with academic achievement when examined individually; however, both variables demonstrate a significant combined predictive association when analyzed simultaneously. This suggests that academic achievement is shaped by the interaction of cognitive engagement and motivational factors rather than by isolated variables. These results highlight the importance of integrating reading activities with strategies that foster meaningful learning interest. It is recommended that future research explore additional mediating variables and apply more comprehensive analytical models to better understand the mechanisms underlying students' academic achievement in science education.

DOI:
https://doi.org/10.65622/ijei.v2i1.243

Keywords: Science learning interest, learning outcomes, student engagement, academic achievement.

INTRODUCTION

Primary education plays a fundamental role in developing students' character, knowledge, and higher-order thinking skills as a foundation for further learning (Sihombing et al., 2024). At this level, Science (IPA) is a key subject that not only emphasizes mastery of scientific concepts but also fosters critical thinking and problem-solving skills applicable to daily life (Verawati et al., 2023). One of the essential topics in the Grade VI curriculum is animal reproduction, which requires relatively complex conceptual understanding involving abstract biological processes. Mastery of this topic depends on students' ability to actively construct knowledge, which is closely related to their engagement in learning activities.

However, empirical evidence shows that students' learning outcomes in science, particularly on conceptually demanding topics such as animal reproduction, tend to be lower compared to other topics (Dewi, 2019). This condition indicates the presence of underlying factors influencing academic achievement. Among these, the frequency of science reading and learning interest is considered an important predictor (Cheung, 2018; Wani & Ismail, 2024). Reading frequency refers to how often students engage with science-related texts, contributing to knowledge construction, while learning interest reflects students' internal motivation to participate in the learning process (Slameto, 2010).

Previous studies have demonstrated that learning interest is positively associated with students' engagement and academic performance (Gunawan, 2019; Wahdi et al., 2024) and that consistent reading practices improve comprehension and conceptual understanding (Astuti, 2020). Nevertheless, these studies generally examine each variable separately. Limited research has investigated the combined effect of reading frequency and learning interest on students' academic achievement, particularly within specific science content at the elementary level. This gap indicates the need for a more integrative analysis to understand how both variables interact in influencing learning outcomes.

Therefore, this study aims to: (1) analyze the relationship between science reading frequency and students' academic achievement; (2) examine the relationship between learning interest and academic

Citation:
Halimatussoleha, S., Jihad, B., Hadi, M. S., & Dede Prianto, D. (2026). Science reading habits, learning interest, and their effect on students' academic achievement. *Indonesian Journal of Educational Innovation, 2*(1), 21–29. https://doi.org/10.65622/ijei.v2i1.243

achievement; and (3) investigate the combined effect of reading frequency and learning interest on the academic achievement of Grade VI students, specifically in the topic of animal reproduction. The findings are expected to contribute theoretically by clarifying the interaction between these variables and, practically, by providing insights to improve science teaching strategies in elementary education.

MATERIALS AND METHODS

Time and Place

This study was conducted in April 2025 at SDN Pengengat, located in Pujut Subdistrict, Central Lombok Regency, West Nusa Tenggara, Indonesia. The site was selected using purposive sampling based on its relevance to the research objectives, particularly the availability of sixth-grade students who had completed instruction on animal reproduction, as well as access to measurable data on science reading frequency, learning interest, and academic achievement. This context enabled the collection of data aligned with the variables examined in this study.

Research Design

This study employed a quantitative, non-experimental design using a correlational survey approach to examine the relationships among science reading frequency, learning interest, and students' academic achievement. In this context, correlation analysis was used to assess the degree and direction of association between variables, while multiple regression analysis was used to examine the predictive effects of science reading frequency and learning interest on academic achievement.

As a non-experimental study, no manipulation or treatment was applied to the variables; instead, data were collected from naturally occurring conditions through questionnaires (to measure reading frequency and learning interest) and achievement tests (to assess academic performance). This design was selected because it enables analysis of relationships and predictive contributions among variables in an authentic educational setting, aligning with the study's objective of exploring both associative and predictive patterns without direct intervention (Vuong et al., 2021; Vogt, 2008).

Population and Sample

The population of this study comprised all sixth-grade students at SDN Pengengat. Due to the relatively small population size, total sampling was employed, in which all members of the population were included as the research sample (Hossan et al., 2023). The final sample consisted of 37 students.

The inclusion criteria were all actively enrolled sixth-grade students who had participated in science instruction on animal reproduction during the study period. The use of total sampling ensured full representation of the population under study, allowing for an accurate description of relationships among science reading frequency, learning interest, and academic achievement within this specific context. However, the findings are limited in terms of generalizability beyond similar populations.

Research Procedure

Data were collected using two instruments: a questionnaire and an achievement test. The questionnaire was designed to measure students' frequency of science reading and learning interest, consisting of 15 Likert-scale items (1–5). The items were developed based on established theoretical indicators of reading engagement and learning interest, and were subjected to content validation by experts in elementary education. A pilot test was conducted to assess the instrument's reliability, yielding a Cronbach's alpha coefficient that indicated acceptable internal consistency.

The second instrument was an achievement test used to measure students' learning outcomes on animal reproduction. The test items were constructed based on the core competencies and learning indicators specified in the Grade VI science curriculum. Content validity was ensured through expert review, while item analysis was conducted to examine difficulty level and discrimination index, ensuring that the test appropriately measured students' conceptual understanding.

Data collection was carried out by administering the questionnaire and test to all participants under standardized conditions. The collected data were then analyzed using descriptive statistics, correlation analysis, and multiple regression to examine both the relationships and the predictive effects of science reading frequency and learning interest on students' academic achievement..

Data Analysis Techniques

Data were analyzed using SPSS version 25 through a sequence of descriptive and inferential statistical procedures. Descriptive statistics were used to summarize the distributions of each variable (science reading frequency, learning interest, and academic achievement) to provide an overall profile of the sample.

Inferential analysis began with Pearson correlation to examine the bivariate relationships between each independent variable (reading frequency and learning interest) and the dependent variable (academic achievement). In addition, partial correlation was employed to assess the relationship between one independent variable and the dependent variable while controlling for the other independent variable, thereby providing a clearer estimation of each variable's unique contribution.

To examine predictive effects, multiple linear regression analysis was conducted using the following model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where Yrepresents students' academic achievement, X_1denotes science reading frequency, and X_2represents learning interest. The analysis aimed to determine both the simultaneous effect (F-test) and partial effects (t-test) of the independent variables, with a significance level set at $p < 0.05$.

Prior to the main analysis, several assumption tests were performed, including normality, linearity, homogeneity of variance, and multicollinearity. These tests were conducted to ensure that the data met the assumptions required for valid correlation and regression analysis, thereby enhancing the accuracy and interpretability of the results.

RESULTS AND DISCUSSION

Result

Reading Frequency Scores, Interest in Learning Science, and Student Achievement

To provide a visual representation of the distribution of data for each student, the results for reading frequency scores, interest in science, and student achievement are presented as line graphs. This presentation aims to show patterns of variation in scores for each variable among students, thereby facilitating the identification of trends and differences in achievement among individuals. The data visualization is shown in Figure 1 below.

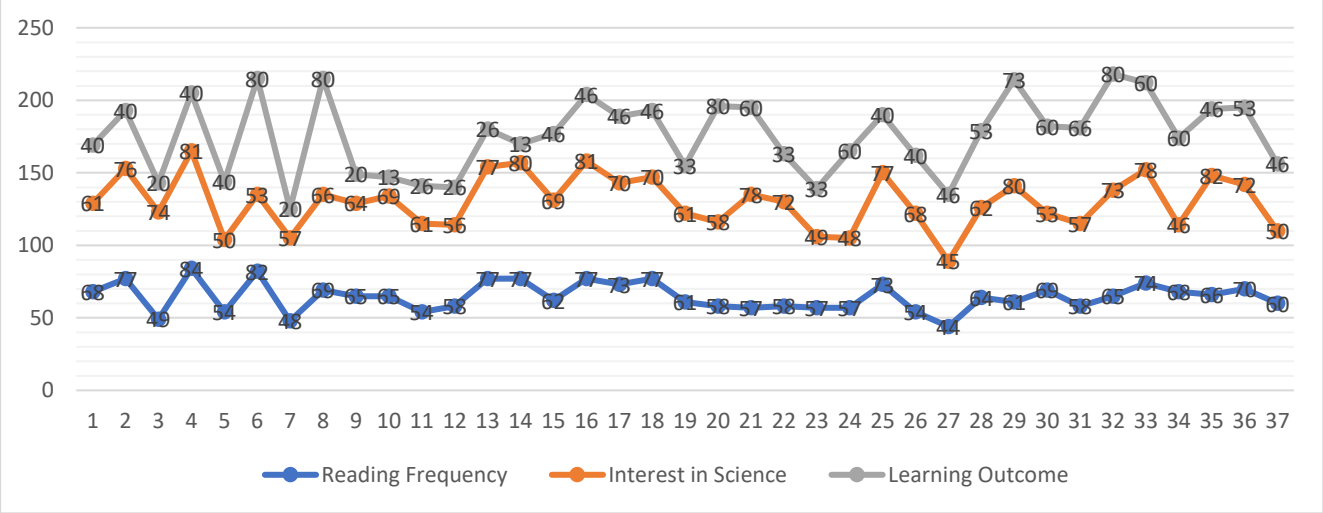

Figure 1. Students' Reading Frequency Scores, Interest in Learning Science, and Student Achievement

Based on Figure 1, all three variables exhibit fluctuating patterns among students. Reading frequency and interest in learning science tend to fall within the medium-to-high range, although variations still exist among some students. Meanwhile, students' learning outcomes show more pronounced variations, with a fairly significant difference between the lowest and highest scores. Furthermore, no consistent linear pattern is observed between reading frequency, interest in learning, and learning outcomes, indicating that high reading frequency or interest in learning is not always accompanied by high learning outcomes. These visual findings reinforce the results of the previous statistical analysis, which showed that the relationship between variables is not always partially direct.

Furthermore, Table 1 presents a complete set of descriptive statistics, including the number of respondents (N), range, minimum, maximum, mean, standard deviation, and variance for each variable. This table provides more detailed numerical data, allowing readers to conduct a more in-depth analysis if necessary.

Table 1. Descriptive Statistics of Students' Reading Frequency Scores, Interest in Learning Science, and Academic Achievement

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
x1	37	40	44	84	64,59	1,610	9,794	95,914
x2	37	37	45	82	65,51	1,875	11,406	130,090
y	37	67	13	80	45,68	3,119	18,971	359,892
Valid N (listwise)	37							

Based on the table above, variable X1 (students' reading frequency) has a mean of 64.59 and a range of 44 to 84, indicating that most students have a fairly high reading frequency. Variable X2 (interest in learning science) has a mean of 65.51, with a minimum value of 45 and a maximum of 82, indicating that students' interest in learning science falls into the moderate to high category. Meanwhile, variable Y (student learning outcomes) has a mean of 45.68, a minimum of 13, and a maximum of 80, indicating a fairly large variation in learning outcomes among students. This descriptive interpretation serves as the basis for further analysis, including correlation tests, regression, and hypothesis testing, to determine the relationships and influences between variables in this study.

Results of the Partial Correlation Test

To examine the bivariate relationships among science reading frequency (X1), learning interest (X2), and academic achievement (Y), Pearson correlation analysis was conducted. The results are presented in Table 2.

Table 2. Results of the partial correlation test

Correlations

		x1	x2	y
x1	Pearson Correlation	1	,472**	,144
	Sig. (2-tailed)		,003	,397
	N	37	37	37
x2	Pearson Correlation	,472**	1	-,121
	Sig. (2-tailed)	,003		,475
	N	37	37	37
y	Pearson Correlation	,144	-,121	1

	Sig. (2-tailed)	,397	,475	
	N	37	37	37

**. Correlation is significant at the 0.01 level (2-tailed).

Based on Table 2, a moderate positive correlation was found between reading frequency (X1) and learning interest (X2) ($r = 0.472$, $p < 0.01$), indicating that students who read science materials more frequently tend to report higher levels of learning interest. This relationship is statistically significant, suggesting a meaningful association between these two variables.

In contrast, the correlation between reading frequency (X1) and academic achievement (Y) is weak and not statistically significant ($r = 0.144$, $p = 0.397$). Similarly, the relationship between learning interest (X2) and academic achievement (Y) is also weak and non-significant, with a negative direction ($r = -0.121$, $p = 0.475$). These findings indicate that, at the bivariate level, neither reading frequency nor learning interest shows a meaningful association with students' academic achievement.

The weak and non-significant relationships with academic achievement may suggest that these variables do not directly translate into improved performance, but rather operate through more complex or indirect mechanisms. For instance, reading frequency may enhance interest without necessarily improving conceptual understanding measured by tests. More notably, the negative (although non-significant) correlation between learning interest and academic achievement warrants attention. This pattern may reflect inconsistencies between students' perceived interest and their actual academic performance, potentially influenced by factors such as ineffective study strategies, superficial engagement, or misalignment between instructional methods and assessment formats. These results highlight the need for further analysis using multivariate approaches to better understand the combined and predictive roles of the variables.

Results of the Multiple Correlation Analysis

Next, to simultaneously determine the relationships among the variables, the researcher conducted a multiple correlation analysis. This analysis was used to assess the combined relationship between reading frequency (X1) and interest in learning science (X2) on student learning outcomes (Y), while controlling for the individual effects of each independent variable on the dependent variable. This approach allowed the researcher to understand the extent to which the two independent variables simultaneously influenced student learning outcomes on animal reproduction. The results of the multiple correlation analysis are presented in the following table.

Table 3. Results of the multiple correlation analysis

Correlations				
Control Variables			x1	x2
y	x1	Correlation	1,000	,498
		Significance (2-tailed)	.	,002
		df	0	34
	x2	Correlation	,498	1,000
		Significance (2-tailed)	,002	.
		df	34	0

Based on the table above, the multiple correlation coefficient among reading frequency (X1), interest in learning science (X2), and academic achievement (Y) indicates a significant positive relationship. The significance value (two-tailed) of 0.002 (< 0.01) indicates that, simultaneously, reading frequency and interest in learning science have a significant effect on student learning outcomes. In other words, an increase in reading frequency and student interest in learning, together, contribute to improved learning outcomes in the subject of animal reproduction.

Results of the Data Normality Test

A normality test was conducted to determine whether the research data used in the regression analysis are normally distributed. This test is one of the key prerequisites for regression analysis, as a valid regression model requires that the residuals be normally distributed. In this study, the normality of the residuals was assessed using the Kolmogorov-Smirnov test. The results of the normality test are presented in the following table.

Table 4. Results of the data normality test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		37
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	18,32870072
Most Extreme Differences	Absolute	,103
	Positive	,103
	Negative	-,069
Test Statistic		,103
Asymp. Sig. (2-tailed)		,200[c,d]

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

The results show that the Asymp. Sig. (2-tailed) The value is 0.200, which exceeds the significance level of 0.05. This indicates that the residuals do not significantly deviate from a normal distribution. Therefore, the normality assumption for regression analysis is satisfied.

Results of the Test for Homogeneity of Variances

A normality test was conducted to assess whether the regression model residuals were normally distributed, as this is a key assumption of linear regression. The Kolmogorov–Smirnov test was applied to the unstandardized residuals, and the results are presented in Table 4.

Table 5. Results of the test for homogeneity of variances

Test of Homogeneity of Variances					
		Levene Statistic	df1	df2	Sig.
x1	Based on Mean	6,934	2	108	,001
	Based on Median	6,626	2	108	,002

Based on Median and with adjusted df	6,626	2	71,804	,002
Based on the trimmed mean	6,955	2	108	,001

Based on the table above, the significance value (Sig.) for variable X1 is 0.001, which is < 0.01. This indicates that the variances across groups are not homogeneous. In other words, the data in this study exhibit different levels of variation across groups, meaning that the assumption of homogeneity of variances is not met. This condition must be taken into account when selecting further analytical methods or interpreting the results of statistical tests.

Multicollinearity Test Results

A multicollinearity test was conducted to assess whether the independent variables in the regression model exhibit strong relationships. This is important because multicollinearity can affect the stability of regression coefficient estimates, thereby invalidating the regression model. This test was conducted by examining the Tolerance and Variance Inflation Factor (VIF) values for each independent variable. The results of the multicollinearity test are presented in the following table.

Table 6. Results of the Multicollinearity Test

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-6,145E-15	22,968		,000	1,000		
	x1	,000	,364	,000	,000	1,000	,778	1,286
	x2	,000	,313	,000	,000	1,000	,778	1,286

a. Dependent Variable: ABS_RES

Decision-making in this multicollinearity test can be based on the Tolerance and VIF values. Based on the "Coefficients" output table in the "Collinearity Statistics" section, it is observed that the Tolerance value for the reading frequency variable (X1) and the interest in learning science variable (X2) is 0.778, which is greater than 0.10. Meanwhile, the VIF values for the reading frequency variable (X1) and interest in learning science (X2) are 1.286 < 10.00. Therefore, based on the decision-making criteria for the multicollinearity test, there is no multicollinearity in the regression model.

Results of the Heteroscedasticity Test

A test for heteroscedasticity was conducted to determine whether the residuals of the regression model exhibit unequal variance. Uneven residual variance can cause regression coefficient estimates to be inefficient and reduce the model's validity. Therefore, a good regression model must be free from heteroscedasticity. In this study, the heteroscedasticity test was conducted using the Glejser test by examining the significance values of each independent variable against the residuals. The test results are presented in the following table.

Table 7. Results of the Heteroscedasticity Test

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-6,145E-15	22,968		,000	1,000
	X1	,000	,364	,000	,000	1,000
	X2	,000	,313	,000	,000	1,000

a. Dependent Variable: ABS_RES

To interpret the results of the Glejser test for heteroscedasticity, we simply need to look at the "Coefficients" output table, with the Abs_RES variable as the dependent variable. Based on the table above, the significance value (Sig.) for the reading frequency variable (X1) is 1.000, while for the interest in learning science variable (X2) it is also 1.000. Both values are greater than 0.05; therefore, according to the Glejser test criteria, there is no evidence of heteroscedasticity in the regression model. Thus, the regression model used meets one of the classical assumptions, namely that it has homogeneous residual variance.

Hypothesis Test Results

Hypothesis testing was conducted using multiple linear regression analysis to examine the partial (individual) effects of science reading frequency (X1) and learning interest (X2) on students' academic achievement (Y). The decision criterion was based on a significance level of $\alpha = 0.05$. A variable is considered to have a significant predictive effect if its p-value is less than 0.05. The results are presented in Table 8.

Table 8. Hypothesis Test Results

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	39,856	22,968		1,735	,092
	x1	,500	,364	,258	1,374	,178
	x2	-,404	,313	-,243	-1,294	,205

a. Dependent Variable: y

Based on Table 8, the regression coefficient for reading frequency (X1) is positive (B = 0.500), indicating a positive direction of association; however, the effect is not statistically significant (p = 0.178 > 0.05). Similarly, learning interest (X2) shows a negative regression coefficient (B = -0.404), but this effect is also not statistically significant (p = 0.205 > 0.05). Therefore, neither hypothesis, that reading frequency and learning interest significantly predict academic achievement, is supported.

These findings suggest that although reading frequency and learning interest may be related (as shown in the correlation analysis), neither independently predicts students' academic achievement in this context. This result may indicate that academic performance is influenced by more complex factors beyond individual engagement variables, such as instructional quality, assessment alignment, prior knowledge, or cognitive ability. In particular, the non-significant, negative coefficient for learning interest highlights a potential discrepancy between students' perceived interest and their actual performance, which may arise when interest is not accompanied by effective learning strategies or deep conceptual understanding.

Discussion

The Relationship Between Reading Frequency and Interest in Learning Science

The findings reveal a moderate positive correlation between students' reading frequency and their interest in learning science ($r = 0.472$, $p < 0.01$), indicating that more frequent reading engagement is associated with higher levels of learning interest. This result is in line with Sugiharti (2016), who states that regular reading activities contribute to the development of cognitive abilities and comprehension, and with Tarigan (2008), who emphasizes that reading is an active process involving analytical thinking that can enhance students' motivation and interest. However, beyond confirming these general perspectives, the present study highlights a more specific mechanism within the context of elementary science learning.

At the primary school level, science learning often involves abstract concepts that are not directly observable, such as biological processes in animal reproduction. In this context, reading serves not only as a means of acquiring information but also as a cognitive stimulus that introduces new ideas and fosters curiosity. This supports the findings of Rini (2018), who reported that frequent reading is associated with improved engagement in science learning, and of Nurlaili (2020), who found that reading habits can stimulate curiosity and intrinsic motivation. Thus, reading frequency may serve as an entry point for developing situational interest, particularly when students are exposed to meaningful, contextually relevant science texts.

Nevertheless, it is important to note that the relationship identified in this study is associative rather than causal. While reading frequency may contribute to increased interest in learning, it is also possible that students who already have a higher interest in science are more likely to engage in reading activities. This reciprocal relationship suggests that reading and interest may reinforce each other. Therefore, the contribution of this study lies in emphasizing that, within elementary science education, reading frequency plays a supportive role in strengthening interest in learning, particularly in topics requiring conceptual imagination and cognitive engagement.

The Relationship Between Reading Frequency and Student Academic Achievement

The results indicate that reading frequency is not significantly associated with students' academic achievement ($r = 0.144$, $p = 0.397$). This finding suggests that, although reading is an essential academic activity, its frequency alone does not directly translate into improved learning outcomes in science. Rather than indicating the absence of any role of reading, this result points to a more complex relationship in which reading frequency may not function as a direct predictor of achievement.

From a theoretical perspective, reading is expected to enhance conceptual understanding and analytical skills, as emphasized by Sugiharti (2016) and Tarigan (2008). Frequent reading activities can support vocabulary development and facilitate comprehension of subject matter. Empirical findings by Rini (2018) also suggest a positive association between reading frequency and academic performance. However, the current findings indicate that this theoretical expectation does not automatically apply in all contexts, particularly in elementary science learning.

A more plausible explanation lies in the distinction between reading frequency and reading effectiveness. Students may engage in frequent reading without achieving meaningful comprehension, especially when reading activities are not guided or aligned with instructional goals. In the context of science education, understanding complex topics such as animal reproduction requires not only exposure to information but also structured support, including teacher explanation, discussion, and opportunities for conceptual application. Without these elements, reading may remain a surface-level activity that contributes minimally to assessed learning outcomes.

Furthermore, the misalignment between reading practices and assessment formats may also contribute to the non-significant relationship. If assessments emphasize higher-order thinking or the application of concepts, students who read frequently but do not engage in deep-processing strategies may not perform well. This interpretation is supported by Huang et al. (2018) and Kim and Park (2020), who argue that reading quality, material relevance, and active learning strategies play a more critical role in determining academic achievement than reading frequency alone.

Based on these considerations, this study proposes that reading frequency operates as an indirect or enabling factor rather than a direct determinant of academic achievement. Its influence is likely mediated by variables such as comprehension quality, instructional support, and learning strategies. Therefore, improving students' academic outcomes requires not only increasing reading frequency but also ensuring that reading activities are meaningful, guided, and aligned with learning objectives and assessment practices.

The Relationship Between Interest in Science and Student Achievement

The results indicate that interest in learning science is not significantly associated with students' academic achievement ($r = -0.121$, $p = 0.475$). Although the relationship is weak and statistically non-significant, the negative direction is noteworthy and warrants careful interpretation. This finding suggests that higher reported interest does not necessarily correspond to better academic performance and, in some cases, may even reflect a misalignment between students' perceived engagement and their actual learning outcomes.

From a theoretical perspective, interest in learning is considered a form of intrinsic motivation that promotes active engagement and supports academic success (Sardiman, 2011; Hamzah B. Uno, 2013). Students with high interest are expected to participate more actively, explore additional resources, and develop deeper conceptual understanding. However, the present findings indicate that such expectations may not be fully realized in practice, particularly in the context of elementary science learning.

One possible explanation lies in the nature of how learning interest is manifested and measured. Self-reported interest may reflect students' enjoyment or preference for a subject rather than their actual cognitive engagement or use of effective learning strategies. As a result, students may express high interest but still rely on superficial learning approaches that do not support strong academic performance. This interpretation is consistent with Schiefele (1991) and Pintrich (2003), who argue that interest alone is insufficient to produce achievement unless accompanied by strategic learning behaviors and meaningful interaction with the content.

Additionally, contextual factors such as instructional quality, Classroom environment, and assessment alignment may influence the relationship between interest and achievement. If teaching methods do not effectively channel students' interest into structured learning activities, or if assessments emphasize skills not supported during instruction, then interest may not translate into measurable outcomes. The slight negative tendency observed in this study may therefore indicate that interest, when not supported by appropriate pedagogical practices, does not guarantee improved achievement.

These findings highlight that learning interest should be understood as part of a broader system of learning variables. Its contribution to academic achievement is likely indirect and contingent upon other factors such as reading engagement, learning strategies, and instructional support. Therefore, enhancing student achievement requires not only fostering interest but also ensuring that such interest is effectively guided toward meaningful and cognitively engaging learning processes.

The Combined Effect of Reading Frequency and Interest in Science on Academic Achievement

The results of the multiple regression analysis indicate that, when considered simultaneously, reading frequency and interest in science significantly predict students' academic achievement ($p = 0.002 < 0.05$). This finding suggests that the joint contribution of these variables is statistically meaningful, even though each variable does not show a significant contribution when examined independently. However, given the correlational and non-experimental nature of the study, this result should be interpreted as a combined predictive association rather than a causal effect.

From a theoretical perspective, this finding is consistent with Bloom's (1956) framework, which posits that learning outcomes are influenced by the interaction of cognitive and affective factors. In this context, reading frequency can be understood as supporting cognitive engagement through exposure to content, while learning interest represents an affective component that sustains motivation and attention. The significance of their combined role suggests that neither cognitive engagement nor motivation alone is sufficient; rather, their interaction creates conditions conducive to meaningful learning.

This interpretation is supported by Guthrie and Wigfield (2000), who emphasize that integrating reading engagement and motivation leads to better academic performance, particularly in subjects requiring conceptual understanding, such as science. Importantly, the present findings extend this perspective by showing that the synergy between reading frequency and learning interest may compensate for the limited contribution of each variable when considered separately. This indicates an interaction-like pattern, in which the effectiveness of one variable depends on the presence of the other.

Nevertheless, the findings should be interpreted with caution. The absence of significant partial effects alongside a significant simultaneous result may reflect underlying complexities such as shared variance, indirect relationships, or the influence of unmeasured variables (e.g., instructional quality or prior knowledge). Therefore, the contribution of this study lies not in establishing direct causal relationships, but in highlighting the importance of considering multiple interrelated factors when examining academic achievement.

In terms of practical implications, these results suggest that instructional strategies should not focus solely on increasing reading frequency or fostering interest in isolation. Instead, teachers should design integrated learning activities, for example, guided science reading tasks combined with inquiry-based discussions or problem-solving exercises, that simultaneously promote engagement and conceptual understanding. Such approaches may help translate students' interest and reading engagement into more meaningful and measurable learning outcomes.

CONCLUSION

This study examined the relationships and predictive roles of science reading frequency and learning interest on students' academic achievement. The findings reveal that, individually, neither reading frequency nor learning interest shows a significant association with academic achievement. However, when analyzed simultaneously, both variables demonstrate a significant combined predictive relationship. This indicates that students' academic achievement is not influenced by isolated factors but by the interaction between cognitive engagement (reading frequency) and motivational aspects (learning interest), highlighting the importance of considering multiple variables together to understand learning outcomes.

These findings imply that improving academic achievement requires integrated instructional approaches that simultaneously foster students' engagement in reading and their interest in learning, rather than addressing these factors separately. However, this study is limited by its small sample size and reliance on self-reported measures of learning interest, which may not fully capture actual student engagement. Future research is recommended to include larger, more diverse samples, incorporate additional variables, such as learning strategies and instructional quality, and apply more advanced analytical models to explore indirect or mediated relationships. Such efforts are essential to develop a more comprehensive understanding

of the factors influencing students' academic achievement in science education.

ACKNOWLEDGEMENT

The author would like to express sincere gratitude to all parties who have contributed to the completion of this research. Special thanks are extended to the principal, teachers, and students of the primary school in Central Lombok Regency who participated in this study and provided valuable support and cooperation during data collection. The author also acknowledges the guidance, advice, and constructive feedback from supervisors and colleagues, which greatly helped shape the research framework, methodology, and interpretation of the results. Finally, the author wishes to express appreciation to all individuals and institutions whose support, directly or indirectly, made this research possible. Any shortcomings in this study remain the responsibility of the author.

AUTHOR'S CONTRIBUTION

Table of Author Contributions

Contribution Indicator	Author			
	1	2	3	4
Conceptualization	✓	✓		
Literature Review	✓	✓	✓	
Research Design / Methodology		✓	✓	
Instrument Development	✓		✓	
Data Collection	✓			✓
Data Curation		✓	✓	
Formal Analysis	✓	✓		
Data Interpretation	✓	✓		
Writing – Original Draft	✓			
Writing – Review & Editing		✓	✓	✓
Visualization / Tables	✓			
Supervision	✓	✓	✓	✓

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