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Influence of Academic Sefl-Efficacy and Classroom Climate on Science Literacy Among Senior High School Students

JUDILLE D. WALING
Graduate School
Holy Cross of Davao College, Inc
Philippines
ORCID: 0009-0007-7049-835X

ROGAR R. GARCIA, EdD
Master Teacher II, Department of Education – Division of Davao City,
F. Bangoy National High School
https://orcid.org/009-0001-5947-0184

Abstract — Poor science literacy remains a concern in education. The influence of academic self-efficacy and classroom climate on science literacy among senior high school students was verified. A diagnostic research design, random sampling, a survey technique, and multiple linear regression analysis were used in this study. The data collected from 258 senior high school students showed that science literacy was significantly influenced by the determinant variables, partly and partially supporting the Social Cognitive Theory. Future research may include additional variables and qualitative studies to explain the remaining 97% of the variance in science literacy and further explore factors influencing student learning. At the same time, school administrators, policymakers, and teachers may collaborate to promote inclusive, supportive learning environments that enhance students' science literacy.

Keywords: Influence of academic self-efficacy, classroom climate, science literacy, senior high school students

I. INTRODUCTION

Poor science literacy remains a major concern in science education. Poor science literacy among students has long been identified as a critical problem, often reflected in difficulties in understanding scientific concepts, interpreting data, and applying knowledge to real-life situations (De Jesus & Vinoya, 2025). The persistent poor science literacy weakens learners' ability to think critically and solve problems, which are essential competencies in a science-driven society. It also limits student capacity to make informed decisions in academic and everyday contexts.

Research across various contexts shows that poor science literacy remains a widespread issue in education. In Finland and the United Kingdom, poor science literacy is still observed among adults without formal degrees, indicating uneven development of scientific understanding (The Times, 2025). Globally, poor scientific literacy remains prevalent as many learners fail to meet the expected competencies for 21st century skills (De Jesus & Vinoya, 2025). In the Philippines, poor scientific literacy is also evident among junior high school students, who exhibit incomplete, transitional understanding of basic scientific concepts (Gerondio et.al., 2023). This poor science literacy affects academic performance, critical thinking, and readiness for STEM-related pathways. For this reason, this study is conducted.

This study was significant because improving science teaching efficacy supported Sustainable Development Goal 4, which aimed to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, since confident and effective science teachers were essential to meaningful learning and better learner outcomes. It was also important to the Department of Education's national mission of protecting and promoting every Filipino's right to quality, equitable, culture-based, and complete basic education, because stronger science teaching efficacy helped teachers deliver better instruction and create a more effective learning environments. Moreover, the study supported the vision and mission of Holy Cross of Davao College by contributing knowledge that helped form competent, values-oriented, and Christ-centered educators through quality education. In this way, the study guided the teacher.

Generally, this study determined the significant influence of academic self-efficacy and classroom climate on science literacy among senior high school students. Specifically, it aims to determine the levels of academic self-efficacy in terms of perceived control, competence, persistence, and self-regulated learning; classroom climate in terms of student agency, collaborative learning environment, inclusive and flexible learning, student autonomy; and the science literacy in terms of nature of science knowledge, science technology knowledge, science content knowledge, and technology usage knowledge, the significance of the correlation between academic self-efficacy and classroom climate, and science literacy; and to determine the significance of the individual and combined influence of academic self-efficacy and classroom climate on science literacy. This study is grounded in Social Cognitive Theory by Albert Bandura in 1986.

II. METHODOLOGY

This study employed a diagnostic research design. This design was appropriate because it allowed the researcher to describe the current levels of the variables and examine their relationships without manipulating the respondents natural setting (Best & Kahn, 2026). Moreover, it was structured, problem-oriented research design used to examine current conditions, identify relevant patterns or relationships, and describe the strength of the determinant factor in influencing the outcome (Wisenthige, 2023; Samanth, 2024).

The study was conducted in the Division of Davao Occidental, Philippines. The locale consists of three public senior high schools under the supervision of the Department of Education, Division of Davao Occidental, under DepEd Region XI, namely Lawa National High School, Jhon Martin Johnson National High School, and Don Marcelino National High School. The selected schools represent Grade 11 and Grade 12 students enrolled during the School Year 2025-2026. This locale was selected because senior high school students in these schools are actively engaged in classroom instruction, curriculum implementation, and science-related learning activities within the public school system. The setting provides a relevant context for examining scientific literacy, as the findings may reflect the actual level of scientific literacy among senior high school learners in public schools in Davao Occidental.

The respondents of this study were Senior High School students enrolled in science classes in three public senior high schools in Davao Occidental during SY 2025-2026. The total population consisted of 780 students, of whom 258 were selected as respondents. Participants were chosen regardless of sex, grade level, or track. Random sampling technique was used in this study to ensure that every member of the population had an equal chance of being selected. This technique was applied to minimize bias and obtain a representative sample for the quantitative research design (Creswell, 2018). Its advantages include reducing selection bias and improving the validity and reliability of the study findings (Etikan & Bala, 2017). The researcher obtained the official list of Grade 11 and Grade 1 students and randomly selected respondents from each cluster. Participation was voluntary, with informed consent secured, including parental consent and assent for those below 18 years old. The sample size was determined using the Raosoft sample size calculator with 5% margin of error and 95% confidence level, ensuring reliable and representative data.

The survey technique was used in gathering data. It is a method for collecting data through structured questionnaires to obtain standardized information on respondents' perceptions and behaviors (Creswell & Creswell, 2023; Cohen et.al., 2021). It is commonly used in descriptive and correlational research because it allows researchers to examine relationships among variables and to describe trends systematically (Neuman, 2020; Creswell & Creswell, 2023). It is also advantageous in reaching large samples, producing quantifiable data for statistical analysis, and ensuring replicability througj standardized procedures (Oranga & Matere, 2025)

Three adapted and modified survey questionnaires were used in this study, and the instruments were validated by three experts in educational assessment and one psychologist using a five-point Likert scale, yielding a mean validation score of 4.25, interpreted as excellent validity (Likert, 1932). A pilot test was also conducted to assess reliability, yielding Cronbach's alpha values greater than 0.90 for all instruments, indicating very high reliability (Taber, 2018). A 4-point Likert Scale was used to measure respondents' answers, ranging from 1- Strongly Disagree to 4- Strongly Agree, to reduce neutral responses and improve clarity of responses (Koo, 2025). The first instrument, academic self-efficacy, was adapted from Dullas (2018) and consisted of 20 items measuring perceived control, persistence, and self-regulated learning, with a Cronbach's alpha of 0.095. The second instrument, classroom climate, was adapted from the Classroom

Climate Inventory developed by Olarte et.al (2024), consisting of 23 items measuring student agency, collaborative learning environment, inclusivity and flexibility, and student autonomy, with a Cronbach's alpha of 0.680. The third instrument, science literacy, was adapted from Celik (2024) and consisted of 22 items measuring knowledge of the nature of science, science and technology, science content, and technology use, with a Cronbach's alpha of 0.764.

Descriptive analysis summarizes data using measures such as the mean and standard deviation, providing a clear overview of patterns and distributions without determining relationships between variables (Gravetter & Wallnau, 2021). In this study, the mean was used to summarize and describe the levels of academic self-efficacy, classroom climate, and science literacy, and the standard deviation was used to measure the spread or variability of the data around the mean. Moreover, the correlation analysis is used to determine the strength and direction of relationship between variables without establishing causation (Creswell & Creswell, 2023; Borg et.al., 2021). The Pearson product-moment correlation was used to determine the strength and direction of the relationship between academic self-efficacy, classroom climate, and science literacy. Lastly, multiple linear regression analysis is a statistical method used to examine the influence of variables and predict outcomes by identifying the strength and significance of predictors (Field, 2024). Moreover, the standardized beta coefficient is used to determine which predictor variables has the strongest influence on the outcome variable and to compare the relative effects of predictors in the regression model (Roustaei, 2024).

The matrix, which contains the scale, descriptive level, and corresponding interpretation for each variable, is presented and is specifically used to describe the levels of academic self-efficacy, classroom climate, and scientific literacy among senior high school students.

Range of Mean	**Descriptive Level**	**Academic Self-Efficacy**	**Classroom Climate**	**Science Literacy**
3.26-4.00	Very High	Very Good	Very Good	Very Strong
2.50-3.25	High	Good	Good	Strong
1.75-2.49	Low	Poor	Poor	Weak
1.00-1.74	Very Low	Very Poor	Very Poor	Very Weak

To measure and interpret the standard deviation, the following standard scheme is followed.

Standard Deviation Value Ranges and Interpretation

Range	Description	Interpretation
SD ≤ 0.50	Highly Consistent Responses	Strong and uniform perception
SD = 0.51-1.00	Moderately Consistent Responses	Acceptable consistency
SD = 1.01-1.50	Low Consistency Responses	Differing views or experiences
SD > 1.50	Very Low Consistency Responses	High variability and lack of consensus

The significance of the correlation is tested at a 0.05 confidence level. For the interpretation scale of r-value, the following scheme is used:

Computed r	Descriptive Interpretation
+/- 1.00	Perfect correlation
Between +/- 0.75 – +/- 0.99	High correlation
Between +/- 0.51 – +/- 0.74	Moderately high correlation
Between +/- 0.31 – +/- 0.50	Moderately low correlation
Between +/- 0.01 – +/- 0.30	Low correlation
0.0	No correlation

The degree of influence and the overall predictive effects of academic self-efficacy and classroom climate on science literacy among senior high students were analyzed using multiple linear regression, with unstandardized and standardized beta coefficients, assuming a linear relationship among the variables.

For the Scale of Beta (β) Coefficient Strength, the following scheme is used:

β Value Range	**Strength of Influence**
+ 0.00 - +0.09	Very Weak
+ 0.10 - + 0.29	Weak
+ 0.30 - + 0.49	Moderate
+ 0.50 - + 0.69	Strong
+ 0.70 and above	Very Strong

The study complied with established ethical standards and obtained approval from the Holy Cross of Davao College – SMILE ethics committee prior to data collection. Permissions to conduct the study were subsequently obtained from the Department of Education (DepEd) Division of Davao Occidental SDS Office, District PSDS, and the school principals. Before the participant took the survey, informed consent for minor participants was obtained by asking permission from the parent or legal guardian, along with the child's informed assent after the study had been explained in a manner suited to their level of understanding, to ensure voluntary participation (Spriggs, 2023). Participants were informed about the purpose of the study, the procedures, and the right to withdraw at any time without penalty. Confidentiality and privacy were strictly maintained throughout the study (Mirza et al., 2023). No personal identifiers were collected, and all data were securely stored and used solely for research purposes in compliance with the Data Privacy Act of 2012, with results reported in aggregate to protect participants' identities.

III. RESULTS AND DISCUSSIONS

Table 1 is a descriptive table. It contains the variables involved, namely, academic self-efficacy, classroom climate, and science literacy among senior high school students, and the number of samples, standard deviation, mean, and descriptive level specifically corresponding with each of the variables.

TABLE 1
DESCRIPTIVE STATISTICS (N=258)

Variables	Standard Deviation	Mean	Descriptive Level
Academic Self-Efficacy	**0.18**	**3.37**	**Very High**
Perceived Control	*0.33*	*3.36*	*Very High*
Competence	*0.28*	*3.36*	*Very High*
Persistence	*0.27*	*3.39*	*Very High*
Self-regulated Learning	*0.24*	*3.38*	*Very High*
Classroom Climate	**0.20**	**3.37**	**Very High**
Inclusive and Flexible Learning	0.34	3.38	*Very High*
Collaborative Learning	0.33	3.36	*Very High*
Student Agency	0.27	3.36	*Very High*
Science Literacy	**0.30**	**3.34**	**Very High**
Nature and Science Knowledge	*0.33*	*3.41*	*Very High*
Science – technology Knowledge	*0.36*	*3.35*	*Very High*
Science Content Knowledge	*0.48*	*3.36*	*Very High*
Technology Usage Knowledge	*0.45*	*3.31*	*Very High*

Table 1 shows that the academic self-efficacy variable had a mean of 3.37, which is described as very high. This indicates that the respondents demonstrate a very strong academic self-efficacy. All indicators are also described as very high. The standard deviation of 0.18, described as highly consistent responses, indicates a strong and uniform perception among the respondents. Moreover, the classroom climate variable had a mean of 3.37, which is described as very high. This denotes that respondents perceive their classroom climate. All indicators are also describe as very high. The standard deviation of 0.20, indicating highly consistent responses, suggests a uniform perception of classroom climate.

Furthermore, the science literacy variable had a mean of 3.34, described as very high. This indicates that respondents demonstrate a very high level of science literacy. All indicators are described as very high. The standard deviation of 0.30, described as highly consistent responses, indicates generally uniform perceptions. The findings reveal that all variables, academic self-efficacy, classroom climate, and science literacy, are described at a very high level, indicating strong academic confidence, a highly positive classroom environment, and a very high level of science literacy among respondents.

Table 2 is a correlation table. It contains determinant and criterion variables. It shows the r-value, p-value, decision on the null hypothesis, and the corresponding interpretation.

TABLE 2
CORRELATION TABLE (N=258)

Variables	Science Literacy			
	r-value	p-value	Decision on $H0$	Interpretation
Academic Self-Efficacy	0.11	0.08	Fail to Reject $H0$	Not Significant
Classroom Climate	0.12	0.03	Reject $H0$	Low Positive, Significant

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

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Table 2 specifically shows that the correlation between academic self-efficacy and science literacy variables obtained a p-value of 0.08. this value exceeds the 0.05 significance level. Hence, the null hypothesis was not rejected. This indicates the correlation is not significant. The corresponding r-value of 0.11 indicates a very weak positive correlation. This indicates that academic self-efficacy is not meaningfully associated with science literacy among the respondents.

On the other hand, the correlation between classroom climate and science literacy yielded a p-value of 0.03, which is below the 0.05 significance level. Hence, the null hypothesis was rejected. This denotes that the relationship is statistically significant. The r-value of 0.12 indicates a low positive correlation between classroom climate and science literacy. This implies that as classroom climate improves, science literacy tends to improve as well. The results revealed that while academic self-efficacy showed no meaningful relationship with science literacy, classroom climate demonstrated a significant positive relationship, indicating that classroom climate has a stronger influence on science literacy among the respondents.

Table 3 is a regression table. It contains the variables, unstandardized beta coefficient, standard error, standardized beta coefficient, t-value, p-value, decision on null hypoyhesis, and corresponding interpretation.

TABLE 3
REGRESSION TABLE (N=258)

	Science Literacy						
	Unstandardized Coefficients		**Standardized Coefficients**				
Variables	**B**	**Std. Error**	**Beta**	**t**	**Sig.**	**Decision on H_0**	**Interpretation**
(Constant)	2.13	0.45	–	4.69	0.000	–	–
Academic Self-Efficacy	0.17	0.10	0.10	1.67	0.096	Fail to Reject	Not Significant
Classroom Climate	0.18	0.09	0.12	2.02	0.044	Reject	Positive Significant Influence

$R = 0.16$ | $R^2 = 0.03$ | $F = 3.58$ | $p = 0.029$
Level of Significance: 0.05
Decision Rule: Reject H_0 if $p < 0.05$

Table 3 specifically shows that the academic self-efficacy variable had a standardized beta coefficient of 0.10. It indicates that the influence of academic self-efficacy on the criterion variable is very weak. With a corresponding p-value of 0.096, the null hypothesis was not rejected. It signifies that the influence of academic self-efficacy on science literacy is not statistically significant. This implies that for a unit change in academic self-efficacy, there is no corresponding change in science literacy. Likewise, the classroom climate variable obtained a standardized beta coefficient of 0.12. It indicates that the influence of classroom climate on the criterion variables is weak. The corresponding p-value of 0.044, and the null hypothesis was rejected. It denotes that the influence of classroom climate on science literacy is positively significant. This implies that for every 1-unit increase in classroom climate, there is a corresponding 0.12- unit increase in science literacy among the respondents.

The table also shows an R^2 value of 0.03. This indicates that the collective influence of determinants variables on the criterion variable is weak. The corresponding p-value of 0.029 is less than the 0.05 significance level. Thus, the null hypothesis was rejected. This indicates that the combined influence of academic self-efficacy and classroom climate on science literacy is statistically significant. This implies that for every unit change in the combined influence of the determinant variables, there is a corresponding 0.03 unit change in the criterion variable.

The findings revealed that classroom climate had a stronger and statistically significant influence on science literacy. In contrast, academic self-efficacy had only a very weak, non-significant influence on the criterion variable. Moreover, although the combined influence of academic self-efficacy and classroom climate on science literacy was statistically significant, their overall predictive strength remained weak.

Summary of Findings

Based on statistical results, it was specifically found that Classroom climate, not academic self-efficacy, has a significant correlation with science literacy among senior high school students. Academic self-efficacy and classroom climate have a significant collective influence on science literacy.

The current study reveals that academic self-efficacy does not significantly correlate with science literacy, while classroom climate is significantly correlated with science literacy among senior high school students. The current finding supports the findings of Hyseni et al. (2023), which report that supportive classroom environments contribute to better academic outcomes. In addition, this current finding supports Fraser (2022), who found that classroom environments characterized by cooperation, inclusivity, and active participation enhance learning effectiveness, including the development of scientific competencies.

Moreover, the current finding contradicts the study of Spaan et al. (2024), which reported that classroom climate does not consistently predict science literacy and may, in some contexts, be influenced by other learner-related and environmental factors. While the earlier study focused on the varying effects of environmental factors on academic outcomes across different contexts, the present study examined the influence of classroom climate on science literacy among senior high school students. The differing results may also be partly explained by sample size differences, thereby providing more specific evidence for the observed relationship between classroom climate and science literacy.

This study found that classroom climate has a significant positive influence on science literacy among senior high school students. This aligns with the study of Erdem and Kaya (2024), who found that supportive and positive learning environments are significantly related to improve science literacy, showing that students exposed to encouraging classroom conditions tend to demonstrate better understanding and engagement in science learning. Similarly, the current finding supports the findings of Peterson et al. (2024), which claim that positive classroom environments enhance student participation and improve literacy development.

However, the present finding contradicts the study of Grabau et al. (2024), which argued that science literacy may also be influenced by learner-related factors beyond classroom climate alone, suggesting that academic outcomes are shaped not only by the learning environment but also by students' personal and psychological factors. This indicates that classroom climate may not always consistently predict science literacy across different educational settings and learner populations.

Conclusion

Based on findings, it was concluded that classroom climate significantly influences science literacy, while academic self-efficacy does not. Hence, the Social Cognitive Theory, which emphasizes that learning occurs through the dynamic interaction of personal factors, behavior, and the environment, was only partially supported.

Recommendations

Based on the conclusions, the following are recommended:

1. Future research may include additional variables, such as student engagement or the availability of learning resources, to explain the remaining 97% variance in science literacy. Qualitative studies may be conducted to explore deeper themes related to classroom climate and science literacy, which may help identify emerging factors and develop new indicators for future quantitative research.

2. School administrators, policymakers, and teachers may collaborate to implement programs and classroom practices that promote a positive, inclusive, and collaborative learning environment, enhancing students' science literacy and addressing low literacy levels.

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