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Mediating Effect of Self-Efficacy on the Relationship Between Classroom Environment and Motivation in Learning Science

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Abstract — Low science motivation is disconcerting. The mediating effect of self-efficacy on the correlation between classroom environments and motivation in learning science among grade 11 senior high school students was determined. Using predictive research design, surveying 287 samples selected via stratified random sampling, and analyzing the data applying mediation analysis, the result showed that self-efficacy does not significantly mediate the relationship between classroom environment and motivation in learning science, although the significant direct effect of classroom environment partially supports Social Cognitive Theory. It is recommended that school leaders strengthen classroom and laboratory environments through targeted programs and resource support, while future studies explore other possible mediating variables affecting motivation in learning science.

Keywords: Mediating effect, self-efficacy, classroom environment, motivation in learning science

I. INTRODUCTION

This chapter includes the following: the problem and its scope, significance of the study, statement of the problem, hypotheses, theoretical and conceptual frameworks.

The Problem and Its Scope

Globally, low motivation in learning science among students remains a significant educational concern in contemporary science education (OECD, 2024; Potvin et al., 2025).

Similarly, research in middle school science classrooms identified a subgroup of students with below motivation, suggesting that low science motivation persists among learners in formal educational settings (Cabrera et al., 2023). Recent international evidence based on TIMSS science-learning motivation data further underscores that low science motivation remains an important issue requiring sustained educational attention across diverse contexts (Zhang et al., 2023).

In Indonesia, low motivation in learning science-related subjects continues to be observed among upper-secondary students, reflecting the persistence of weak science motivation in this context (Huda & Rohaeti, 2023). In the same way, students in Pakistan also demonstrate low motivation toward learning science, indicating that the problem is likewise present in higher education settings (Ahmad & Rana, 2023). Furthermore, in Vietnam, science motivation declines among students exhibiting lower motivation, which further highlights the continuing problem of low science motivation across different national contexts (Van Vo & Csapó, 2023).

Recent local studies indicate that Filipino learners do not consistently exhibit strong motivation across important dimensions of science learning, suggesting that low science motivation continues to characterize the learning experiences of many students (Mempin et al., 2024). Furthermore, recent studies in the country indicate that students' science motivation remains less than robust, underscoring the persistence of this problem in the Philippine educational context (Digo & Disca, 2025). Taken together, recent local studies indicate that low motivation to learn science persists among Filipino students, thereby affirming its relevance as an educational concern in the Philippine context (Nazareth & Israel, 2025; Toroba, 2025).

Empirical studies have shown that low motivation in learning science is associated with weaker academic performance and lower levels of science proficiency. In the Philippine context, motivation toward science learning was found to be significantly related to science academic performance, indicating that students with lower motivation tend to demonstrate less favorable academic outcomes in science (Mempin et al., 2024). Similarly, students' motivation was also significantly associated with science proficiency, suggesting that low motivation may

limit the attainment of expected competence in the subject (Digo & Disca, 2025). Moreover, low motivation has been linked to lower affective engagement and less favorable academic adjustment among students, thereby underscoring the serious educational consequences of low science motivation (García-Martínez et al., 2024; Ahmad & Rana, 2023).

Significance of the Study

This study is significant as it contributes globally to the growing body of research on how learning environments shape students' science motivation, offering insights that can inform international efforts to strengthen STEM education in accordance to the SDG 4 of the United Nations' Sustainable Development Goal for Quality Education. At the national level, it provides the Department of Education (DepEd) with evidence to support policy development and programs that enhance student engagement in science. In the Philippine context, this study supports the national goal of education by promoting quality, inclusive, and learner-centered science education aligned with SDG 4. It is also relevant to the mission and vision of Holy Cross of Davao College, as it reinforces the institution's commitment to providing transformative, values-oriented, and quality education that develops competent, motivated, and socially responsive learners. Finally, for future researchers, this study offers a foundation for further investigations on the interplay of learning environment, selfefficacy, and science motivation.

Statement of the Problem

This study aimed to examine the mediating effect of self-efficacy on the correlation between classroom environments and motivation in learning science among senior high school students. Specifically, to answers to the following questions:

1. To determine the levels of classroom environment of students in terms of: Student cohesiveness, teacher support, involvement, investigation, task orientation, equality; the self-efficacy in terms of: Identifying and remembering,

explaining and applying, inquiring and argumenting, and evaluating; and the motivation in learning Science in terms of intrinsic motivation, career motivation, self-determination, and grade motivation;

2. To determine significance of the relationship between classroom environment and motivation in learning motivation in learning science and self-efficacy, self-efficacy and motivation in learning science;

3. To determine the direct effect of classroom environment on motivation in learning, controlling for Self-efficacy;

4. To determine the indirect effect of classroom environment on motivation in learning science through self-efficacy;

5. To determine the total effect of classroom environment on motivation in learning science.

Hypotheses

The research hypotheses were tested at a 0.05 level of significance.

Ho_1: Classroom environment, self-efficacy, and the motivation in learning science are not correlated.

Ho_2: The direct effect of Classroom Environment on Motivation in Learning Science, controlling for self-efficacy, is not significant.

Ho_3: The indirect effect of Classroom Environment on Motivation in Learning Science through self-efficacy, is not significant.

Ho_4: The total effect of Classroom Environment on Motivation in Learning Science is not significant.

Theoretical Framework

This study is anchored on Bandura's Social Cognitive Theory (1986), which states that the reciprocal interaction among personal factors, environmental influences and behavior. According to Badura, learning happens in the social context where individuals acquire knowledge and skills through different lenses like observation, imitation and modeling. Selfefficacy is the individual belief of their capability to perform a specific task successfully.

In the study classroom environment indicated by student cohesiveness, teacher support, investigation, involvement and task orientation represents the environmental factors mentioned in the theory. The self-efficacy indicated by identifying and remember, explaining and applying, inquiring and argumenting, and evaluating stand for personal factor. Lastly, the motivation in learning science indicated by intrinsic motivation, selfdetermination, grade motivation and career motivation defines behavioral factors in the theory. Hence, this study is fully anchored on the Social Cognitive Theory of Bandura.

Conceptual Framework

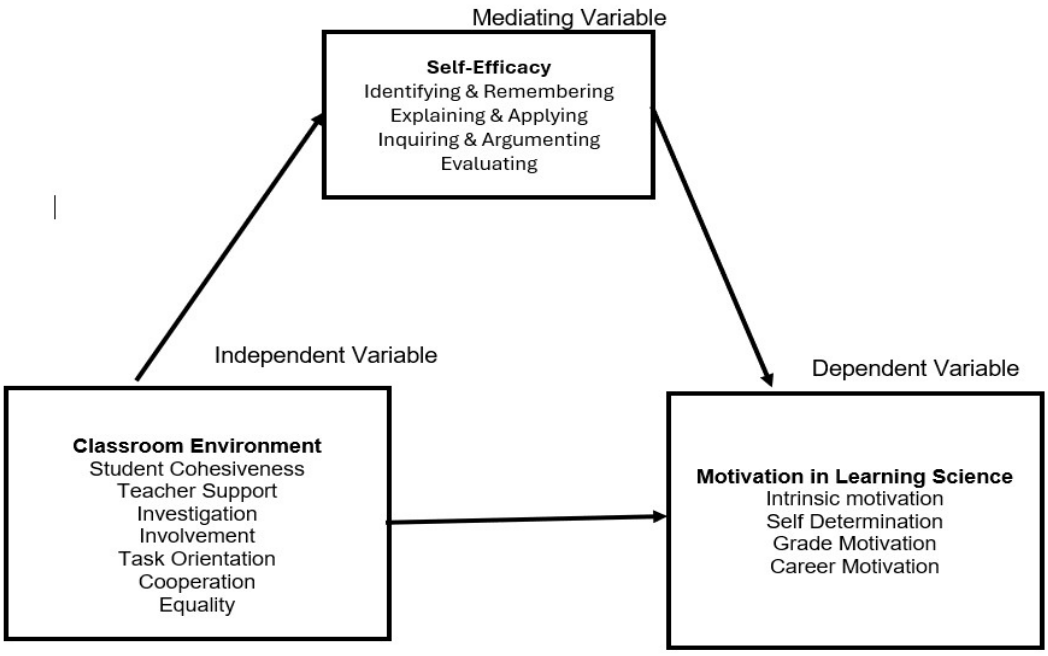

Figure 1. Conceptual Framework of the Study

II. METHODOLOGY

In this chapter the research design, local of the study, sample and sampling technique, data gathering technique, data analysis technique and ethical consideration are presented.

Research Design

A predictive research design is a quantitative approach used to forecast future outcomes based on one or more predictor variables (Efthimiou et al., 2024; Collins et al., 2024). Aparicio-Gómez et al. (2023) explained that it is used when a researcher wants to anticipate a specific result. It is advantageous because it supports early intervention and improves data-driven decision-making (Altabbaa et al., 2024). It can also handle complex patterns that may not be easily explained by traditional methods (Collins et al., 2024). However, Collins et al. (2024) emphasized that predictive studies should be properly validated to ensure fairness, accuracy, and applicability.

Local of the Study

This study will be conducted in Davao, City Philippines. Davao city has a high number of enrollees. Additionally, Espinosa (2024) reported that Davao City Division recorded 419,552 enrollees for School Year (SY) 2024-2025. This study will be conducted particularly at one school under Cluster thirteen, Division of Davao City. This school is one of the chosen schools to be a pilot school for the strengthening of senior high school. This school has a large number of learners, which makes it suitable for descriptive-correlative design. Since, this school is one the pilot schools under the strengthened senior high school, The school supports an interactive and child friendly classroom, with that it is the perfect school to conduct the study to discover the mediating effect of self-efficacy in the relationship between the science classroom environment and motivation.

Sample and Sampling Technique

The respondents of the study will be Grade 11 students, with a total population of 1,040 students from 19 Grade 11 sections. A total of 287 students will participate in the study, and all students may be included regardless of sex. To qualify, respondents must be officially enrolled in School Year 2025–2026, 16–17 years old, and currently taking General Science as one of their core subjects. Students will be excluded if they are outside the required age bracket, absent during data collection, not enrolled in General Science, or fail to complete the survey instrument in its entirety.

The study will use proportionate stratified sampling to ensure fair representation from the 19 Grade 11 sections. In this method, students will be grouped by section, and a proportionate number of respondents will be selected from each group. The total sample of 287 students will be determined using Slovin's formula (Nurkholis et al., 2024).

Data Gathering Technique

In this study as survey questionnaire was used as a data gathering technique. A survey/questionnaire is a structured set of written questions used to gather information from respondents about their attitudes, behaviors, perceptions, or experiences (Xiaoli, 2024; Koo & Yang, 2025). It is commonly used when a researcher needs standardized data from many participants, especially in descriptive or quantitative studies (Maheshwer, 2023; Tombs & Strange, 2024). Its advantages include being cost-effective, time-efficient, easy to administer to large groups, and useful for collecting consistent data that are easier to analyze (Koo & Yang, 2025; Tombs & Strange, 2024).

There are three questionnaires used in this study. The first was drawn from the questionnaire made by Sharma in (2021) about the classroom environment containing 56 items, it has a Cronbach's α of 0.933. Secondly, the self-efficacy as defined by Hu, et al in (2022) about the self-efficacy that has 24 items, and the Cronbach's α of 0.914. Lastly, the motivation

in learning science was proposed by Glynn, et al (2011) with 19 items with Cronbach's α of 0.888.

Data Analysis Technique

In this study there are three data analysis techniques used namely, descriptive analysis, correlation analysis and mediating analyses.

Descriptive analysis is a statistical method used to summarize and present the main features of a dataset through measures such as frequencies, percentages, means, and standard deviations (Starbuck, 2023; Fabricant, 2024). It is commonly used when the researcher aims to describe and organize data clearly before conducting more advanced statistical analysis (Fabricant, 2024; Kim et al., 2024). Its advantages include helping researchers identify patterns and trends, simplifying large amounts of data, and making results easier to interpret and present (Starbuck, 2023; Kim et al., 2024). In this study it uses the mean and the standard deviation.

Correlation analysis is a statistical method used to determine the strength and direction of the relationship between two variables (Yang, 2024; Prasad, 2023). It is used when the researcher aims to examine whether variables are significantly associated without implying causation (Yang, 2024). As noted by Okoye and Hosseini (2024), its advantages include identifying patterns in data and providing a basis for further statistical analysis. It is also simple to apply and interpret, making it useful in quantitative research (Prasad, 2023). In this study it uses the pearson R.

Mediation analysis is a statistical method used to explain how an independent variable influences a dependent variable through a mediator, helping identify indirect effects and underlying mechanisms between variables (Andrew F. Hayes, 2021; Schuler et al., 2024). It is used when a researcher wants to determine whether the effect of one variable on another occurs through a third variable, making it useful for examining causal pathways and explaining how relationships occur (Hayes, 2021). It also provides advantages such as clarifying complex relationships, strengthening the interpretation of results, and improving the explanatory power

of quantitative research by identifying underlying processes (Kim et al., 2024; Schuler et al., 2024). In this study it uses the path analysis and the direction. In the following is the table used in interpreting the data gathered.

Scale	Level	Classroom Environment	Self-Efficacy	Motivation in Learning Science
1.00-1.74	Very low	Very poor	Very poor	Very poor
1.75-2.49	Low	Poor	Poor	Poor
2.50-3.74	High	Good	Good	Good
3.75-4.00	Very High	Very Good	Very good	Very good

The following is the Standard Deviation Value 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

In this study, the significance of the correlation is tested at 0.05 confidence level. The following is the standard measure 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
0.00	No correlation

The standard measure for the interpretation of the strength of the mediation is as follows:

Proportion Mediated	*Interpretation*
< 0.20	Weak Mediation
0.20 – 0.50	Moderate Mediation
> 0.50	Strong Mediation

Ethical Consideration

This study adhered to the ethical standards for educational research and was reviewed and approved by the Holy Cross of Davao College – Society for Moral Integrity and Legal Ethics (HCDC-SMILE). The researcher informed the participants of the purpose, scope, and procedures of the study, and participation was entirely voluntary. Since the respondents were minors, student assent and parental consent were secured prior to data collection. Participants were also given the right to withdraw at any time without penalty or coercion. Moreover, confidentiality and anonymity were strictly maintained, and all data gathered were used solely for academic purposes.

III. RESULTS

Included in this chapter are the descriptive, correlation, and mediation tabular presentation, and the corresponding analysis and interpretation of the statistical results. Presented also in this chapter is the summary of findings.

Descriptive Results

Table 1 is descriptive table. It includes the variables namely, classroom environment, self-efficacy, and motivation in learning science. It also includes the # of sample, mean, SD and corresponding descriptive level.

The table specifically shows that the Classroom Environment variable obtained a mean of 3.25 described as high. It indicates that classroom environment of the respondents is good. The SD of 0.16 is describe as highly consisting response indicating that the respondents have strong and uniform perception. The three indicator has a descriptive level of very high and the other three is high. It also shows the Self-efficacy variable and it has a mean of 3.13 described as high. This indicates that the self-efficacy of the respondents is good. With the SD of 0.23

this indicate that there is highly consistent response that shows that the respondents have strong and uniform perception. All the indicators have high descriptive level. Lastly, the motivation in learning science. The mean is 3.33 with the corresponding descriptive level of very high, this indicate that the motivation in learning science of the respondent is very good. With the SD of 0.23 this indicate that there is a high consistent response of the respondents indicating the strong and uniform perception.

TABLE 1
DESCRIPTIVE STATISTICS (N = 287)

Variables	Mean	Standard Deviation	Descriptive Level
Classroom Environment	**3.25**	**0.16**	**High**
Student Cohesiveness *3.31* *0.27* *Very High* *Teacher Support* *3.26* *0.30* *Very High*			
Involvement	*3.24*	*0.27*	*High*
Investigation	*3.22*	*0.27*	*High*
Task Orientation	*3.26*	*0.25*	*Very High*
Cooperation	*3.25*	*0.28*	*High*
Equality	*3.25*	*0.27*	*High*
Self-efficacy	**3.13**	**0.23**	***High***
Identify and Remembering	*3.15*	*0.29*	*High*
Explain and Applying	*3.14*	*0.33*	*High*
Inquiring & Argument	*3.12*	*0.35*	*High*
Innovative Design	*3.10*	*0.35*	*High*
Motivation in learning Science	**3.33**	**0.23**	***Very High***
Intrinsic Motivation	*3.32*	*0.33*	*Very High*
Career Motivation	*3.32*	*0.33*	*Very High*
Self-determination	*3.33*	*0.36*	*Very High*
Grade Motivation	*3.35*	*0.33*	*Very High*

The findings revealed that among the three variables, motivation in learning science obtained the highest descriptive interpretation, indicating that it was the most evident among the respondents. Classroom environment and self-efficacy were also interpreted positively, although classroom environment appeared slightly more favorable than selfefficacy. Overall, the results suggest that all variables were manifested at favorable levels, with motivation in learning science emerging as the strongest variable.

Correlation Analysis

Table 2 is the correlation table. It contains the determinant, mediator and criterion variables. It also in includes the r .

TABLE 2
CORRELATION TABLE (N=287)

	Motivation in Learning Science			
Variables	r-value	p-value	Decision on *H*0	Interpretation
Classroom Environment	0.356	<0.001	Reject *H*0	Significant
Self-efficacy	0.151	0.010	Reject *H*0	Significant

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

The correlation between Classroom Environment and Motivation in Learning Science obtained a p-value of 0.0001 which is less than 0.05 the degree of confidence, hence the null

hypothesis was rejected. It indicates that the Classroom Environment and Motivation in Learning Science is significant. The r-value is 0.356 indicates that the Classroom Environment and Motivation in Learning Science has moderately low correlation. It also shows the correlation between Self-efficacy and Motivation in Learning Science has a p-value of 0.010 which is less than 0.05 degree of confidence, therefore the null hypothesis was rejected. It means that the Self-efficacy and Motivation in Learning Science is significant. With the r-value of 0.151 this indicates that Self-efficacy and Motivation in Learning Science has low correlation.

Classroom Environment showed a stronger positive relationship with Motivation in Learning Science than Self-efficacy did. While both relationships were significant,

Classroom Environment had a moderately low correlation, whereas Self-efficacy had only a low correlation.

Mediation Results

Table 3 presents mediating table. The table includes several columns: Predictor, Estimate, Standard Estimate, SE (Standard Error), t (t-value), p (p-value), and Decision on null hypothesis.

The table shows the direct effect of Classroom Environment on Motivation in Learning in Science controlling for Self-efficacy obtained an estimate beta of 0.51. With the p -value of 0.001, which is less than 0.05 the degree of confidence, hence the null hypothesis was rejected. This indicate that the direct effect of Classroom Environment on Motivation in Learning in Science controlling for Self-efficacy is significant. Moreover, the indirect effect of Classroom Environment on Motivation in Learning Science through Self-efficacy obtained an estimate beta of 3.20. With a p value of 0.995, which is greater than 0.05 the degree of confidence, hence the null hypothesis was rejected. This shows that the indirect effect of Classroom Environment on Motivation in Learning Science through Self-efficacy is not significant. Lastly, the total effect of Classroom Environment on Motivation in Learning Science obtained an estimate beta of 0.51. The p value is

0.001 which is less than 0.05 the degree of confidence hence the null hypothesis was accepted. It indicates that the direct effect of Classroom Environment to Motivation in Learning Science is significant.

TABLE 3
MEDIATION TABLE (N = 287)

Label	Path / Effect	Estimate (B)	SE	Z-value	p-value	Decision on H_0	Interpretation
A	Classroom Environment → Self-efficacy	0.618	0.08	6.90	<0.001	Reject H_0	Significant
B	Self-efficacy → Motivation in Learning Science	5.227	0.07	0.01	0.994	Failed to Reject H_0	Not Significant
c’	Science Classroom Environment → Motivation in Learning Science (Direct Effect)	0.511	0.11	4.78	<.001	Reject H_0	Significant
a × b	Indirect Effect (Mediation)	3.204	0.04	0.01	0.995	Failed to Reject H_0	Not Significant
c (Total Effect)	Classroom Environment→ Motivation in Learning Science (Total)	0.511	0.08	5.80	<0.001	Reject H_0	Significant

Level of Significance: 0.05
Decision Rule: Reject H_0 if $p < 0.05$
% Mediation: Direct – 99.94%; Indirect – 0.06%

Classroom Environment had a meaningful influence on Motivation in Learning Science even when Self-efficacy was taken into account. In contrast, Self-efficacy did not explain how or why Classroom Environment affected Motivation in Learning Science.

Overall, the findings suggest that Classroom Environment influences Motivation in Learning Science more directly than through Self-efficacy.

Summary of Findings

1. Classroom Environment and self-efficacy are high, while motivation in learning science is very high.

2. Both science classroom environment and self-efficacy have **statistically significant but low positive correlations** with motivation in learning.

3. The direct effect of classroom environment on motivation in learning science controlling for self-efficacy is significant.

4. The indirect effect if classroom environment on motivation in learning science through Self-efficacy is not significant.

5. The total effect of classroom environment on motivation in leaning science is significant.

IV. DISCUSSIONS

Discussed in this chapter are the correlation and mediation analysis results of the study. The discussions highlight what previous assertions are either supported or denied by these findings. Included here as well are the conclusion based on the findings, and the recommendations based on the conclusion.

Discussion for the Correlation Results

The study found a significant positive relationship between the science classroom environment and science motivation, suggesting that a supportive, safe, and collaborative classroom can enhance student motivation. Parallel with Mindo and Paglinawan (2025) also found that a positive classroom environment—encompassing physical, pedagogical, and psychosocial factors—was significantly correlated with increased student motivation in science. This aligns with Held and Mori (2024), who demonstrated that environments providing psychological safety and support are linked to higher motivation. Congruent with Mammadov and Schroeder (2023) emphasize that autonomy-supportive classrooms are consistently associated with favorable motivational outcomes. However, some studies suggest that this relationship may not always be direct. This supports the study of Haji Vosoogh et al. (2021) found that when self-efficacy was included in the model, classroom climate was not a strong predictor of motivation, indicating that psychological factors may play a more central role. Additionally, this reinforces Wang et al. (2020) noted that the impact of classroom climate on academic outcomes varies across different contexts.

Regarding self-efficacy, it was found to have a weak but significant relationship with science motivation. While self-efficacy does contribute to motivation, it does not exert a strong independent influence. Corresponding with this supports Basileo et al. (2024) that found a strong relationship between academic self-efficacy and motivation, with increased self-efficacy linked to higher motivation levels in academic settings. Research by Yang et al. (2020) suggests that self-efficacy is most effective when paired with a supportive classroom environment. Moreover, in line with Li and Singh (2022) and Whitcomb et al. (2022) propose that self-efficacy plays a crucial role in motivating students, particularly in STEM contexts, where it correlates with other factors like interest and recognition. However, Li et al. (2024) suggest that academic achievement may be a stronger predictor of both self-efficacy and motivation, indicating that the influence of self-efficacy is context-dependent.

Discussions on the Mediating Effect

The results indicated that academic self-efficacy did not significantly mediate the relationship between classroom environment and science motivation. Although self-efficacy was positively correlated with science motivation, the indirect effect was not statistically significant, suggesting that classroom environment may influence students' motivation through more direct mechanisms. This finding suggests that while students who feel more capable tend to report higher motivation, the influence of the classroom environment on motivation may operate independently of students' efficacy beliefs. In other words, classroom conditions themselves may be sufficiently powerful to shape motivational outcomes without necessarily passing through self-efficacy as an intermediary variable.

This suggests that classroom conditions may have a more immediate impact on students' motivation than their self-beliefs. Congruent with Alesi et al. (2024) confirmed the positive link between self-efficacy and motivation, but the current study indicates that factors like classroom interactions play a more direct role. Parallel with the study of Neroni et al. (2022) found similar results, where the science classroom environment had a significant direct effect on motivation, but self-efficacy did not mediate this relationship. This confirms with Kupers et al. (2023) emphasized that teacher support can directly enhance intrinsic motivation, underscoring the importance of classroom dynamics. Likewise, Kuchynka et al. (2021) found that while self-efficacy influences motivation, active learning and a supportive environment significantly contribute to engagement and persistence. This aligns with the current study, suggesting that the direct pathway from the classroom environment to motivation accounts for more variance than the mediation effect of selfefficacy.

Bureau et al. (2021) proposed that the classroom environment may directly influence motivation, reducing the need for self-efficacy as a mediator. In support of Lera et al. (2022) similarly found that self-efficacy did not mediate the relationship between classroom environment and motivation. This supports this view, noting that bidirectional relationships exist between self-efficacy and motivation, and simple mediation models may not fully capture their complexity (Liu, 2024). Bandura's Social Cognitive Theory suggests that selfefficacy

interacts with environmental factors rather than serving solely as a mediator. Thus, self-efficacy should be viewed as a complementary factor rather than the primary mediator.

While some studies (e.g., Wang et al., 2024) show that self-efficacy partially mediates other relationships, this study suggests that external classroom support has a more immediate impact on science motivation. Supports the findings of Valenzuela-Peñuñuri et al. (2024) found that motivation was influenced more by external support than self-belief alone, reinforcing the need for supportive classroom environments. While self-efficacy remains important, this study highlights the necessity of fostering classroom conditions that actively promote motivation, regardless of students' initial self-efficacy levels.

Conclusion

Based on the findings of the study, it was concluded that self-efficacy does not significantly mediate the correlation between classroom environments and motivation in learning science. However, since the classroom environment has a significant direct on the criterion, the theory of Social Cognitive Theory positing that the reciprocal interaction among personal factors, environmental influences and behavior, is partially affirmed.

Recommendations

Based on the conclusions it is recommended that school leaders may initiate programs and activities that help improve the teachers' classroom and laboratory environments. School resources maybe reallocated and refocused to classroom management to support the enhancement of motivation in learning science. Further study may be conducted utilizing other variables not covered in the study as a mediator on the correlation between classroom environment and motivation in learning science.

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