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The Mediating Effect of Inquiry-Based Learning on The Relationship Between Attitude Towards Science and Student Motivation

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Abstract — This study examined the mediating effect of inquiry-based learning on the relationship between attitude toward science and student motivation among Grade 11 STEM students in a private senior high school in Davao City. The study aimed to determine the levels of inquiry-based learning, attitude toward science, and student motivation, and to assess the relationships among these variables. A quantitative non-experimental descriptive–correlational research design with mediation analysis was employed. A total of 216 students were selected through stratified random sampling and responded to validated survey questionnaires. The results showed that inquiry-based learning, attitude toward science, and student motivation were all at high levels and were significantly correlated. Mediation analysis revealed that inquiry-based learning partially mediated the relationship between attitude toward science and student motivation, accounting for 33.2% of the total effect. The study concludes that inquiry-based learning strengthens the influence of positive attitudes toward science on student motivation, and it is recommended that educators integrate structured inquiry-based strategies to enhance students' motivation and engagement in science learning.

Keywords: Attitude towards science, correlation, mediating effect of inquiry-based learning, science, technology, egineering, and mathematics (STEM), stratified random sampling, senior high school, student motivation.

I. INTRODUCTION

Motivation is now a global concern. Studies show that low motivation often leads to academic failure in many educational settings. Poor motivation is common among students of different ages, locations, and educational levels (Mauliya & Relianisa, 2020). These deficits primarily reduce student engagement.

In India, a study found that motivation to learn science was influenced by teaching methods and resource availability (Spandana et al., 2020). In China, exam-driven practices make science learning difficult and limit meaningful engagement, leading to low student motivation to study science (Zuo et al., 2021). In Tanzania, research identifies one main contextual barrier to student motivation in secondary education (Mkimbili & Odegaard, 2019).

Motivation to learn science is still a major problem in the Philippines. PISA results place the Philippines near the bottom in science proficiency. The study shows low participation and motivation among Filipino learners (Trinidad, 2020). Recent local studies found that problems in the science curriculum and weak motivation hinder students' interest (Sumardani, 2021). Other studies highlighting low-performing Filipino students found that a persistent lack of motivation to learn science underscores the need for swift action.

Most studies on attitudes towards science, student motivation, and inquiry-based learning have used qualitative methods, including Mao et al. (2021), Maming et al. (2023b), Attard et al. (2021), and others; thus, this presents a methodological gap. To help fill this gap, this study used a quantitative approach. Addressing students' low motivation to learn science is crucial, as it has been identified as a key factor influencing attitudes towards science (Banjal, 2024).

This study may help achieve Sustainable Development Goal 4, which calls for inclusive and equitable quality education and supports lifelong learning (Kim et al., 2020). For the Department of Education, the findings may support the development of learner-centered science instruction that promotes critical thinking and problem solving. These findings will generate scientific-based information for administrators to create possible programs and policies that support inquiry-based learning. For teachers, the study offers evidential rationale for a common understanding of inquiry-based learning on the relationship between attitude towards science and

student motivation. For students, this research is significant as it demonstrates how inquiry-based learning can create a more engaging and effective science learning experience. Finally, for future researchers it offers further investigation to study inquiry-based learning as it pertains to attitude towards science and student motivation in science education.

This study aims to determine how inquiry-based learning mediated the link between attitude towards science and student motivation. Specifically, this study aimed to determine the level of inquiry-based learning in terms of students' prior knowledge activation, students class engagement, student centered environment creation, and cultivation of the 21st century skills; level of attitude towards science in terms of enjoyment and confidence, student in learning, participation in science learning activity and value of science; and level of student motivation in terms of intrinsic motivation, career motivation, self-determination, self-efficacy, and grade motivation of students, determine the significance of the relationship between inquiry-based learning, attitude towards science, and student motivation, determine the significance of the mediating effect of inquiry-based learning on the relationship between attitude towards science and student motivation.

This study was anchored in Social Cognitive Theory (Bandura, 1986), further developed by researchers such as Pajares and Schunk (2001) and Pintrich (2003), to provide a framework for understanding student motivation. Social cognitive theory (SCT) emphasizes the dynamic interaction between personal, behavioral, and environmental factors in learning (Luszczynska & Schwarzer, 2015). Bandura's (1986) social cognitive theory considers the student's attitude towards science as a personal factor which influences the student's cognition, emotions, and reactions towards the educational experiences. Motivation is considered a behavioral factor that influences students' actions and efforts in the learning process. The inquiry-based learning method is an environmental factor that determines the learning context, and it is also providing opportunities that interact with personal attitudes and behaviors. In summary, SCT provides a valuable understanding of how inquiry-based learning in environmental factors contributes to developing motivation, and attitudes toward science through the reciprocal relationship between personal, behavioral, and environmental factors.

II. METHODOLOGY

This research used a non-experimental, descriptive-correlational, quantitative design using mediation analysis to explore the relationship of the independent variable, dependent variable and the mediating variable. The non-experimental design deals with observation without any intervention or manipulation applied (Nwabuko et al., 2024). The descriptive quantitative research was used to systematically capture and analyze statistical data that reveal the prevailing characteristics of the target population (Thomas and Zubkov, 2023). Correlational research was used to investigate the strength and direction of relationships between phenomena without any attempts of manipulation (Bhandari, 2021). Mediation analysis was used to assess whether inquiry-based learning accounts for the underlying mechanism by which attitude towards science relates to motivation using the mediation model of indirect effects (Jung, 2021). Further, practical steps for the mediation of indirect effects in applied research will be described (Rijnhart et al., 2021), thus giving a comprehensive system to measure and analyze the mediating effects of inquiry-based learning.

This study was conducted at the private senior high school located in Davao City, Philippines, that offers academic tracks specifically Science, Technology, Engineering, and Mathematics (STEM) strand. The selected locale was appropriate since the senior high school STEM students represent a broad range of educational strands and different learning environments, which makes the school a fruitful site for studying the relationships among the selected variables. In addition, the school was well known for its academic excellence and holistic development of learners, which makes it appropriate for studying issues of the attitude towards science, inquiry-based learning, and student motivation.

The participants for this study were 216 out of 489 Grade 11 senior high school students who were enrolled in the STEM strand during the school year 2025-2026, in the private senior high school in Davao City. The researcher uses Raosoft calculator in choosing the sample size. Stratified random sampling was utilized to randomly select participants to ensure sub-group from shared characteristics (Makwana et al., 2023). The following were the requirements for inclusion: (1) only students who are formally enrolled in the STEM strand during the 2025–2026 academic year, (2) between the ages of 16 and 19, and (3) only students who provided consent and assent

forms will be included to participate. The following are the requirements for exclusion: (1) students who are enrolled in other academic programs, (2) students who are absent during the data collecting time, and (3) students who do not complete the survey in its entirety will be excluded from the study

The researcher used a survey questionnaire adapted from the three variables anchored with the Social Cognitive Theory (Bandura, 1986). The researcher adapted an instrument made by Wicaksono and Korom (2023). The researcher utilized twenty-six (26) out of twenty-seven (27) questions and four (4) domains with a Cronbach Alpha of 0.941. Moreover, to assess the respondents' motivation, an adapted instrument of The Science Motivation Questionnaire II by Glynn et al., (2011) the researcher used twenty-four (24) out of twenty-five (25) questions and five (5) domains with a Cronbach Alpha of 0.921. Lastly, the researcher adapted the questionnaire to assess the respondents' inquiry-based learning by Rohmah and Suriani (2024). The questionnaire comprised 15 declarative statements across four (4) domains with a Cronbach Alpha of 0.866.

The 4-point Likert scale was used in the questionnaire given to the respondents, with indicated values to determine the overall responses of the respondents on various parameters.

Scale	Level	Interpretation for Attitude Towards Science	Interpretation for Student Motivation	Interpretation for Inquiry-Based Learning
3.26 – 4.00	Very High	This means that the students' attitude towards science is excellent.	This means that the students' motivation is excellent.	This means that the students' inquiry-based learning is excellent.
2.50 – 3.25	High	This means that the students' attitude towards science is good	This means that the students' motivation is good.	This means that the students' inquiry-based learning is good.
1.75 – 2.49	Low	This means that the students' attitude towards science is poor.	This means that the students' motivation is poor.	This means that the students' inquiry-based learning is poor.
1.00 – 1.74	Very Low	This means that the students' attitude towards science is very poor.	This means that the students' motivation is very poor.	This means that the students' inquiry-based learning is very poor.

For the interpretation scale of R-value, the following scheme was 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

The correlation interpretation scale used in this study was a commonly used descriptive guide for interpreting Pearson's r-values.

The researcher ensured to follow a strict code of ethics throughout the process of dealing with senior high school students. Before commencing data collection, the researcher obtained informed consent and assent forms to the participant, which meant that they were taking part in the study voluntarily and that their answers would remain confidential. Moreover, the researcher ensured that the tools they were taking to use for the research were validated and were reliable to provide accurate and trustworthy results. The Department of Education grant the permission formally to the researcher to implement the study within the private senior high schools under its jurisdiction. The research proposal was reviewed and approved by the Society of Moral Integrity and Legal Ethics (SMILE) so that the researcher would be allowed to work in compliance with the ethical, legal, and moral principles of research.

III. RESULTS AND DISCUSSION

Table 1 presents the results and analyses on the level of inquiry-based learning, attitude towards science, and student motivation. It also includes the number of respondents (N), standard deviations, mean and descriptive level.

TABLE 1
DESCRIPTIVE STATISTICS (N=216)

Variables	N	Standard Deviation	Mean	Descriptive Level
Attitude Towards Science	**216**	**0.42**	**3.11**	**High**
Enjoyment and Confidence		0.62	3.02	High
Ease in Learning		0.50	3.04	High
Participation in Science Learning Activity		0.53	2.99	High
Value of Science		0.48	3.40	Very High
Inquiry-Based Learning		**0.37**	**3.11**	**High**
Student Prior Knowledge Activation		0.49	3.22	High
Students' Class Engagement		0.50	3.20	High
Student Centered Environment Creation		0.48	2.99	High
Cultivation on the 21st Century Skills		0.44	3.02	High
Student Motivation		**0.42**	**3.09**	**High**
Intrinsic Motivation		0.52	3.19	High
Career Motivation		0.50	3.13	High
Self-determination		0.56	3.03	High
Self-efficacy		0.57	2.88	High
Grade Motivation		0.62	3.22	High

3.26-4.00 Very High, 2.50-3.25 High, 1.75-2.49 Low, 1.00-1.74

Specifically, Table 1 shows that the attitude towards science variable had a mean score of 3.11 (SD=0.42), indicating a high level of attitude towards science. It indicates that the students' attitude towards science is good. The single indicator, the value of science, had a mean score described as very high, whereas the rest were rated at a high level.

Furthermore, the inquiry-based learning variable had an overall mean of 3.11 (SD=0.37), indicating a high level of inquiry-based learning. It indicates that the students' inquiry-based learning among senior high school grade eleven (11) STEM students is good. All its indicators of this variable also obtained respective means, which were classified as high levels.

Lastly, the student motivation variable had an overall mean of 3.09 (SD=0.42), indicating a high level of motivation. It indicates that the student motivation is strong. All indicators of this variable also obtained respected means, which were categorized as high levels.

Table 2 is the correlational results between attitude towards science and inquiry-based learning predictive variables and Student Motivation criterion variable.

TABLE 2
CORRELATION TABLE (N=216)

Variables	Student Motivation			
	r-value	p-value	Decision on H_0	Interpretation
Attitude Towards Science	0.73	<0.001	Reject H_0	Moderately High, Significant
Inquiry-Based Learning	0.68	<0.001	Reject H_0	Moderately High, Significant

Level of Significance: 0.05
Decision Rule: Reject H_0 if $p < 0.05$

Table 2 shows that the correlation between attitude towards science and student motivation yielded a p-value of 0.001, which is less than the 0.05 level of significance. Hence, the null hypothesis was rejected. This indicates a statistically significant correlation. With an r-value of 0.73, this correlation is considered moderately high. This implies that when attitude towards science increases, motivation also increases. Moreover, the correlation between inquiry-based learning and student motivation yielded a p-value of 0.001, which is less than the 0.05 level of significance. Hence, the null hypothesis was rejected. This indicates a statistically significant correlation. With an r-value of 0.68, this correlation is considered moderately high. This implies that when inquiry-based learning increases, their motivation also increases.

These findings implied that both attitude towards science and inquiry-based learning were important factors associated with students' motivation. This suggested that strengthening positive attitude towards science and integrating inquiry-based learning could support improvements in students' motivation in science learning.

Table 3 is a mediation table. It contains the number of samples, the determinant, the mediator, and the criterion variable. It also contains the direct, indirect, and total effect of the stress variable on the mediator. Finally, it contains the estimated beta, standard error, Z-value, p-value, decision on the null hypothesis, and corresponding interpretation.

TABLE 3
MEDIATION TABLE (N = 216)

Label	Path / Effect	Estimate (B)	SE	Z-Value	p-value	Decision on H_0	Interpretation
A	Attitude Towards Science → Inquiry-Based Learning	0.60	0.06	10.19	<0.001	Reject H_0	Significant
B	Inquiry-Based Learning → Student Motivation	0.39	0.09	4.06	<0.001	Reject H_0	Significant
c'	Attitude Towards Science → Student Motivation	0.48	0.09	4.90	<.001	Reject H_0	Significant
a × b	Indirect Effect (Mediation)	0.24	0.05	4.54	<.001	Reject H_0	Significant
c (Total Effect)	Attitude Towards Science → Student Motivation (Total)	0.72	0.08	9.44	<0.001	Reject H_0	Significant

Level of Significance: 0.05
Decision Rule: Reject H_0 if $p < 0.05$
% Mediation: Indirect – 33.2%; Direct – 66.8%

Table 3 specifically shows that the direct effect of attitude towards science on student motivation, controlling for inquiry-based learning, yielded an estimate beta of 0.48, with a corresponding p-value of .001, which is less than the 0.05 level of significance. Hence, the null hypothesis was rejected. It indicates that the direct effect of attitude towards science on student motivation, controlling for inquiry-based learning, is significant. Likewise, the indirect effect of attitude towards science on student motivation, via inquiry-based learning, was estimate beta at 0.24 ($p = 0.001$), which exceeds the 0.05 level of significance. Thus, the null hypothesis was accepted. It indicates that the indirect effect of attitude towards science on student motivation, through the mediator, is significant. Lastly, the total effect of attitude towards science on student motivation was estimate beta at 0.72. The corresponding p-value of 0.001 is below the 0.05 level of significance; therefore, the null hypothesis was rejected. This indicates that the total effect of attitude towards science is significant. The table specifies the mediated proportion of 0.333, indicating that the strength of inquiry-based learning in mediating the correlation between attitude towards science and student

motivation is moderate. Since the direct effect of attitude towards science is significant when controlling for inquiry-based learning. These results demonstrated partial mediation: students with positive science attitudes experienced greater motivation, and inquiry-based learning activities further strengthened this effect.

IV. SUMMARY OF FINDINGS

The findings of this study, which show that inquiry-based learning and attitude towards science significantly correlate with student motivation, support the findings of Dah et al. (2024), who found that inquiry-based methods greatly increased student motivation and attitude towards science. Moreover, the current finding affirms Kotsis (2024) claim that inquiry-based learning improves students' motivation to learn and builds their scientific thinking and problem-solving skills. These findings strengthen their positive attitude towards learning.

However, the current finding contrasts with that of Teplá and Distler (2025), who found that inquiry-based science education led to decreased motivation to learn and increased stress during classes. The study by Teplá and Distler had 62 respondents, whereas the current study had 216 samples.

The findings of this study indicate that inquiry-based learning is significant, though it partially mediates the relationship between attitude toward science and student motivation. The result suggests that inquiry-based learning explains part of the relationship between attitude toward science and student motivation, while other factors also influence motivation. The present result supports the study of Ganajová et al. (2025), which reported a positive relationship between inquiry-based learning, student motivation, and attitude toward science. In addition, the current study builds on the findings of Meulenbroeks et al. (2023), who found that when students engaged in inquiry-based learning, their motivation and attitude towards science improved significantly.

Conversely, the present study findings oppose those of Zhang et al. (2024), who stated that motivation depends on various contextual factors to exert its effects, suggesting that attitude may not predict motivation without considering all learning contexts.

V. CONCLUSION

Based on the results obtained from the study, concludes that inquiry-based learning partially mediates the relationship of attitude towards science and student motivation. Specifically, 33.2% of this relationship is mediated by inquiry-based learning. Inquiry-based learning also has a significant mediating effect on the relationship between attitude towards science and student motivation, which reveals that students' positive attitude further enhances their motivation through the implementation of inquiry-based learning approaches. The result affirms Social Cognitive Theory, which explains learning as an interaction among personal, behavioral, and environmental factors.

VI. RECOMMENDATION

Based on the conclusion, further studies may examine other variables that could mediate the relationship between attitude towards science and student motivation.

Future researchers may replicate this study by including additional variables to explain the remaining 66.8% direct effect. Qualitative studies may also be conducted to explore students lived experiences in inquiry-based science classrooms which will reveal deeper insights and emerging themes that can help identify other significant factors influencing motivation and attitudes.

Furthermore, future researchers may conduct an exploratory study to generate relevant themes that could serve as potential variables. The emerging subthemes may act as corresponding indicators which support student-centered instructional innovations that meet international educational standards which include Sustainable Development Goal 4 (Quality Education).

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