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Mediating Role of Student Curiosity Character on The Correlation Between Attitudes Towards Science and Engagement In Scientific Learning

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Abstract — This study aimed to determine the mediating role of student curiosity character on the relationship between attitudes toward science and engagement among Grade 11 students in Davao Occidental. Specifically, it sought to assess the levels of attitudes toward science, student curiosity character, and engagement; examine the relationships among these variables; determine their influence on engagement; and test whether student curiosity character significantly mediates the relationship between attitudes toward science and engagement. Using a quantitative predictive research design with mediation analysis, data were collected from 200 students selected through stratified random sampling. The findings revealed that attitudes toward science and student curiosity character were both at a high level, while engagement was at a very high level. Results further showed that there were significant relationships between attitudes toward science and engagement, between attitudes toward science and student curiosity character, and between student curiosity character and engagement. Moreover, student attitudes toward science demonstrated a stronger relationship with engagement compared to student curiosity character. These findings highlight that although curiosity plays a meaningful role in enhancing engagement, student attitudes toward science remain the primary determinant. Thus, fostering both positive attitudes and curiosity is essential in promoting higher levels of student engagement in science learning.

Keywords: Mediating effect of student curiosity character, correlation between attitides towards science and engagement

I. INTRODUCTION

Student engagement in science is increasingly recognized as a critical factor influencing learning outcomes and academic success. However, low levels of student engagement continue to challenge educators worldwide, as disengaged learners are less likely to actively participate, sustain attention, and develop a deeper understanding of scientific concepts (Mao et al., 2021; Logan, 2023).

Across different countries, declining science engagement has become evident. In Africa, students report feelings of boredom and disconnection from science learning activities (Hadzigeorgiou & Schulz, 2022). In Southeast Asia, learners demonstrate low enthusiasm and participation during science classes, indicating disengagement (Astalini et al., 2021). Similarly, in Bahrain, students perceive science as difficult and unappealing, leading to reduced classroom involvement (Weng et al., 2024). These global trends highlight a persistent issue where students fail to actively engage in science learning.

In the Philippines, the Department of Education has acknowledged the issue of low student engagement in science (Palines & Dela Cruz, 2021). In Davao Occidental, observations reveal that many senior high school students exhibit passive participation, minimal curiosity, and low motivation during science lessons. Such disengagement limits meaningful learning and affects students' ability to relate science to real-life contexts.

Despite curriculum improvements and contextualized teaching approaches, student engagement remains low (Fredricks et al., 2019). While previous studies have established that attitudes toward science influence engagement, the role of student curiosity character as a mediating variable remains underexplored, particularly in the local context. This gap underscores the need to investigate how curiosity can explain the relationship between attitudes and engagement. Thus, this research is pursued.

By promoting meaningful and engaging science learning experiences, the study contributes to the attainment of Sustainable Development Goal 4 (Quality Education). It provides valuable insights for the Department of Education in strengthening programs that enhance student engagement in science, supports teachers in fostering curiosity-driven instruction, and highlights the importance of nurturing students' natural curiosity to transform passive learners into active

participants. Ultimately, it enhances students' motivation, attitudes, and academic performance, fostering lifelong learners who appreciate the relevance of science in real-life situations.

This study was aimed at determining the significance of the mediating effect of student curiosity character on the correlation between attitudes towards science and engagement. Specifically, it aims to determine: the levels of feeling student attitudes towards science in terms of science enjoyment, science confidence, and science importance; student curiosity character in terms of pay attention, take notes, asking and comparing; and student science engagement in terms of engagement in science lessons and tasks, science learning involvement, science effort and preparation, the significance of the correlation between student attitudes towards science, and student curiosity character, and of the student science engagement, the significance of the direct effect of student attitudes towards on student science engagement while controlling for student curiosity character, the significance of the indirect effect of student attitudes towards science on student science engagement through student curiosity character and the significance of the total effect of student attitudes towards science on student science engagement. This study was based on the Social Cognitive Theory by Alber Bandura in 1986.

II. METHODOLOGY

The study employed a predictive research design, which is ideal for examining the direct and indirect relationships among variables without manipulating the data. Predictive research design focuses on forecasting future outcomes using existing data and statistical relationships among variables. It is applied when sufficient data are available to predict trends, such as in education, health, and social sciences. Its key advantages include supporting data-driven decision-making, enabling early intervention, and handling complex variables, making it valuable for planning and theory testing (González-Díaz & Bustamante-Cabrera, 2021; Relich, 2023; Dejardin et al., 2022).

This study was conducted in Region XI, located in the southern part of the Philippines, specifically in the Division of Davao Occidental. The respondents were drawn from three public senior high schools comprising Grade 11 students enrolled during the School Year 2025–2026.

These schools offer the Humanities and Social Sciences (HUMSS) and Information and Communication Technology (ICT) strands.

The selected locale is appropriate for the study as both strands foster critical thinking, inquiry, and engagement through varied instructional approaches. These learning environments support the development of students' attitudes toward science and curiosity, making them suitable for examining their influence on student science engagement. Furthermore, the setting ensures that the data gathered reflect authentic and meaningful learning experiences.

The study utilized a sample of 200 Grade 11 students from the Humanities and Social Sciences (HUMSS) and Information and Communication Technology (ICT) strands, drawn from a population of 400 during the School Year 2025–2026. The sample size was determined using the Raosoft calculator, with a 95% confidence level and a 5% margin of error, to ensure statistical reliability and representativeness. The study employed stratified random sampling, wherein the population was divided into two strata based on academic strand (HUMSS and ICT), and samples were randomly selected from each group proportionate to their size. This technique was used to ensure adequate representation of each subgroup and to minimize sampling bias. Stratified random sampling is appropriate when the population consists of distinct groups, as it enhances the accuracy and reliability of the results. The respondents included students who were officially enrolled in the HUMSS and ICT strands during the specified school year and who voluntarily agreed to participate in the study, ensuring ethical compliance and the collection of data reflective of their actual learning experiences.

The survey technique was used in gathering the data. Survey technique is a research method that involves collecting data by asking a group of people structured questions to understand their opinions, behaviors, or experiences. It is applied when researchers need to gather information from a large population efficiently, such as in education, health, and social science studies. Its advantages include cost-effectiveness, ability to collect large-scale data, standardized responses for easy analysis, and strong generalizability of results (Goodfellow, 2023; Hassan, 2024; Indeed Editorial Team, 2025).

The three constructs of this study, student science engagement, student curiosity character, and attitudes toward science, were assessed using three instruments: Student Science

Engagement Scale Questionnaire adapted from Baraquia (2019), Measuring Student Curiosity Character adapted from Herwin and Nurhayati (2021), and Students' Attitudes Toward Science adapted from Huang et.,al (2017). These three questionnaires underwent restructuring to align with the study's objectives. *Attitudes toward Science Questionnaire.* To gather the data for the dependent variable, attitudes toward science, the researcher adapted the students' attitudes toward science constructs questionnaire from Huang et al., (2019). It has three indicators: science enjoyment, science confidence, science importance. The scale contains 20 items and achieved a cronbach's alpha of 0.95.

This study employed descriptive, correlational, and mediation analyses. Descriptive statistics, specifically mean and standard deviation, were used to summarize and describe the data. Pearson Product-Moment Correlation was applied to determine the strength and direction of the relationships among variables. Furthermore, mediation analysis was utilized to examine whether the effect of the independent variable on the dependent variable occurs directly or indirectly through a mediating variable.

In the succeeding page, the matrix containing the scale, descriptive level, and corresponding interpretation assigned to each variable involved in this study is presented. This measure is used particularly in describing the level of student curiosity character.

Scale	***Level***	***Interpretation for Student Curiosity Character***	***Interpretation for Attitudes towards Science***
1.00 – 1.74	Very low	The student curiosity character is very poor.	The atttitudes towards are very poor.
1.75 – 2.49	Low	The student curiosity character is poor.	The attitudes towards science are poor.
2.50 – 3.74	High	The student curiosity character is good.	The attitudes towards science are good.
3.75 – 4.00	Very high	The student curiosity character is excellent.	The attitudes towards science are very good.

Scale	*Level*	*Interpretation for Engagement*
1.00 – 1.74	Very low	The engagement is very poor.
1.75 – 2.49	Low	The engagement is poor.
2.50 – 3.25	High	The engagement is good.
3.26 – 4.00	Very High	The engagement is excellent.

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

The study observed strict ethical standards in conducting research involving senior high school students. Prior to data collection, informed consent was obtained from all respondents, ensuring their voluntary involvement and confidentiality of responses. The research instruments underwent validation and reliability testing to guarantee the accuracy and trustworthiness of the findings. Permission from the Department of Education was formally secured to conduct the study within public schools under its jurisdiction. Moreover, the research proposal was reviewed and approved by the Society of Moral Integrity and Legal Ethics (SMILE) to ensure adherence to ethical, legal, and moral research principles.

III. RESULTS AND DISCUSSIONS

Shown in Table 1 are the descriptive statistical results of the study. Contained in the table are the variables involved namely attitudes towards science, student curiosity character, and engagement with their respective indicators; and the number of samples, standard deviation, mean and descriptive level specifically corresponding with each of the variables.

Specifically shown is the attitudes towards science, which has an overall mean of 3.44, indicating a high level and suggesting that students generally hold positive attitudes toward science. Its indicators Science Enjoyment, Science Confidence, and Science Importance all registered high means, reinforcing that students not only appreciate and enjoy science but also recognize its significance and feel confident in their abilities. Moreover, the respondents demonstrate an overall high level of student curiosity character, with an overall mean of 3.51, indicating well-developed curiosity among students. Its indicators Pay Attention, Take Notes, Asking, and Comparing all obtained high descriptive levels, reflecting active engagement and curiosity in the learning process. Finally, the respondents demonstrate a very high level of engagement, with an overall mean of 3.50, indicating that students are extremely engaged in science learning. All its indicators Engagement on Science Lessons and Tasks, Science Learning Involvement, and Science Effort and Preparation also obtained very high descriptive levels, highlighting students' consistent participation and effort in science activities.

TABLE 1
DESCRIPTIVE STATISTICS (N = 200)

Variables	Standard Deviation	Mean	Descriptive Level
Attitudes Toward Science	**0.19**	**3.44**	**High**
Science Enjoyment	*0.23*	*3.38*	*High*
Science Confidence	*0.27*	*3.47*	*High*
Science Importance	*0.26*	*3.46*	*High*
Student Curiosity Character	**0.40**	**3.51**	***High***
Pay Attention	*0.37*	*3.49*	*High*
Take Notes	*0.82*	*3.51*	*High*
Asking	*0.61*	*3.53*	*High*
Comparing	*0.38*	*3.48*	*High*
Engagement	**0.22**	**3.50**	**Very High**
Engagement on Science Lessons and Tasks	*0.29*	*3.50*	*Very High*
Science Learning Involvement	*0.31*	*3.51*	*Very High*
Science Effort and Preparation	*0.28*	*3.48*	*Very High*

Specifically, the table shows that attitudes towards science obtained an overall mean of 3.44, described as high level. All its indicators also obtained a high level. The standard deviation of 0.19 is described as highly consistent, reflecting strong and uniform responses among the participants. In terms of student curiosity character, it has an overall mean score of 3.51, indicating a high level. All its indicators also obtained a high level, suggesting a well-developed curiosity character among the students. The standard deviation of 0.40 is described as highly consistent, further emphasizing strong and uniform responses. On the other hand, engagement has an overall

mean of 3.50, described as very high. All its indicators obtained a very high level. The standard deviation of 0.22 is described as highly consistent, indicating strong and uniform responses across participants. Overall, the low standard deviations across all variables indicate that participants provided consistent responses, highlighting a robust and homogeneous profile of student curiosity character, attitudes towards science, and engagement. These results suggest that students not only hold positive attitudes toward science but also possess strong curiosity and very high engagement in science learning activities.

Table 2 is correlational table. It contains determinant and criterion variables. Aside from the variables, it also contained the number of samples, *r*-value, p-value, decision on null hypothesis, and the corresponding interpretation.

TABLE 2
CORRELATION TABLE (N=200)

Variables	Student Science Engagement			
	r-value	p-value	Decision on H0	Interpretation
Attitudes Toward Science	0.26	<.000	Reject H0	Low Positive, Significant
Student Curiosity Character	0.28	<.000	Reject H0	Low Positive, Significant

Level of Significance: 0.05

Decision Rule: Reject H_0 if $p < 0.05$

The correlation analysis revealed statistically significant positive relationships between the independent variables and engagement. Attitudes toward science demonstrated a low positive correlation with engagement ($r = 0.26$, $p = <.000$), indicating that more positive attitudes toward

science are associated with higher levels of engagement in science-related activities. Similarly, student curiosity character showed a low positive and statistically significant relationship with engagement (r = 0.28, p = <.000), suggesting that students who exhibit greater curiosity tend to be more engaged in science learning. Since both relationships were significant at the .05 level, the null hypotheses were rejected, confirming that attitudes toward science and student curiosity character are meaningfully associated with engagement.

Table 3 is mediation table showing the mediating effect of Student Curiosity Character on the correlation between Attitudes towards Science and Engagement. It contains the number of samples, and the determinant, mediator, and criterion variable. It also contains the direct, indirect and total effect of feeling stress variable controlling and going through the mediator, and its total effect, respectively. Finally, it contains the estimate beta, standard error, Z-value, p-value, decision on null hypothesis and corresponding interpretation.

TABLE 3 MEDIATION TABLE (N = 200)

Label	Path / Effect	Estimate (B)	SE	Z-value	p-value	Decision on H_0	Interpretation
A	Attitudes Toward Science → Student Curiosity Character	0.30	0.12	2.51	<.012	Reject	Significant
B	Student Curiosity Character → Engagement	0.13	0.07	1.81	<.071	Fail to Reject	Not Significant
c’	Attitudes Toward Science → Engagement (Direct Effect)	0.25	0.09	2.74	<.006	Reject	Significant
a × b	Indirect Effect (Mediation)	0.04	0.02	1.99	<.046	Reject	Significant
c (Total Effect)	Attitudes Toward Science → Engagement (Total)	0.29	0.09	3.15	<.002	Reject	Significant

Level of Significance: 0.05
Decision Rule: Reject H_0 if $p < 0.05$
% Mediation: Direct – 86%; Indirect – 14%

Presented in Table 3 is the mediation analysis examining the role of student curiosity character in the relationship between attitudes toward science and engagement, using bootstrapping with 5,000 samples. The results showed that attitudes toward science significantly predicted student curiosity character (B = 0.30, p = .012), indicating that more positive attitudes toward science are associated with higher levels of curiosity. However, student curiosity character did not significantly influence engagement (B = 0.13, p = .071). Despite this, the direct effect of student attitudes toward science on engagement remained positive and significant (B = 0.25, p = .006), suggesting that attitudes independently contribute to engagement. Notably, the indirect effect (a × b) was found to be statistically significant (B = 0.04, p = .046), indicating the presence of a mediation effect. The total effect was also significant (B = 0.29, p = .002), confirming that student attitudes toward science significantly influence student science engagement overall. The mediation analysis further revealed that 14% of the effect is indirect, while 86% is direct, indicating partial mediation. These findings suggest that while student curiosity character plays a mediating role, student attitudes toward science remain the stronger and more direct determinant of engagement.

Summary of Findings

Based on statistical results, it specifically was found that student attitudes toward science have a significant low positive correlation with engagement supports prior studies asserting that learners' positive attitudes toward a subject enhance their level of participation and involvement in learning activities. It has been emphasized that students who perceive science as enjoyable, valuable, and meaningful are more likely to actively engage in science-related tasks and demonstrate sustained interest in learning (Sinatra et al., 2015). Similarly, this finding affirms the claim that affective factors such as attitudes toward science significantly influence behavioral engagement, as students with favorable attitudes tend to invest more effort and attention in learning (Wang & Degol, 2017).

On the other hand, this finding contradicts claims suggesting that student attitudes alone may not strongly relate to engagement, particularly when external factors such as instructional quality, classroom environment, or teaching strategies play a more dominant role (Fredricks et al.,

2016). This implies that while attitudes are important, their association with engagement may vary depending on contextual factors.

Moreover, the finding that student curiosity character has a significant low positive correlation with student science engagement supports existing literature emphasizing curiosity as a driver of learning engagement. It has been asserted that curiosity promotes exploration, questioning, and deeper cognitive processing, which leads to increased academic engagement (Kashdan et al., 2018). In addition, curiosity has been identified as a key motivational factor that stimulates students' desire to seek new knowledge and sustain attention in learning tasks (Grossnickle, 2016). Recent studies further highlight that curiosity enhances students' active involvement in classroom activities by encouraging inquiry-based behaviors and self-directed learning (Hidi & Renninger, 2020). In the same way, this study confirms that students who frequently ask questions, compare ideas, and actively participate in learning tasks tend to exhibit higher levels of engagement in science.

However, this relationship suggests that the effect of curiosity on engagement is not automatic but is shaped by the learning environment. When classroom practices and instructional strategies provide opportunities for inquiry, exploration, and meaningful participation, curiosity is more likely to be expressed and translated into active engagement (Engel, 2011). This implies that curiosity becomes more effective in enhancing engagement when it is supported and sustained through appropriate teaching strategies and a conducive classroom environment.

The mediation results of this study revealed that student curiosity character has a significant indirect effect on the relationship between student attitudes toward science and student science engagement, indicating partial mediation. This suggests that student attitudes toward science influence engagement both directly and indirectly through curiosity. This finding is consistent with contemporary literature highlighting curiosity as a psychological mechanism that connects affective dispositions with active learning behaviors. For instance, Grossnickle (2016) explained that curiosity stimulates exploratory behavior and sustained cognitive engagement, thereby strengthening the translation of positive attitudes into meaningful learning actions.

Similarly, this result aligns with the view that curiosity functions as a motivational pathway that deepens students' engagement when interest is activated and sustained in learning contexts.

Hidi and Renninger's (2006; 2020) four-phase model of interest development further explains that curiosity supports the progression from situational interest to more sustained forms of engagement, especially when students are provided with opportunities for inquiry and exploration. In this sense, curiosity contributes to meaningful engagement by encouraging questioning, knowledge-seeking, and persistence in academic tasks.

However, the results also indicate that the direct relationship between student attitudes toward science and student science engagement remains stronger than the indirect effect through curiosity. This implies that while curiosity contributes to engagement, its role is supportive rather than dominant in this context. It further suggests that engagement is more strongly shaped by students' affective dispositions toward science, particularly their perceptions of value, enjoyment, and relevance, which may exert a more immediate influence on learning participation.

Moreover, the non-significant or weaker pathway between curiosity and engagement suggests that curiosity alone may not consistently translate into higher engagement unless it is reinforced by positive attitudes or supported by effective instructional conditions. This is consistent with recent educational research emphasizing that curiosity is most effective when it operates within supportive learning environments that encourage inquiry-based and student-centered practices (e.g., Jirout & Klahr, 2021; OECD, 2021). From this perspective, curiosity acts as a facilitating factor rather than a standalone driver of engagement.

Overall, the findings partially support recent arguments that mediation effects in student engagement models are often shared among multiple psychological and contextual variables rather than explained by a single mechanism. While some studies emphasize stronger roles for motivation or self-efficacy as mediators, the present study demonstrates that curiosity still plays a meaningful, though limited, mediating role in explaining how attitudes toward science are translated into engagement.

IV. CONCLUSION

Based on the findings, learners demonstrated high levels of student curiosity character, attitudes towards science, and engagement. The findings also showed significant relationships among the three variables showing that these variables are interconnected in supporting students' learning processes. It is also concluded that student curiosity character partially mediates the relationship between attitudes toward science and engagement. This finding is consistent with the Social Cognitive Theory (Social Cognitive Theory), particularly the principle of reciprocal determinism, which posits that personal factors, behavior, and environmental influences interact to shape learning outcomes.

V. RECOMMENDATIONS

Aligned with the Social Cognitive Theory, it is recommended to conduct further studies incorporating other potential mediating variables such as motivation, self-efficacy, or instructional strategies to explain the remaining 86% of the variance in student science engagement. Also, to undertake qualitative research to explore how curiosity is expressed in classroom settings and identify additional factors that may enhance or hinder its influence on engagement. And lastly, to develop and implement instructional strategies that foster both positive attitudes toward science and curiosity, such as inquiry-based learning, problem-based activities, and interactive classroom experiences to further enhance student engagement.

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