



The Mediating Role of the Use of Instructional Media Utilization on the Relationship between the Study Interest and Engagement of Students in Learning Mathematics

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Abstract: This study examined the mediating role of the use of instructional media utilization in the relationship between students' study interest and their engagement in learning mathematics. With a focus on a sample of 300 high school students, the research highlighted the moderate levels of study interest (mean = 3.34) and engagement (mean = 3.29), as well as high utilization of instructional media (mean = 3.41). The findings revealed that while students recognized the value of mathematics, their emotional engagement was lower, indicating a need for strategies that enhanced their intrinsic motivation. The analysis demonstrated that instructional media significantly enhanced student engagement as a crucial mediator connecting study interest to active participation in learning. The results underscored the importance of integrating diverse instructional media as a strategic pedagogical tool to foster both motivation and engagement in mathematics education. This study contributed valuable insights for educators aiming to create a more engaging learning environment through effective media utilization.

Keywords: Quality Education, Pedagogy, Study Interest, Engagement, Instructional Media, High School Students, Philippines

1. INTRODUCTION

1.1. Rationale

In today's educational landscape, pressing concern is the declining enthusiasm and active participation of students in mathematics learning. This downward trend is especially alarming as studies by Smith (2020) and Johnson et al. (2021) reported a significant drop in students' motivation toward mathematics. Several factors contributing to this issue includes the use of outdated instructional strategies and lack of engaging, interactive learning materials. Traditional methods that rely heavily on rote memorization and formulaic problem-solving have proven insufficient in stimulating student interest. The absence of innovative and hands-on resources limits students' opportunities to explore and internalize mathematical concepts in meaningful ways. This growing disinterest has broad implications—not only compromising students' academic performance but also raising concerns about the future workforce's competency in essential mathematical skills, which are increasingly critical in today's technology-driven world.

Despite advancements in educational technology, a notable gap remains in understanding how the utilization of instructional media influences students' study interest and engagement in mathematics. While existing research has emphasized the importance of teacher preparedness in integrating technology effectively (Green & Gilbert, 2007; Fleming, Motamedi, & May 2007), fewer studies have explored the specific role of instructional media in enhancing students' motivation and participation, especially among Junior High School learners.

This study explores the relationship between the independent variable, *Study Interest*, and the dependent variable, *Engagement*, taking into account the role of *Instructional Media Utilization* as a mediating factor that may influence the extent to which interest impacts student engagement. It is posited that students who show a strong interest in studying mathematics are more likely to be engaged in the learning process. Study interest encompasses curiosity, willingness to invest effort, and a personal value placed on learning mathematics—all of which contribute to greater engagement. When students are

genuinely interested in the subject, they tend to participate more actively, seek more profound understanding, and persist in the face of challenges.

The use of Instructional Media as a mediating variable plays a significant role in facilitating this relationship between Study Interest and Engagement. By utilizing instructional media, such as multimedia resources, educational games, and interactive simulations, teachers can create an environment that fosters engagement and motivates students to learn mathematics. These tools have the potential to stimulate students' interest, which in turn fosters greater behavioral and emotional engagement. For instance, a student who is initially disinterested in mathematics may become more engaged and motivated to learn when exposed to interactive multimedia resources that make the subject more accessible and fun.

Understanding the mediating role of instructional media is crucial for understanding how students' interest in mathematics translates into active engagement. By examining the relationship between these variables, this study aims to uncovering the extent to which the use of instructional media enhances students' engagement and interest in studying mathematics. The findings of this study offer valuable insights for educators and policymakers, underscoring the importance of integrating instructional media into mathematics education to foster student engagement and interest. By doing so, we can work towards creating a more effective and engaging learning environment that fosters a love for mathematics among students.

2. RESEARCH OBJECTIVE

This research aims to fill this void by examining the mediating effect of instructional media use on the relationship between student interest and engagement in mathematics. This study aims to explore the following objectives:

- 1. To measure the level of study interest of students in learning mathematics** in terms of:
 - 1.1. feeling-related valences,
 - 1.2. value-related valences, and
 - 1.3. intrinsic character valence beliefs;
- 2. To assess the level of engagement in learning mathematics of students** in terms of:
 - 2.1. cognitive engagement,
 - 2.2. emotional engagement, and
 - 2.3. behavioral engagement;
- 3. To ascertain the level of the students' use of instructional media in learning mathematics** in terms of:
 - 3.1. perceived use of audiovisual,
 - 3.2. perceived use of multipurpose areas, and
 - 3.3. perceived use of instructional materials;
- 4. To determine the significant relationship** between the following:
 - 4.1. study interest and engagement of students,
 - 4.2. study interest and the use of instructional media, and
 - 4.3. the use of instructional media and engagement of students in learning mathematics;
- 5. To determine the significance of the mediating role of the use of instructional media** on the relationship between study interest and engagement of students in learning mathematics.

3. HYPOTHESES

The following hypotheses were tested at 0.05 level of significance:

1. There is no significant relationship between:
 - 1.1 study interest and engagement in learning mathematics;
 - 1.2. Study interest and the use of instructional media in learning mathematics;
 - 1.3. The use of instructional media and engagement of students in learning mathematics.

2. There is no mediating role of the use of instructional media utilization on the relationship between the study interest and engagement of students in learning mathematics.

4. THEORETICAL FRAMEWORK

This study is anchored in Self-Determination Theory (Ryan & Deci, 2000), which posits that a combination of intrinsic and extrinsic factors drives motivation. In this context, the utilization of instructional media serves as a mediating variable that enhances students' intrinsic motivation by making learning more engaging and interactive. Supporting this theoretical foundation, three additional frameworks are introduced: the Situational Interest Development Model by Hidi and Renninger, which describes how short-term situational interest can evolve into long-term individual interest; Schiefele's conceptualization of interest, which emphasizes its content-specific nature and its role in directing students' attention and effort towards particular topics or activities; and the findings of Abubakar et al. (2007) and Apte (2017), which underscore the positive impact of instructional media on students' learning outcomes and self-directed learning behaviors.

5. CONCEPTUAL FRAMEWORK

The conceptual framework of this study is grounded in a mediation model that investigates the indirect influence of students' study interest on their engagement in mathematics learning through the utilization of instructional media. In this model, study interest is treated as the independent variable, student engagement as the dependent variable, and instructional media utilization as the mediating variable. Study interest is operationalized through three dimensions: feeling-related valences, value-related valences, and intrinsic character valence beliefs. Engagement is examined across cognitive, emotional, and behavioral domains, while instructional media utilization is categorized into perceived use of audiovisual materials, multipurpose learning areas, and instructional materials.

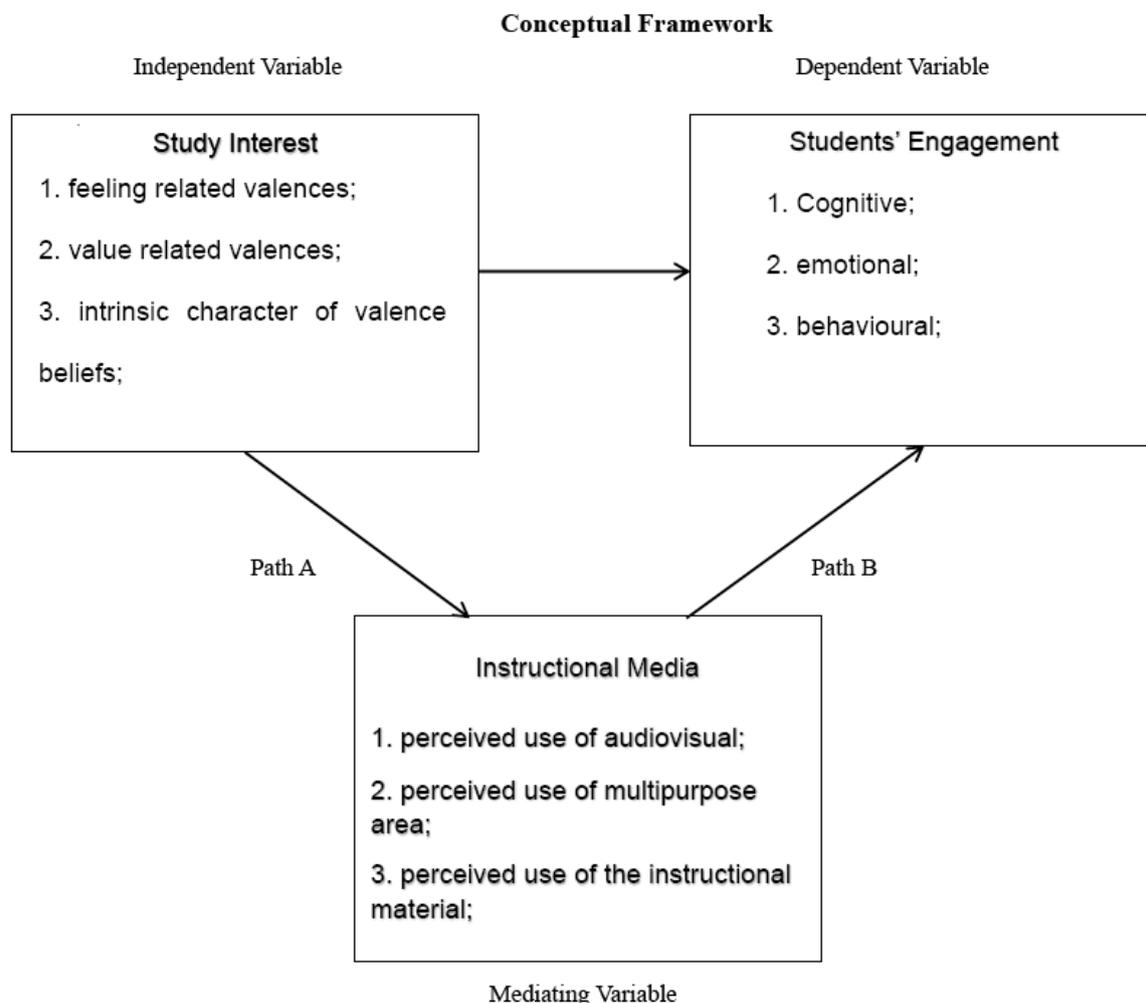


Figure 1. Conceptual paradigm of the study

The framework hypothesizes that study interest significantly predicts student engagement, and that this relationship is mediated—either partially or fully—by the use of instructional media. Specifically, Path A represents the effect of study interest on instructional media use; Path B denotes the impact of instructional media on engagement; and Path C captures the direct effect of study interest on engagement, independent of the mediator. Through the application of mediation analysis and structural equation modeling, the study aims to quantify the proportion of the total effect accounted for by the indirect path, thereby elucidating the mediating capacity of instructional media in enhancing student engagement. This conceptual model provides a basis for analyzing how motivational and environmental factors interact to influence academic behaviors in mathematics education.

6. SIGNIFICANCE OF THE STUDY

This study holds significant value in advancing the understanding of how instructional media can enhance student engagement in mathematics by acting as a mediating factor between study interest and active participation. As the educational landscape increasingly incorporates digital tools and learner-centered pedagogies, identifying the mechanisms that foster both motivation and engagement becomes vital. The findings of this research are expected to provide critical insights for educators, enabling them to adopt more effective instructional strategies that integrate relevant media to sustain students' interest and promote deeper engagement in mathematics learning.

For school administrators and curriculum developers, the results underscore the need for investment in instructional resources and professional development programs that support the integration of multimedia tools in classroom instruction. Policymakers can also benefit from the study by gaining evidence-based direction for designing interventions aimed at improving mathematics performance through technologically enhanced learning environments.

Moreover, this study contributes to the broader goal of achieving Sustainable Development Goal (SDG) #4: Quality Education, by promoting inclusive and engaging learning practices that equip students with essential mathematical skills for real-world problem solving. It addresses the pressing need to prepare a future workforce competent in mathematics and technology by fostering interest and engagement through the strategic use of instructional media. Ultimately, this research aims to influence both theory and practice in the field of mathematics education by offering a model that links student interest, instructional tools, and academic engagement.

6.1. Definition of Terms

To ensure clarity and consistency, the following terms are defined as they are used within the context of this study:

Study Interest – Refers to the students' internal motivation to learn mathematics.

Student Engagement – Denotes the degree to which students are involved in the learning process.

Instructional Media Utilization – Describes the use of various media and educational tools by students or facilitated by teachers to support mathematics learning.

7. METHOD

7.1. Research Design

The researchers employed a quantitative, non-experimental design, utilizing the correlational research technique to collect data, ideas, facts, and information pertinent to the study. Quantitative research, as outlined by scholars such as Bhandari (2021), focuses on the quantification and analysis of data. Such research employed a deductive approach, prioritizing theory testing based on empiricist and positivist philosophies. In the context of non-experimental research, the focus is on observing variables in their natural state without manipulating an independent variable.

The correlational technique employed in this study is a statistical method used to examine the relationships between the independent variable (Study Interest), the mediating variable (Use of Instructional Media), and the dependent variable (Engagement). Specifically, this study employed a mediation analysis, a type of correlational design that aims to investigate the indirect effect of the independent variable on the dependent variable through the mediating variable. In this study, the correlational technique is used to examine the following relationships: The relationship between Study

Interest (IV) and Engagement (DV), the relationship between Study Interest (IV) and Use of Instructional Media (MV), and the relationship between Use of Instructional Media (MV) and Engagement (DV). The mediation analysis helped to determine the extent to which the Use of Instructional Media mediates the relationship between Engagement and Study Interest. To analyze the data, this study employed statistical techniques, including Pearson's correlation coefficient, multiple regression analysis, and mediation analysis, using Baron and Kenny's (1986) approach. The results of the analysis provided insights into the relationships between the variables and the mediating role of Instructional Media Utilization on the relationship between Engagement and Study Interest. By using a correlational technique, this study aims to provide a comprehensive understanding of the relationships between the variables and to identify the underlying mechanisms that influence students' interest and engagement in learning mathematics. The findings of this study will have implications for educators, policymakers, and technology developers who are striving to create more effective and engaging learning environments for students.

7.2. Research Locale

Caraga, Davao Oriental Map shows in Figure 2 is presented to show where the study was conducted. The target population consisted of **Junior High School (JHS) students** enrolled in these schools during the time of the study. The selection of respondents followed both purposive and simple random sampling procedures to ensure representation. Proportional stratified sampling was also employed to ensure that different subgroups within the student population were fairly represented in the sample. A total of **300 student respondents** were targeted to ensure statistical reliability and generalizability of findings.



Figure 2. *Research Locale Map*

7.3. Population and Sample

The study targets are the Junior High School (JHS) students from selected Secondary Schools in Caraga, Davao Oriental, Philippines, to comprise the respondent group. To ensure comprehensive and publishable results. To ensure sufficient statistical power and generalizability, the study employed a **sample size of 300 students**. This number was determined based on methodological guidelines that recommend a minimum of 200 to 500 participants for correlational and mediation studies (Cohen, 1992). The inclusion criteria required that participants be officially enrolled JHS students during the time of the study and have provided informed assent and parental consent. Students who were from outside the designated school districts, were not enrolled at the time of the study, or belonged to the Senior High School level were excluded.

8. RESEARCH INSTRUMENT

Three structured and expert-validated questionnaires were utilized, each targeting a specific construct: student interest, student engagement, and instructional media utilization. Prior to the actual data collection, a pilot test was conducted involving a representative group of students, resulting in an overall Cronbach’s alpha reliability coefficient of 0.838, indicating a high level of internal consistency across the instruments. The three sets of questionnaires are a 5-point Likert Scale from 1 (Strongly Disagree) to 5 (Strongly Agree). In evaluating the variables, 5-point Likert Scale, these are the following range:

Range of Means	Descriptive Level	Interpretation
4.20 - 5.00	Very High	Measures are always Manifested.
3.40 - 4.19	High	Measures are oftentimes manifested.
2.60 - 3.39	Moderate	Measures are sometimes manifested.
1.80 - 2.59	Low	Measures are seldom manifested.
1.00 - 1.79	Very Low	Measures are not manifested.

The first part of the questionnaire focused on students’ interest in learning mathematics. This tool, adapted from Mahyudi (2019), consisted of 18 items categorized into three components: feeling-related valences, intrinsic motivation, and value-related beliefs. The pilot test produced a Cronbach’s alpha of 0.746, confirming its reliability.

The second instrument evaluated students’ engagement in mathematics learning. It was derived from the work of Kalogeropoulos et al. (2021) and included 13 items covering cognitive, emotional, and behavioral engagement. This tool also demonstrated acceptable reliability, with a pilot test resulting in a Cronbach’s alpha of 0.709.

The third and final instrument examined the extent of instructional media utilization. Based on the framework by Capuno et al. (2019), this 19-item questionnaire assessed three areas: the perceived use of audiovisual materials, multipurpose areas, and instructional materials. Content validation was conducted by a panel of experts, and the instrument underwent pilot testing, which yielded a Cronbach’s alpha of 0.753, confirming its appropriateness for the study.

In evaluating, the following scales were used:

9. DATA COLLECTION

During the data collection, the researcher began with a duly signed and noted request letter from the Professional School Dean, an approved letter from the supervisor, and a request for permission to conduct the research to the school principal. Upon approval, the researcher administered the validated questionnaires to the Junior High School students (JHS) with assistance from the year-level coordinator. After data collection, responses were tabulated, encoded, and subjected to statistical analysis. The collected data underwent several statistical treatments and analyses to achieve the research objectives. To establish the significance of the mediator, the study utilized Baron and Kenny's (1986) approach, which involves a series of multiple regression analyses. This methodological approach provided valuable insights into the mechanisms through which instructional media might influence students' interest and engagement, contributing to a more comprehensive understanding of effective teaching strategies in mathematics education.

Mean was used to determine the level of mediating role of instructional media utilization on student interest and engagement in mathematics.

Pearson Product Moment Correlation Coefficient (Pearson r) was employed to identify the significant relationship between instructional media utilization and student interest.

10. ETHICAL CONSIDERATION

This study upholds the highest ethical standards to ensure the protection of the rights and welfare of the Junior High School (JHS) students participating in the research. Informed consent was obtained from the students and their parents/guardians prior to data collection, ensuring that they were fully aware of the study's objectives, procedures, and potential risks and benefits.

Voluntary Participation: The researcher will secure the voluntary participation of the respondents of the study so it will require that the respondents will not be coerced into participating in this research; rather, they were the ones who willingly participated.

Privacy and Confidentiality: The researcher will ensure to protect the privacy of research respondents. In addition, adequate level of confidentiality of the research data will be ensured throughout the process.

Informed Consent Process: Prior to the administration of the questionnaires, the researcher will secure consent from the respondents and will discuss the nature of the study and all the pertinent details which will have bearing in their approval of participating. This ensures that the personal rights of the persons involved will be respected.

Recruitment: The researcher will specify a plan to identify and enroll the target respondents. Inclusion and exclusion criteria will be established, as was discussed in the Population and Sample section.

Risks: The researcher will also discuss potential risks that the respondents may encounter upon their agreement to participate. The respondents may encounter psychological risks which include a potential to cause undesired changes in thought processes and emotion. The researcher will ensure that the questions were constructed and delivered in a respectful manner so as to avoid embarrassment.

Benefits: The main benefits of the study is the potential to yield generalizable knowledge about the respondents' condition related to the interest and engagement in learning mathematics. Respondents may also gain insights into how their engagement and interest in mathematics can be influenced by the use of instructional media.

Plagiarism: The use of another person's ideas, processes, results, or words without giving appropriate credit will be addressed through citing or giving credit to the work of others, whether published or unpublished, and whether it had been a written work, an oral presentation, or material on a website. Each and every in-text citation is reflected in the Reference section.

Fabrication: The researcher will obligate his/herself to maintain a clear and complete record of data acquired in order to preserve accurate documentation of observed facts with which later reports or conclusions can be compared.

Falsification: This will also be avoided by making sure that the research materials or processes used are true and correct. There will be no changing or omitting of data or results such that the research is not accurately represented in the research record.

Conflict of Interest (COI): The researcher is acquainted with the respondents, which may give rise to possible conflicts of interest, measures will be implemented to ensure impartiality and integrity throughout the research process. Furthermore, the researcher discloses that no support, financial or otherwise, has been received from any organization that may have an interest in the submitted work, and there are no other relationships or activities that could appear to have influenced the submitted work.

Deceit: The researcher will stick to what has been written and discussed in the consent form concerning the nature of the study and the benefits as well as risks that the respondents may encounter. Hence, any type of communication in relation to the research will be done with honesty and transparency.

Permission from Organization/Location: the researcher will seek the permission of the head of the Department of Education, DepEd supervisors and the principals of the targeted schools and respondents.

Authorship: The researchers will make a significant contribution to the idea and design, data gathering, or data analysis and interpretation with the support and guidance of the adviser, the co-authorship. The research will be written cooperatively by the researchers, and it will be critically revised for essential intellectual substance. Both contributed to the investigation that resulted in the research being published.

11. RESULTS

11.1. Level of Study Interest of Students in Learning Mathematics

The overall mean score for study interest among students is 3.34, indicating a moderate level of interest. Among the three indicators, value-related valences received the highest mean at 3.41 with an SD of 0.57, indicating students place considerable importance on the value of studying mathematics. The lowest mean was observed in feeling-related valences at 3.29 (SD = 0.49), suggesting a relatively lower emotional attachment to the subject. The standard deviations range from 0.49 to 0.68, reflecting moderate variability in student responses across the different interest components.

Table 1. Level of Study Interest of Students in Learning Mathematics

Indicators	Mean	SD	Descriptive Level
Feeling-related valences	3.29	0.49	Moderate
Value-related valences	3.41	0.57	High
Intrinsic character valence beliefs	3.3	0.68	Moderate
Overall	3.34	0.38	Moderate

11.2. Level of Engagement of Students in Learning Mathematics

The students' overall engagement level in learning mathematics is rated as moderate, with an overall mean of 3.29. The highest mean score of 3.44 was found in behavioral engagement (SD = 0.76), indicating that students demonstrate observable actions such as participation and effort. In contrast, emotional engagement recorded the lowest mean at 3.17 (SD = 0.69), suggesting that students may feel less emotionally connected to the learning process. The standard deviations, which range from 0.64 to 0.76, indicate moderate to high variability in engagement experiences.

Table 2. Level of Engagement of Students in Learning Mathematics

Indicators	Mean	SD	Descriptive Level
Cognitive engagement	3.31	0.64	Moderate
Emotional engagement	3.17	0.69	Moderate
Behavioral engagement	3.44	0.76	High
Overall	3.29	0.52	Moderate

11.3. Level of the students' use of instructional media in Learning Mathematics

The overall level of instructional media use is high, with a mean of 3.41 and a relatively low standard deviation of 0.49, indicating consistent responses. Among the three indicators, instructional materials had the highest mean at 3.50 (SD = 0.71), while audiovisual media had the lowest mean at 3.31 (SD = 0.56). This suggests that while all instructional media are generally used, students perceive more frequent or effective use of physical instructional materials over audiovisual tools.

Table 3. Level of the students' use of instructional media in Learning Mathematics

Indicators	Mean	SD	Descriptive Level
Perceived use of Audiovisual	3.31	0.56	Moderate
Perceived use of Multipurpose areas	3.45	0.59	High
Perceived use of Instructional materials	3.5	0.71	High
Overall	3.41	0.49	High

11.4. Correlation Matrix on the Relationship between Study Interest and Engagement of students in learning Mathematics

The correlation matrix shows significant positive relationships between students' study interest and their engagement. The strongest correlation is between overall study interest and overall engagement ($r = 0.482$, $p < .000$), indicating that as students' interest in math increases, their engagement follows. Notably, behavioral engagement correlates most strongly with feeling-related valences ($r = 0.387$) and overall study interest ($r = 0.410$). The lowest or non-significant correlation is between cognitive engagement and intrinsic character valence beliefs ($r = -0.040$, $p = 0.493$), indicating a weak or negligible relationship in this aspect.

Table 4.1. Correlation Matrix on the Relationship between Study Interest and Engagement of students in learning Mathematics

Engagement	Study Interest			
	Feeling-related valences	Value-related valences	Intrinsic character of valence beliefs	Overall
Cognitive Engagement	0.339* (.000)	0.295* (.000)	-0.04 (.493)	0.326* (.000)
Emotional Engagement	0.342* (.000)	0.217* (.000)	0.197* (0.001)	0.377* (.000)
Behavioral Engagement	0.387* (.000)	0.212* (.000)	0.231* (.000)	0.410* (.000)
Overall	0.463* (.000)	0.320* (.000)	0.158* (0.006)	0.482* (.000)

*Correlation is significant at $p < 0.05$

11.5. Correlation Matrix on the Relationship between Study Interest and the use of instructional media in learning Mathematics

This matrix reveals statistically significant correlations between study interest and use of instructional media, though the relationships are generally weaker. The strongest correlation is between overall study interest and the use of multipurpose areas ($r = 0.304, p < .000$). In contrast, the lowest correlation is between audiovisual media use and intrinsic character valence beliefs ($r = 0.032, p = .584$), which is also not significant. These findings suggest that students who value and feel positively about learning math also perceive greater use of instructional media, particularly in multipurpose areas.

Table 5.1. Correlation Matrix on the Relationship between Study Interest and the use of instructional media in learning Mathematics

Use of Instructional Media	Study Interest			
	Feeling-related valences	Value-related valences	Intrinsic character of valence beliefs	Overall
Perceived use of Audiovisual	0.155* (.007)	0.198* (.001)	0.032 (.584)	0.206* (.000)
Perceived use of Multipurpose areas	0.120* (.037)	0.244* (.000)	0.256* (.000)	0.304* (.000)
Perceived use of Instructional materials	0.116* (.045)	0.195* (.001)	0.157* (.007)	0.234* (.000)
Overall	0.166* (.004)	0.262* (.000)	0.168* (.004)	0.302* (.000)

*Correlation is significant at $p < 0.05$

11.6. Correlation Matrix on the Relationship between the Use of Instructional Media and Engagement of students in learning Mathematics

The correlation matrix indicates modest but mostly significant positive relationships between students' perceptions of instructional media use and their engagement. The highest correlation is between emotional engagement and audiovisual use ($r = 0.252, p < .000$). In contrast, the lowest correlation, with the most negative value, is observed between cognitive engagement and instructional materials ($r = -0.017, p = .764$), which is not statistically significant. Overall, the total correlation between media use and student engagement is $r = 0.220$, implying that students who perceive greater use of instructional media tend to be more engaged.

Table 6.1. Correlation Matrix on the Relationship between the Use of Instructional Media and Engagement of students in learning Mathematics

Engagement	Use of Instructional Media			
	Perceived use of Audiovisual	Perceived use of Multipurpose areas	Perceived use of Instructional materials	Overall
Cognitive Engagement	0.194* (.001)	0.08 (.065)	-0.017 (.764)	0.111* (.054)
Emotional Engagement	0.252* (.000)	0.251* (.000)	0.106* (.067)	0.249* (.000)
Behavioral Engagement	0.036 (.533)	0.146* (.012)	0.128* (.027)	0.122* (.035)
Overall	0.231* (.000)	0.214* (.000)	0.088 (.128)	0.220* (.000)

11.7. On the Mediating role of the Use of Instructional Media

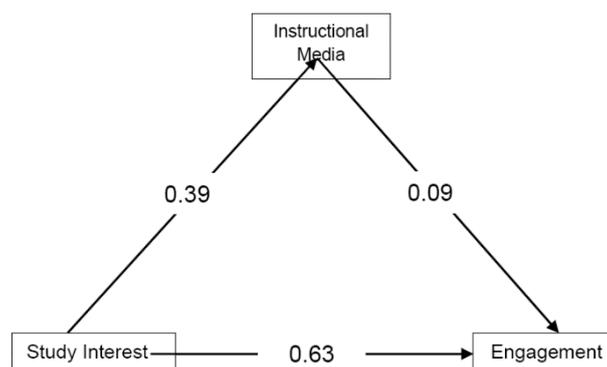


Figure 2. Medgraph showing the variables of the study

As shown in Figure 2, the mediating effect of the use of instructional media on the relationship between study interest and engagement, whether complete mediation, partial mediation, or no mediation. If the direct effect of the factors of study interest becomes non-significant when the mediator —the use of instructional media —is included in the model, complete mediation will be attained. It means that the mediator variable mediates all effects. Moreover, partial mediation occurs when the direct effect of study factors on engagement remains significant even after the mediator is included in the model, indicating that both direct and indirect paths contribute to the total effect. Given that the direct effect of the study's factors on interest ($B = 0.639, p < .005$) remains significant even after accounting for the indirect effect through the use of instructional media in learning mathematics, partial mediation is attained. The percentage of the total effect of study factors on engagement in learning mathematics that is mediated by the learning environment is 5.57%. This indicates that approximately six out of every hundred effects of student study interest on engagement in learning mathematics are mediated through its influence on the use of instructional media. At the same time, the remaining 94 out of every hundred represent direct effects. Since partial mediation occurred in this study, it can be understood that the use of instructional media is not the sole reason study interest influences the engagement of high school students.

Table 7.1. Regression results of the variables in the criteria of the presence of mediating effect

Indirect and Total Effects

Type	Effect	Estimate	SE	Lower	Upper	B	Z	P
Indirect	SI ⇒ M ⇒E	0.0337	0.0228	- 0.0110	0.0784	0.0245	1.48	< .001
Component	SI ⇒ M	0.3905	0.0711	0.2512	0.5299	0.3023	5.49	< .001
	M ⇒ E	0.0864	0.0563	- 0.0239	0.1966	0.0812	1.54	< .001
Direct	SI ⇒ E	0.6394	0.0727	0.4869	0.7717	0.4578	8.66	< .001
Total	SI ⇒ E	0.6631	0.0696	0.5266	0.7996	0.4823	9.52	< .001

% Mediation = 5.57

The direct effect of the factors of study interest on the engagement of students in learning mathematics, as shown in Table 5, is estimated at 0.639 with a standard of error of 0.0686 and a 95% C.I. ranging from 0.5266-0.7966. This is statistically significant ($z = 8.66, p < .001$), indicating that the factors of students' study interest directly influence engagement in learning mathematics when controlling for the mediating effect of the use of instructional media. Since the p-value of 0.001 is lower than 0.05, this means that the relationship is highly significant, and the null hypothesis is rejected. This suggests that the students' study interest has a significant direct impact on engagement, independent of their influence through the use of instructional media. Similarly, the data revealed that the total effect was significant ($B = 0.633, z = 9.52, p < .001$).

12. DISCUSSION

12.1. Study Interest of Students in Learning Mathematics

The study revealed that student's interest in learning mathematics is moderate overall ($M = 3.34, SD = 0.38$). Among the three dimensions measured, value-related valences received the highest mean score ($M = 3.41, SD = 0.57$), indicating that students generally see the usefulness and importance of mathematics in their academic and real-life contexts. Feeling-related valences and intrinsic character valence beliefs both registered moderate levels ($M = 3.29$ and 3.30 , respectively), suggesting that while students may appreciate the value of mathematics, they are less emotionally connected to it and may not fully internalize mathematics as part of their academic identity.

This outcome supports the expectancy-value theory (Eccles & Wigfield, 2002), which posits that students are more likely to value subjects that they perceive as valuable or important, even if intrinsic motivation is lacking. The findings align with Wigfield and Eccles (2000), who argued that students'

academic motivation is heavily influenced by their perception of a subject's relevance. Similarly, Schukajlow, Rakoczy, and Pekrun (2017) found that value-related beliefs play a stronger role in interest formation than intrinsic enjoyment alone. Furthermore, Krapp (2002) emphasized the developmental nature of interest, showing that value appraisals often precede emotional engagement in mathematics. The moderate levels of feeling-related and intrinsic components align with the results of Middleton and Spanias (1999), who observed that students' affective connection to mathematics often declines over time, notably when instruction lacks contextualization and personalization.

12.2. Engagement of Students in Learning Mathematics

The level of engagement of students found that students exhibited a moderate overall level of engagement in learning mathematics ($M = 3.29$, $SD = 0.52$). Behavioral engagement ranked highest ($M = 3.44$, $SD = 0.76$), indicating that students are generally participative, consistent in attendance, and diligent in completing tasks. Cognitive engagement ($M = 3.31$, $SD = 0.64$) and emotional engagement ($M = 3.17$, $SD = 0.69$) followed, both at moderate levels, with emotional engagement being the lowest among the three. These findings align with the three-component model of engagement proposed by Fredricks, Blumenfeld, and Paris (2004), who emphasized that behavioral participation does not necessarily indicate deep learning unless accompanied by cognitive and emotional investment. Appleton, Christenson, and Furlong (2008) also noted that surface-level compliance often masks low affective engagement in academic settings. The disparity between behavioral and emotional engagement in this study aligns with Reeve and Tseng's (2011) findings, which highlighted the limitations of traditional classroom practices in fostering genuine emotional connections with academic content. Moreover, Finn and Zimmer (2012) emphasized that meaningful engagement arises from instructional environments that foster both intellectual curiosity and emotional resonance. The moderate cognitive engagement seen here suggests room for strategies that enhance metacognition and problem-solving, such as inquiry-based learning (Boekaerts, 2016).

12.3. Students' use of instructional media in Learning Mathematics

Students' use of instructional media in learning mathematics reported a high level of instructional media use overall ($M = 3.41$, $SD = 0.49$), with the use of instructional materials scoring the highest ($M = 3.50$, $SD = 0.71$), followed by the use of multipurpose areas ($M = 3.45$, $SD = 0.59$). Audiovisual tools, although still moderately used, received the lowest mean score ($M = 3.31$, $SD = 0.56$). These findings show that traditional instructional materials and flexible learning environments are more frequently utilized than audiovisual media. This pattern aligns with Mayer's (2005) Cognitive Theory of Multimedia Learning, which suggests that multimedia elements such as pictures, narration, and animation enhance understanding when used strategically. The lower use of audiovisual tools may indicate missed opportunities to leverage dual coding and cognitive load reduction (Mayer, 2009). Clark and Mayer (2011) emphasized the importance of integrating media that aligns with instructional goals and student needs. Studies such as those by Kebritchi, Hirumi, and Bai (2010) demonstrate that technology-enhanced learning environments can improve math achievement when properly implemented. The preference for print-based or multipurpose tools may also reflect teacher familiarity and accessibility issues, as noted by Tondeur et al. (2017) in their study on technology integration in schools. Therefore, maximizing the potential of audiovisual aids requires not just availability but also training and curricular alignment (Li & Ma, 2010).

12.4. Relationship between Study Interest and Engagement of students in learning Mathematics

The correlation between study interest and engagement in learning mathematics reveals a significant and positive relationship between the two. Specifically, overall study interest is strongly correlated with overall engagement ($r = 0.482$, $p < 0.05$), with behavioral engagement ($r = 0.410$) showing the strongest correlation among the engagement subdomains. Among the dimensions of study interest, "feeling-related valences" had the highest correlation across all types of engagement, especially behavioral engagement ($r = 0.387$). This suggests that students who experience more positive emotions toward math tend to engage more cognitively, emotionally, and behaviorally in their learning process. The implication here is that cultivating students' interest in mathematics, particularly through positive emotional experiences and value-based motivations, may increase their overall learning engagement. This supports the Self-Determination Theory (Deci & Ryan, 2000), which posits that interest and intrinsic motivation are predictors of academic engagement and performance. Ainley and Ainley (2011)

similarly found that interest has a positive influence on cognitive and emotional engagement in mathematics learning.

Additionally, Hidi and Renninger (2006) proposed a four-phase model where interest develops progressively and increasingly predicts engagement levels. The relationship between emotional valences and engagement aligns with findings by Pekrun et al. (2011), who emphasized the role of academic emotions in shaping student motivation and effort. This connection suggests that increasing emotional resonance in math learning—through real-life problems, games, or collaborative tasks—may yield higher engagement (Renninger & Bachrach, 2015).

12.5. Relationship between Study Interest and the use of instructional media in learning Mathematics

The correlation between study interest and use of instructional media illustrates a significant positive correlation between study interest and students' perceived use of instructional media in learning mathematics. Overall, study interest is positively correlated with overall use of instructional media ($r = 0.302$, $p < 0.05$). Notably, "value-related valences" showed a moderate correlation with all types of media use, particularly with multipurpose areas ($r = 0.244$) and audiovisual tools ($r = 0.198$). The dimension of "intrinsic character valence beliefs" had the weakest but still statistically significant correlations. These results imply that when students value mathematics or perceive it as meaningful and valuable, they are more likely to recognize and use various instructional media. This highlights the importance of aligning instructional tools with students' interests to foster more meaningful learning experiences. This finding supports the Technology Acceptance Model (TAM) proposed by Davis (1989), which emphasizes perceived usefulness and ease of use as key drivers of media adoption. When students value math, they are more inclined to use tools that enhance understanding (Teo, 2011). Zhao et al. (2005) found that students with higher academic interests also exhibit greater engagement with technology. Likewise, Turel and Serenko (2012) argued that motivation and interest significantly predict students' openness to technology-enhanced instruction. Mayer (2009) further reinforced that student-centered multimedia learning must align with learner preferences and motivational states to be effective. Thus, curricular planning should consider how to integrate media that not only informs but also appeals to students' interest profiles (Keller, 1987).

12.6. Relationship between the Use of Instructional Media and Engagement of students in learning Mathematics

The correlation between the use of instructional media and student engagement is generally positive, though modest. The strongest relationship was found between audiovisual media use and overall engagement ($r = 0.231$), with emotional engagement ($r = 0.252$) being exceptionally responsive to audiovisual input. The use of multipurpose areas and instructional materials showed weaker yet still significant associations with behavioral and emotional engagement. These results suggest that integrating media, particularly audiovisual elements, in math instruction can enhance students' emotional involvement and behavioral participation, which may lead to better engagement outcomes. These findings are supported by Mayer's (2009) Cognitive Theory of Multimedia Learning, which emphasizes the importance of multimedia in facilitating active cognitive processing and fostering an emotional connection to the content. Empirical search by Moreno and Mayer's (2000) assertion that multimedia design, when done effectively, can enhance learner motivation and emotional engagement. Kay et al. (2012) also reported improved affective and behavioral engagement in classrooms that utilized interactive video and animations. While media use alone does not guarantee deep engagement, studies by Wang and Reeves (2006) and Cheung and Slavin (2013) highlight that its effectiveness depends on the instructional approach and alignment with student preferences. Audiovisual aids appear to be particularly effective in supporting emotional engagement by offering relatable narratives, real-world applications, and visual explanations of abstract concepts (Gupta & Fisher, 2012). The results align with these perspectives, indicating that while media alone may not fully drive engagement, their appropriate use in alignment with student needs and interests can enhance the learning environment and promote student participation.

12.7. On the Mediating role of the Use of Instructional Media

Mediation analysis showed that the use of instructional media plays a small but statistically significant mediating role in the relationship between study interest and student engagement (Indirect Effect $\beta =$

0.0245, $p < .001$). The total effect of study interest on engagement was strong ($\beta = 0.4823$, $p < .001$), with 5.57% of this effect attributed to the mediating influence of instructional media. This finding supports Bandura's Social Cognitive Theory (1986), which emphasizes environmental factors—like instructional tools—as contributors to learning behavior. Instructional media serves as a social and cognitive scaffold that reinforces both interest and engagement (Zimmerman, 2000). Clark and Mayer (2011) also found that integrated instructional media amplifies learning outcomes, particularly when it mediates motivation and engagement pathways. Similarly, Wang and Holcombe (2010) demonstrated that supportive classroom environments (including technological tools) can mediate the impact of motivational variables on engagement. Thus, the study highlights that while intrinsic interest is crucial, the strategic deployment of instructional media further enhances its impact on student engagement.

The study indicates that students demonstrated a moderate level of interest in learning mathematics, with the highest mean rating observed in value-related valences, suggesting that they recognized the relevance and importance of mathematics in their lives. However, the relatively low rating in feeling-related valences and emotional engagement points to the need for strategies that strengthen students' affective connection to the subject. While behavioral engagement was rated highly, indicating active classroom participation, the use of instructional media was also reported to be high, particularly in terms of instructional materials and multipurpose areas, with audiovisual tools receiving the lowest ratings. Inferential analyses revealed significant positive correlations between study interest and student engagement, as well as between study interest and instructional media use and between media use and engagement. Moreover, regression analysis confirmed that instructional media use served as a partial mediator in the relationship between study interest and engagement, albeit with a modest mediation effect of 5.57%.

13. CONCLUSION

The descriptive results of the study revealed that students demonstrated a moderate level of study interest in learning mathematics, with value-related valences receiving the highest mean rating, suggesting that students recognized the relevance and importance of mathematics in their lives. The lowest-rated dimension was feeling-related valences, indicating a less positive emotional association with the subject. In terms of student engagement, behavioral engagement received a high rating, suggesting that students were more likely to participate actively in class activities. However, emotional engagement was the lowest-rated component, highlighting the need for strategies to enhance students' affective connection to learning mathematics. Regarding the use of instructional media, students reported a high level of usage, particularly for instructional materials and multipurpose areas, while audiovisual tools were rated the lowest among the three indicators.

The inferential analysis showed a significant positive correlation between study interest and student engagement, indicating that students who were more interested in mathematics tended to be more cognitively, emotionally, and behaviorally engaged. Similarly, a significant relationship was found between study interest and the use of instructional media, and between instructional media use and student engagement. The regression results indicated that instructional media use partially mediated the relationship between study interest and engagement. While the direct effect of study interest on engagement was strong, the indirect effect through instructional media was statistically significant but small, with a mediation percentage of 5.57%. This suggests that while instructional media contributes to enhancing engagement, its mediating role is modest, and the primary influence remains the students' intrinsic interest in the subject.

The results of the study support the theoretical framework that posits the importance of affective and cognitive factors in academic engagement. The findings are consistent with interest theory and engagement theory, which emphasize that students' internal motivational states and emotional responses play a critical role in their learning behaviors. Empirical studies cited in the literature also support the idea that using instructional media can positively influence student engagement, albeit as a supplementary factor rather than a primary driver. Thus, this study affirms the theoretical assumption that while tools and strategies like instructional media are valuable, fostering intrinsic interest remains crucial in promoting meaningful learning and sustained engagement in mathematics.

14. RECOMMENDATION

In light of these findings, it is recommended that mathematics educators and school administrators implement targeted interventions to improve students' emotional engagement. Strategies include incorporating real-life applications, gamified learning experiences, and collaborative problem-solving activities. Additionally, efforts should be made to improve the availability, accessibility, and integration of audiovisual tools through updated resources and teacher training. Policymakers and curriculum developers are likewise encouraged to support holistic instructional approaches that cultivate both interest and engagement, ultimately contributing to improved learning experiences and outcomes in mathematics education.

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STATISTICAL TABLES

Table 1.1. *Level of Study Interest of Students in Learning Mathematics in terms of Feeling-Related Valences*

Indicators	Mean	Standard Deviation	Descriptive Level
1. I like to work related to my math subject	3.377	1.227	Moderate
2. I like to talk much about the subject matter related.	3.283	1.175	Moderate
3. I like to look forward to get back math topic after long weekend.	3.243	1.181	Moderate

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4. I feel happy when I am involved in math lessons.	3.413	1.233	High
5. I prefer to talk to my classmates rather than my family	3.057	1.309	Moderate
6. I like to browse in a magazine or books to do related to my lesson.	3.393	1.173	Moderate
7. I feel many areas within my math subject which means something.	3.290	1.139	Moderate
Overall	3.29	0.49	Moderate

Table 1.2. Level of Study Interest of Students in Learning Mathematics in terms of Value-Related Valences

Indicators	Mean	Standard Deviation	Descriptive Level
1. I feel great to be able to study to some particular lessons.	3.590	1.192	High
2. I feel close relations towards my classmates	3.427	1.123	High
3. I feel my classmates has big impact to my self-realization.	3.357	1.108	Moderate
4. My studies has significance to me.	3.437	1.159	High
5. I love to study my math lesson than spend unproductive things.	3.320	1.193	High
6. I review my previous lessons in math before starting the current one.	3.303	1.159	Moderate
7. I am confident that my math lesson has a positive influence on my personality.	3.420	1.190	High
Overall	3.41	0.57	High

Table 1.3. Level of Study Interest of Students in Learning Mathematics in terms of Intrinsic Character of Valence Beliefs

Indicators	Mean	Standard Deviation	Descriptive Level
1. I work more intensively to deep certain aspect of my math lesson.	3.370	1.109	Moderate
2. I choose math subject based on my personal preference.	3.347	1.136	Moderate
3. I prepare the math material before studying them	3.297	1.152	Moderate
4. I chose math subject primarily because of the interesting subject matter involved.	3.200	1.232	Moderate
Overall	3.30	0.68	Moderate

Table 2.1. Level of Engagement of Students in Learning Mathematics in terms of Cognitive Engagement

Indicators	Mean	Standard Deviation	Descriptive Level
1. I am confident, I can do the math work at home	3.543	1.101	High
2. I can do most of the math work by myself	3.280	1.175	Moderate
3. When I choose a math task, I like to pick one that challenges me	3.317	1.143	Moderate
4. It is not hard learning math at home	3.123	1.194	Moderate
5. When I choose a math task, I like to pick one that is not so easy to do	3.283	1.258	Moderate
Overall	3.31	0.64	Moderate

Table 2.2. Level of Engagement of Students in Learning Mathematics in terms of Emotional Engagement

Indicators	Standard Deviation	Mean	Descriptive Level
1. Learning math at home is fun	3.057	1.314	Moderate
2. The math I learn at home is interesting	3.253	1.211	Moderate
3. Learning math at home is exciting	3.317	1.242	Moderate
4. I am happy when doing math work at home	3.323	1.277	Moderate
5. When I have a choice, I usually choose to do a math task rather than another subject	2.923	1.320	Moderate
Overall	3.17	0.69	Moderate

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Table 2.3. Level of Engagement of Students in Learning Mathematics in terms of Behavioural Engagement

Indicators	Mean	Standard Deviation	Descriptive Level
1. Someone at home helps me with my math work when I am stuck	3.300	1.281	Moderate
2. I do all the math work my teacher wants me to do	3.467	1.131	High
3. I miss doing math with my friends at school	3.647	1.265	High
Overall	3.44	0.76	High

Table 3.1. Level of the students' use of instructional media in Learning Mathematics in terms of Perceived use of the Audiovisual

Indicators	Mean	Standard Deviation	Descriptive Level
1. My teacher is using cassette tapes, karaoke as an aid in teaching the different lessons.	3.177	1.210	Moderate
2. My teacher is using recorded tapes/ sounds/ conversations to provide more information and entertainment.	3.547	1.128	High
3. My teacher is using television as instructional materials.	3.563	1.133	High
4. My teacher is using an overhead projector in the discussion.	3.270	1.141	Moderate
5. My teacher is using LCD or electronic projection.	3.323	1.185	Moderate
6. My teacher is using a computer to facilitate learning.	3.347	1.246	Moderate
7. My teacher is using a microphone and speaker in the sound discussion.	3.013	1.246	Moderate
8. My teacher is using computer programs (IQ, adventure, puzzle) to facilitate learning.	3.263	1.191	Moderate
Overall	3.31	0.56	Moderate

Table 3.2. Level of the students' use of instructional media in Learning Mathematics in terms of perceived use of the Multipurpose Areas

Indicators	Standard Deviation	Mean	Descriptive Level
1. My teacher is using an area for Parent-Teacher and Community assembles.	3.443	1.227	High
2. My teacher is using an area served as a place for small group conferences for Math members.	3.290	1.145	Moderate
3. My teacher is using an area that serves as a place for school faculty meetings to discuss the program and other school-related activities.	3.693	1.054	High
4. My teacher is using an area utilized as a place for district meetings and school meetings.	3.393	1.153	Moderate
5. My teacher is using an area served as a place for the district and school contests such as math fair and quiz bee, conventions and the like.	3.447	1.160	High
Overall	3.45	0.59	High

Table 3.3. Level of the students' use of instructional media in Learning Mathematics in terms of perceived use of the Multipurpose Areas

Indicators	Standard Deviation	Mean	Descriptive Level
1. My teacher is using ready-to-use Instructional Materials available in schools like TV, cassette player, and DVD player.	3.490	1.184	High
2. My teacher explains the value and importance of Instructional Materials before using.	3.543	1.157	High
3. My teacher allows us to manipulate or to hold the Instructional Materials to promote hands-on training.	3.403	1.079	High

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4. My teacher is using varied Instructional Materials that appropriate to the lessons.	3.480	1.152	High
5. My teacher explains well the lessons thru the use of Instructional Materials.	3.500	1.158	High
6. My teacher is using Instructional Materials like pictures, graphs, map, and real objects in teaching.	3.607	1.204	High
Overall	3.50	0.71	High

AUTHORS' BIOGRAPHY



Loriebel Orbeta Paquidongan is a dedicated public secondary school teacher with over eleven years of experience in the Philippine education system. Known for her unwavering commitment to student excellence and holistic learning, she has made significant contributions both in the classroom and in academic competitions. She has served as a coach in various mathematics contests, notably leading her students to a 4th-place finish in the Tower of Hanoi category at the National Science and Math Quest held in Baguio City. Under her mentorship, her students have also earned championships at the division and district levels. In May 2025, she further expanded her professional horizon by presenting her research at the Professional School International Research Conference, showcasing her dedication to continuous learning and academic scholarship. A proud wife to Gerson T. Paquidongan and a loving mother to James Andrew O. Paquidongan and

Josh Aeron O. Paquidongan. She is the daughter of Luningning C. Margen and the late Virginio P. Orbeta, and shares a close bond with her youngest sister, Lou Ver M. Orbeta. Her personal and professional life is rooted in a strong sense of purpose, service, and love for learning—values that continue to inspire her journey as an educator and researcher.



Angelito D. Gardose is a faculty member of the Mathematics Discipline in the University of Mindanao, Philippines. He's been a math instructor for twenty-five years. On a national and international level, he presented his mathematics research investigation.

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