



The Mediating Effect of E-Learning Service Quality on the Relationship between Perceptions towards Modular Distance Learning Approach and Student Attitude towards Mathematics

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Abstract: The study investigated the mediating effect of e-learning service quality on the relationship between perception towards Modular Distance Learning (MDL) approach and student attitude towards mathematics. It used the survey questionnaires with a five-point Likert scale, where responses ranged from 1 to 5. The research was conducted among 300 Grade 11 senior high school students from various schools in Caraga North and South districts of Caraga, Davao Oriental. The study employed a quantitative non-experimental design with correlation, regression, and path analyses, the research addresses the UN's SDG in terms of education quality. The findings revealed high levels among the study variables. Additionally, regression results revealed a strong and statistically significant positive relationship between the students' perception towards MDL approach and e-Learning service quality. This suggests that the students who perceive MDL approach more favorably also tend to perceive e-learning service quality as improve, which in turn boosts their attitude toward mathematics. Furthermore, the modeling results revealed that e-learning service quality significantly and partially mediates the relationship between the perception towards MDL approach and attitude towards mathematics of the students. The study proposes that while e-learning service quality played a significant mediating role, addressing challenges remained crucial for the students' perception towards MDL approach and attitude toward mathematics.

Keywords: education and pedagogy, e-learning service quality, modular distance learning approach, students' attitude towards mathematics, quantitative, Philippines.

1. INTRODUCTION

1.1. Rationale

Mathematics is an essential subject for students, yet in recent years, increasing attention has been drawn to the persistent issue of students' negative attitudes toward the subject, especially in distance and online learning environments. These negative attitudes are often linked to anxiety, lack of motivation, and poor academic performance. Such challenges have only intensified in the digital era, where mathematics instruction has transitioned to alternative delivery modes. Research consistently shows that students' attitudes toward mathematics critically influence their engagement, persistence, and achievement (Davis et al., 2021; Smith & Johnson, 2022). As mathematics serves as a foundational discipline across all academic levels, fostering positive student attitudes is vital for long-term academic success.

One educational strategy that gained widespread adoption during the COVID-19 pandemic is the modular distance learning approach, which emphasizes self-paced, independent learning through printed or digital modules. While this approach provides flexibility and accessibility, especially in resource-constrained settings, its effectiveness in teaching mathematics—a subject that often benefits from guided instruction and real-time feedback—remains a concern. Students' perceptions of the modular distance learning approach significantly influence their engagement and academic outcomes. Although modular learning promotes self-directed study, its ability to cultivate positive attitudes toward mathematics depends on students' perceptions of its structure, clarity, and content relevance. However, there is still a considerable gap in understanding how these perceptions shape students' readiness and willingness to engage with mathematical content within a modular format.

In this context, e-learning service quality has emerged as a critical mediating factor. The success of any distance learning initiative, including modular learning, is closely tied to the quality of digital

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infrastructure, instructional design, learner support, and content delivery. High-quality e-learning services can enhance students’ experiences, boost motivation, and improve perceptions of both the learning method and the subject matter itself. For instance, Zhang et al. (2021) found that when students perceived e-learning services as high quality, their attitudes toward mathematics improved significantly due to greater engagement and satisfaction. Likewise, Capinding (2022) reported increased motivation among students who found modular content accessible and relevant. Aksan (2021) emphasized that students’ perceptions of the effectiveness of modular learning directly impacted their academic performance in mathematics. Moreover, Lee and Kim (2024) observed that students’ positive attitudes toward mathematics were strongly associated with their engagement in modular learning environments.

Table 1.1. *Level of Students’ perception towards modular distance learning approach in terms of Content of the Self-Learning Module*

Indicators	Standard Deviation	Mean	Descriptive Level
1. The activities in the modules are readable.	0.98977	3.8833	High
2. The instructions on the activities are clear.	0.93527	3.8533	High
3. The lessons have illustrations, graphs, and pictures that help the lessons be understood better.	0.99846	3.9200	High
4. The key concepts of the content are present and helpful.	0.91646	3.7700	High
5. The deepening part of the modules through examples are present.	0.91109	3.7633	High
6. The activities in the modules are many.	1.03236	3.6667	High
7. The lessons in the modules are easy to understand.	1.05836	3.4167	High
8. The activities in the modules are easy to do.	0.95865	3.5267	High
9. The modules have enough examples.	1.05196	3.4800	High
10. The questions in the module are easy to answer.	1.02074	3.4300	High
11. The activities in the modules are repetitive.	0.95296	3.5700	High
Overall	0.87789	4.1233	High

Table 1.2. *Level of Students’ perception towards modular distance learning approach in terms of Parental Support*

Indicator	Standard Deviation	Mean	Descriptive Level
1. My parents provide my school supplies.	1.01164	3.6000	High
2. My parents make me do household chores during module time.	1.03290	3.6633	High
3. My parents check the completeness of my answer before submitting it.	1.07612	3.6500	High
4. My parents monitor me while answering my modules.	1.09204	3.5900	High
5. My parents retrieve and submit my modules.	1.08034	3.4900	High
6. My parents assist me in performing the activities indicated in the modules.	1.13068	3.3500	Moderate
7. My parents’ guide me in answering the modules.	1.14606	3.2400	Moderate
8. My parents help me in doing my modules.	0.63681	3.5883	High
Overall	1.02379	3.8633	High

Table1.3. *Level of Students’ perception towards modular distance learning approach in terms of Teacher Support*

Indicator	Standard Deviation	Mean	Descriptive Level
1. My teacher is approachable when asked to explain the content of the module	1.08157	3.7100	High
2. My teacher is easy to reach out.	0.96929	3.9167	High
3. My teacher gives reminders about the tasks in my modules.	0.99618	3.7600	High
4. My teacher responds to my questions quickly and comprehensively.	0.99663	3.8267	High
5. My teacher provides feedback about my assessment result.	1.03004	3.7433	High
6. My teacher visits to hear issues and problems about my modules.	0.98538	3.8400	High
7. My teacher provides additional learning materials aside from modules such as books, video lessons, and handouts.	0.98538	3.8400	High
Overall	0.62665	3.8086	High

Taken together, these findings underscore the need to examine how students’ perceptions of the modular distance learning approach—mediated by the quality of e-learning services—affect their attitudes toward mathematics. This study aims to address this critical gap by exploring the mediating role of e-

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learning service quality in the relationship between perceptions of modular distance learning and student attitudes toward mathematics. In doing so, it contributes to the growing body of literature on effective strategies for mathematics instruction in the evolving context of distance learning.

2. RESEARCH OBJECTIVE

The study investigated, as its primary objective, the mediating effect of e-learning service quality on the relationship between perceptions of the modular distance learning approach and student attitudes towards mathematics among Grade 11 students from Caraga North and South District, Division of Davao Oriental namely: San Luis National High School, Sangab National High School, Caraga National High School, Santiago National High School and Pantuyan National High School. Specifically, the study ascertained the following objectives:

Table 2.1. Level of attitude of students towards mathematics in terms of Self-Confidence in Mathematics

Indicators	Standard Deviation	Mean	Descriptive Level
1. Mathematics is one of the subjects I am determined to improve in.	0.88512	4.0500	High
2. I feel challenged but capable of clear thinking when working with mathematics.	0.86886	3.7400	High
3. Studying mathematics motivates me to improve my skills.	0.79418	3.8933	High
4. Mathematics presents an opportunity to grow and learn for me.	0.84765	3.9767	High
5. I aim to change my negative perception towards math.	0.93176	3.7267	High
6. Mathematics is not intimidating to me.	0.96075	3.3267	Moderate
7. I approach mathematics with confidence.	0.99570	3.4567	High
8. I can handle mathematical problems with reasonable ease.	0.95831	3.2267	Moderate
9. I am confident in my ability to excel in any mathematics class I take.	1.01236	3.3767	Moderate
10. I occasionally find mathematics challenging but I persevere.	0.94284	3.4367	High
11. I pick up and understand mathematical concepts quickly.	1.00333	3.3367	Moderate
12. I believe I am skilled at solving mathematics problems.	1.03169	3.2500	Moderate
Overall	0.52772	3.5664	High

Table 2.2. Level of attitude of students towards mathematics in terms of Value of Mathematics

Indicators	Standard Deviation	Mean	Descriptive Level
1. I believe Mathematics is an incredibly beneficial and foundational subject.	1.04884	3.8833	High
2. I am eager to enhance my mathematical skills.	0.98829	3.7767	High
3. I think Mathematics strengthens the mind and teaches one to think critically.	0.93142	3.8633	High
4. I believe Mathematics is vital in daily life.	0.95972	3.8033	High
5. I think Mathematics is one of the most important subjects to focus on.	0.93667	3.8300	High
6. I believe High school mathematics courses are valuable regardless of my chosen field of study.	0.89075	3.7433	High
7. I can identify numerous ways where I apply math outside of school.	0.92576	3.6500	High
Overall	0.60959	3.7929	High

Table 2.3. Level of attitude of students towards mathematics in terms of Enjoyment in Mathematics

Indicators	Standard Deviation	Mean	Descriptive Level
1. I enjoy studying math in school.	0.98313	3.66333	High
2. I believe Mathematics is engaging and challenging.	0.90150	3.99667	High
3. I enjoy solving new problems in mathematics.	1.01978	3.48667	High
4. I prefer completing a task in math over writing an essay.	1.05638	3.43333	High
5. I love mathematics.	1.10098	3.37667	Moderate
6. I feel more comfortable in a mathematics class than in any other class.	1.05625	3.39333	Moderate
7. Mathematics is an interesting subject.	0.99376	3.68000	High
8. I am confident in expressing my ideas on how to find solutions to a challenging problem in mathematics.	1.02770	3.43667	High
9. I am relax when answering questions in my mathematics class.	1.10727	3.10667	Moderate
Overall	0.68202	3.50815	High

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Table 2.4. *Level of attitude of students towards mathematics in terms of Motivation in Mathematics*

Indicators	Standard Deviation	Mean	Descriptive Level
1. I am sure that I could learn forced mathematics.	0.88337	3.6600	High
2. I prefer utilizing math in my study.	0.95071	3.4500	High
3. I take more than the required measure of mathematics.	0.92059	3.3633	High
4. I intend to take as much as I can during my Math learning.	1.01012	3.5800	High
Overall	0.69925	3.5133	High

a. To know the level of students' perception towards modular distance learning approach in mathematics in terms of:

- Content of the Self-Learning Modules
- Parental Support
- Teacher Support

b. To know the level of students' attitudes towards mathematics in terms of:

- Self – Confidence
- Value of Mathematics
- Enjoyment in Mathematics
- Motivation in Mathematics

c. To know the level of students' perception towards e-learning service quality in terms of:

- E-Learning System Quality
- E-Learning Instructor & Course Material Quality
- E-Learning Administrative and Support Service Quality

d. To determine if there is a significant relationship among perception towards modular distance learning approach, attitude towards mathematics, and e-learning service quality

e. To determine the mediating effect of e-learning service quality on the relationship between perceptions of the modular distance learning approach and students' attitudes towards mathematics.

3. HYPOTHESES

Table 3.1. *Level of students' perception towards e-learning service quality in terms of E-learning System Quality*

Indicators	Standard Deviation	Mean	Descriptive Level
1. The layout of the information at e-learning website is easy to follow.	0.89664	3.5933	High
2. I feel the risk associated with e-transactions is low through the school's e-learning website.	0.86019	3.4233	High
3. I feel secure in providing sensitive information for e-transactions through the e-learning website.	0.88651	3.5067	High
4. The information on the e-learning website is up-to-date.	0.92672	3.5267	High
5. The e-learning course website provides me with valuable information	0.90372	3.5967	High
6. The e-learning course website allows me to find information easily.	0.98109	3.5633	High
7. The e-learning course website is visually appealing.	0.91510	3.5933	High
8. When promises is made to do something it is always realized.	0.84765	3.6433	High
9. It is easy for me to complete a transaction through the e-learning website.	0.94566	3.4267	High
10. I do not encounter long delays when searching for information on the e-learning website.	0.97836	3.4033	High
11. The information on the e-learning website is accurate.	0.98949	3.5867	High
12. The e-transactions are accurately dealt with.	0.95856	3.4700	High
Overall	0.56046	3.5278	High

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Table 3.2. Level of students' perception towards e-learning service quality in terms of E-learning instructor and course materials quality

Indicators	Standard Deviation	Mean	Descriptive Level
1. My school's e-learning instructors are knowledgeable in their fields.	0.93891	3.7267	High
2. My school's e-learning course materials are practical.	0.90259	3.6067	High
3. My school's e-learning course materials challenge me to think.	0.90382	3.7500	High
4. My school's e-learning course exams are reasonable in length and difficulty.	0.89450	3.5767	High
5. My school's e-learning instructors quickly and efficiently respond to student needs.	0.94256	3.6567	High
6. My school's e-learning instructors consistently provide good lectures	0.92255	3.7200	High
7. My school's e-learning instructors are well prepared and organized.	0.97411	3.7400	High
8. My school's e-learning instructors provide an environment which encourages interactive participation.	0.89255	3.7633	High
9. My school's e-learning instructors have the students' best long-term interests in mind.	1.03805	3.6267	High
10. My school's e-learning course materials are useful.	0.87372	3.7500	High
11. My school's e-learning course materials are up-to-date.	0.96065	3.6300	High
12. My school's e-learning course assignments are reason able in length and difficulty	0.88870	3.5533	High
Overall	0.57159	3.6750	High

Table 3.3. Level of students' perception towards e-learning service quality in terms of E-learning administrative and support service quality

Indicators	Standard Deviation	Mean	Descriptive Level
1. My school gets its e-learning support service right the first time.	0.86510	3.7100	High
2. With my e-learning, the school's staff tells me exactly when the service I require will be performed.	0.86809	3.6600	High
3. For my e-learning, the school's staff gives me prompt service.	0.95095	3.5933	High
4. For my e-learning, the school's staff has my best interests at heart.	0.97534	3.6233	High
5. For my e-learning, the school's staff understands my specific needs.	0.90580	3.6600	High
6. For my e-learning, the school's staff gives me personal attention.	0.94841	3.4867	High
7. For my e-learning, the help desk of my school has convenient operating hours.	0.99293	3.5267	High
Overall	0.61190	3.6086	High

The following hypotheses of the study was tested at 0.05 level of significance:

a. There is no significant relationship between:

- students' perception towards modular distance learning approach;
- students' attitude towards mathematics;
- Students' perception on e-learning service quality.

b. There is no mediating effect of e-learning service quality on the relationship between perceptions of the modular distance learning approach and student attitudes towards mathematics.

4. THEORETICAL FRAMEWORK

This study adapted the Self-determination theory by Deci & Ryan (2000). The theory describes the pressure caused by the condition of strengthening and any other pressure is decisive on one's actions. In this context of the study, modular distance learning and attitude are components of students' choices that contribute to autonomy, competence, and relatedness that can boost their interest in e-learning services as they succeed in their academic pursuits. Additionally, this study is supported by the theory of individualizing instruction through modules by Kemp and Smelie (1989), stating that students learn better when lessons are designed to match their needs and pace, allowing them to work independently using learning modules. This study illustrates a direct relationship between the mediating effect of students' perception towards modular distance learning approach and their attitude and readiness for e-learning in learning.

5. CONCEPTUAL FRAMEWORK

The conceptual paradigm in Figure 1 shows the independent variable, dependent variable and mediating variable of the study. The study posits students' attitude as the independent variable with indicators such as self-confidence, value, and enjoyment. Meanwhile, students' perception on e-learning service quality serves as the dependent variable, encompassing study skills, time management, and motivation. A mediating variable is a variable that explains the relationship between an independent variable and a dependent variable (Baron & Kenny, 1986). In the current study, e-learning service quality is the mediating variable.

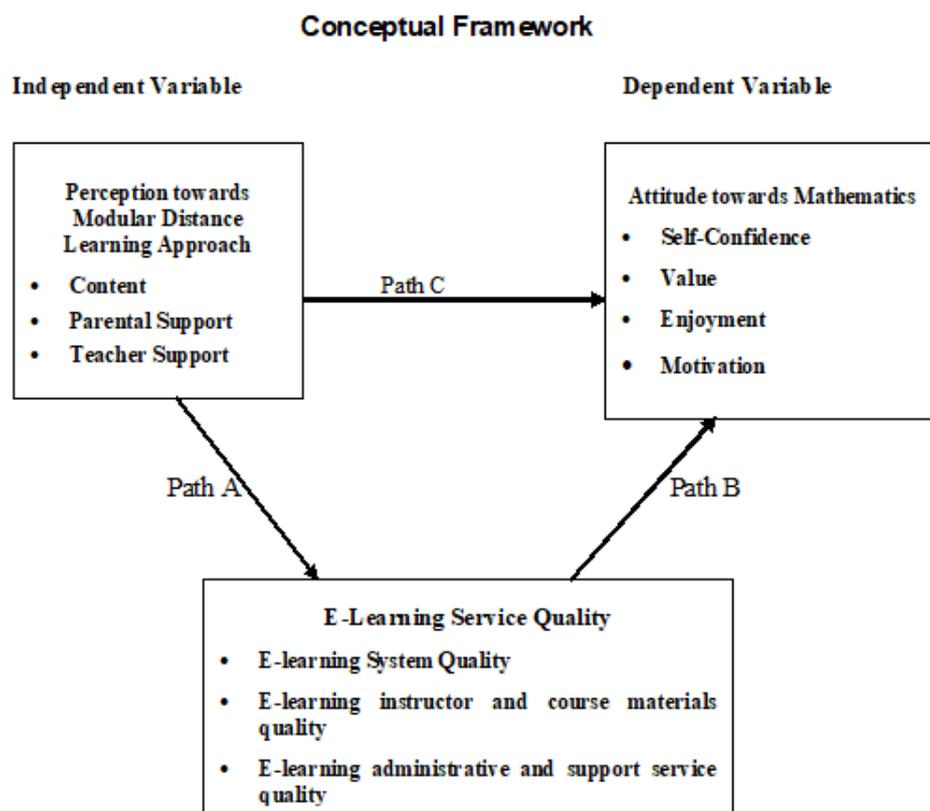


Fig. 1. The Conceptual Framework Showing the Variables of the Study

The framework of the study serves as a guide to determine the relationship between the independent variable (Perception towards Modular Distance Learning Approach - Path A) and dependent variable (Attitude towards Mathematics – Path B), the relationship between the independent variable (Perception towards Modular Distance Learning Approach -Path A), and mediating variable (E-Learning Service Quality - Path C) and dependent variable (Attitude towards Mathematics - Path B). Likewise, it serves as a map if the mediating variable (E-Learning Service Quality) has a mediating effect on both the independent variable (Perception towards Modular Distance Learning Approach) and dependent variable (Attitude towards Mathematics).

6. SIGNIFICANCE OF THE STUDY

The significance of this study has a global impact by enriching the current body of literature on mathematics education and modular learning. At the community level, the results can assist educators in improving the teaching and learning process, facilitating the effective application of the modular distance learning approach even after the pandemic. Additionally, this research will serve future scholars by offering a thorough understanding of how perceptions of the modular distance learning approach mediate students' attitudes and readiness for e-learning in mathematics. This aligns with the Sustainable Development Goals (SDGs) by promoting quality education and fostering inclusive and equitable learning opportunities.

In conclusion, this study endeavors to shed light on the intricate relationship between perception towards modular distance learning approach and student attitude, and the effect of e-learning service

quality, offering insights that could pave the way for more effective and adaptive teaching-learning methodologies in mathematics education.

Definition of Terms

Modular Distance Learning (MDL) – A form of distance education where students learn through printed or digital modules designed for self-paced and independent study. It typically includes limited real-time teacher interaction and was widely implemented during the COVID-19 pandemic.

Perception Towards Modular Distance Learning Approach – Refers to students' evaluation of MDL in terms of its content quality, clarity, relevance, and the support received from teachers and parents.

E-Learning Service Quality – The degree to which students perceive the effectiveness, reliability, and supportiveness of e-learning systems, including technical infrastructure, instructional quality, and administrative support.

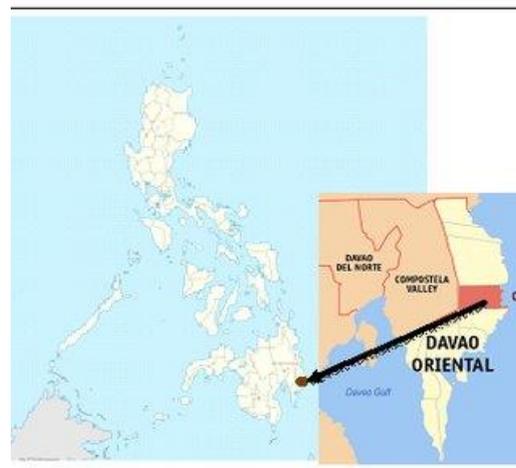
7. METHOD

7.1. Research Design

This study employed a quantitative non-experimental design, specifically utilizing a correlational research technique to collect data relevant to the study's objectives. Quantitative research, as described by Bhandari (2021), focuses on the quantification and analysis of data, primarily adopting a deductive approach that emphasizes theory testing, influenced by empiricist and positivist philosophies. In this context, non-experimental research involves observing and measuring naturally occurring variables without manipulating an independent variable. The study will incorporate mediation analysis to explore how e-learning service quality mediates the relationship between perceptions of the modular distance learning approach and student attitudes towards mathematics.

7.2. Research Locale

Figure 2 illustrates the geographic location of the study site, highlighting Davao Oriental on the map of the Philippines. The research was specifically carried out in selected secondary schools situated in both the Caraga North and South Districts, under the jurisdiction of the Division of Davao Oriental, Philippines.



7.3. Population and Sample

The respondents of the study were the grade 11 students of Caraga North and South District, Division of Davao Oriental namely: San Luis National High School, Sangab National High School, Caraga National High School, Santiago National High School and Pantuyan National High School enrolled during the school year 2024 - 2025; with a sample size exceeding 300 respondents to ensure the reliability and validity of the findings. The sample size was justified as it provides sufficient statistical power to detect meaningful relationships and effects, enhancing the generalizability of the results. The participation of respondents of the study was voluntary and they were able to withdraw anytime without consequences. All participants were informed about the purpose of the study and the rights as respondent. The data collected were kept confidential and used solely for the purpose of the study. A

proportional stratified sampling technique was employed to ensure a representative mix of students across various demographics, which is essential for examining the mediating effect of E-Learning Service Quality on the relationships between the perception towards Modular Distance Learning approach and students' attitudes towards mathematics.

8. RESEARCH INSTRUMENT

The study used the three sets of assessment tools. These instruments were modified and validated by a panel of experts to ensure their suitability for the study. A standardized rating scale was employed for all data collected across the variables used in the study.

The first set was Perception towards Modular Distance Learning Approach adapted from (Sumandal, 2022) serves as the independent variable with indicators: Content of the Self-Learning Module, Parental Support, and Teacher Support. The questionnaire employed a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Comprising a total of 26 items, the instrument demonstrated excellent internal consistency, with a Cronbach's Alpha coefficient of 0.9279. This high reliability score confirms that the data collected through the instrument is both valid and dependable for the purposes of this study.

The second set was Attitude towards Mathematics adapted from (Capuno et al, 2019) as dependent variable with indicators Self-Confidence, Value for Mathematics, Enjoyment in Mathematics and Motivation in Mathematics. The study utilized a 5-point Likert scale questionnaire, with responses ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). A reliability analysis was conducted on the 32-item instrument, yielding a Cronbach's Alpha coefficient of 0.9129. This result signifies a high level of internal consistency, indicating that the instrument is both reliable and suitable for measuring the intended variables in the study.

Third set was E-Learning Service Quality adapted from (Pham et al, 2019) as the mediating variable with indicators E-Learning System Quality, E-Learning Instructor and course materials and E-Learning administrative and support service quality. The study utilized a 5-point Likert scale questionnaire, with responses ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). A reliability analysis was conducted on the 31-item instrument, yielding a Cronbach's Alpha coefficient of 0.9551. This result signifies a high level of internal consistency, indicating that the instrument is both reliable and suitable for measuring the intended variables in the study.

In evaluating the variables, 5-point Likert scale was used of means of description

For the students' perception towards modular distance learning approach, attitude towards mathematics, and e-learning service quality among the students, 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.

Prior to the administration of the main survey, the researcher carried out a pilot test involving 30 respondents through a face-to-face survey. The purpose of this preliminary phase was to assess the reliability of the research instrument. The 89-item questionnaire was evaluated for internal consistency using Cronbach's Alpha, which yielded a coefficient of 0.9597. According to Hinton et al. (2004), this result reflects an excellent level of reliability, confirming that the instrument is both valid and dependable for use in the full study.

9. DATA COLLECTION

After validating the instruments, a request letter was written to the school's principal. Approval for the study was granted as it was awaited subsequently. The researcher personally visited the identified schools. With the assistance of the year-level coordinator, all Grade 11 students were gathered to answer the standardized and validated questionnaires. The answered questionnaires were retrieved immediately after the students completed them.

The data were encoded, analyzed, and interpreted using the following statistical tools: Mean and standard deviation. These statistical tools were used to determine the level of the mediating effect of perception towards the modular distance learning approach on the attitude and readiness for e-learning in learning mathematics of Grade 11 students.

Statistical Tools

Pearson Product Moment Correlation Coefficient (Pearson r): This was utilized to determine the significant relationship among the perception towards the modular distance learning approach, the attitude and perception of e-learning service quality by the students.

Regression Analysis and Path Analysis: These were utilized to ascertain the mediation effect, allowing for a comprehensive understanding of the relationships among the variables.

10. ETHICAL CONSIDERATION

In adherence to the ethical standards established by the University of Mindanao Ethics Review Committee, the researcher implemented measures to uphold the principles of respect, justice, and human dignity throughout the study. These measures included ensuring voluntary participation, safeguarding participants' privacy and confidentiality, obtaining informed consent, identifying and minimizing potential risks, and outlining the possible benefits of the research. Additional ethical considerations were also strictly observed, such as avoiding plagiarism, fabrication, and falsification; disclosing any conflicts of interest; maintaining transparency; securing permissions from relevant institutions or locations; and appropriately recognizing authorship and contributions during the conduct and documentation of the study.

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. Hence, prior to the administration of the questionnaires, the researcher will secure consent and assent 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.

Privacy and Confidentiality: To ensure the privacy and protection of participants, all identifying information will be kept strictly confidential and will not be disclosed to anyone outside the research team. The researcher will uphold the principle of anonymity, ensuring that neither the identities of the respondents nor the institutions they represent will be revealed at any stage of the study. Any personal or sensitive information collected will be securely stored and only accessed when necessary to safeguard the rights or welfare of the participants. This study will fully comply with the provisions of the Data Privacy Act of 2012, ensuring that all data are protected against unauthorized access, and that individual responses cannot be linked back to the participants, thereby preserving their anonymity and confidentiality.

Informed Consent Process: This process ensures that the personal rights and dignity of all participants are fully respected. Respondents will be thoroughly informed about the purpose, procedures, and potential benefits of the study in a clear and understandable manner. Their participation will be entirely voluntary, and informed consent will be obtained prior to their involvement, affirming that they are participating willingly and with full awareness of their rights and the nature of the research.

Recruitment: In recruiting the respondents of the study, 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. Avoid situations where individuals may feel pressured to participate, especially in a work or academic setting. The researcher shall also maintain open lines of communication with participants throughout the study. She will address any concerns or questions promptly and keep them informed about the progress and findings.

Risks: The researcher will also discuss potential risks that the respondents may encounter upon their agreement to participate. The researcher will ensure that the questions were constructed and delivered in a respectful manner so as to avoid embarrassment. More so, confidentiality of their answers will also be ensured all throughout the process.

Benefits: One of 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: In this study, plagiarism or 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. The data and information will be obtained and presented in the most accurate way of writing. Hence, no making up of data and/or outcomes, or knowingly presenting inaccurate conclusions. There will be no information in the text that is inconsistent with the current literature. Similarly, falsification is considered, with no evidence of purposely misrepresenting the work to meet a model or theoretical assumption. There is no proof of over claiming or exaggerations.

Fabrication: To prevent fabrication—the act of inventing data or results and presenting them as genuine—the researcher commits to maintaining accurate, detailed, and transparent records of all data collected throughout the study. This ensures that the documented findings faithfully reflect actual observations, allowing for reliable verification and comparison in future analyses or reporting.

Falsification: Falsification 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): Regarding potential conflicts of interest, the researcher affirms that no financial support or assistance of any kind has been received from any organization that could have a vested interest in the outcome of this study. Furthermore, the author declares that there are no affiliations, relationships, or activities that could be perceived as influencing the integrity, objectivity, or findings of the research.

Deceit: Any deception, deceit, or exaggeration about the aims and objectives of the research will be avoided. 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. Any type of misleading information, as well as representation of primary data findings in a biased way will be avoided. Most importantly, in this study, respondents will not be subjected to any harm in any ways whatsoever.

Permission from Organization/Location: Prior to the collection of data, 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. The researcher will write a letter of request to conduct the study. The copy of the research proposal and the questionnaires shall also be enclosed so that the said authorities would get an idea of the importance of this study to their department or school. Moreover, the researchers will get the convenient schedule of the students for administration. The researcher will request the principal to allow her to administer the questionnaires during the vacant time of the students to prevent the untimely disruption of their classes.

Authorship: The research will be written cooperatively by the researcher and adviser, 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 Students' perception towards modular distance learning approach

The data presented in Table 1 is the level of mathematics students' perception towards modular distance learning approach of the grade 11 students of Caraga North and South District, Division of Davao Oriental. It consisted of three indicators. As reflected in the results, the overall mean score of 3.6967 with (SD=0.55) characterized as high which means that the perception towards modular distance learning approach by students in mathematics are often times manifested clearly in the statements “the key concepts of the content are present and helpful”. In addition, among these three indicators, the highest mean score is recorded for the "Content of the Self-Learning Module" (Mean = 4.1233). Meanwhile, the "Teacher Support" indicator has the lowest mean score of 3.8086) with the standard deviation (SD=0.6267).

The results show that students have a generally favorable perception of the modular distance learning approach.

The Mediating Effect of E-Learning Service Quality on the Relationship between Perceptions towards Modular Distance Learning Approach and Student Attitude towards Mathematics

Table 1. Level of Students' perception towards modular distance learning approach

Indicators	Mean	SD	Descriptive Level
Content of the Self- learning Module	4.1233	0.8779	High
Parental Support	3.8633	1.0238	High
Teacher Support	3.8086	0.6267	High
Overall	3.6967	0.55099	High

11.2. Level of attitude of students towards mathematics

Shown in table 2 is the level of attitude of grade 11 students towards mathematics in Caraga North and South District, Division of Davao Oriental. The overall mean score is 3.5954 with standard deviation of 0.52871 characterized as high, meaning the attitude towards mathematics of grade 11 students is oftentimes valued.

Table 2. Level of attitude of students towards mathematics

Indicators	Mean	SD	Descriptive Level
Self-confidence in Mathematics	3.5664	0.52772	High
Value of Mathematics	3.7929	0.60959	High
Enjoyment in Mathematics	3.5081	0.68202	High
Motivation in Mathematics	3.5133	0.69925	High
Overall	3.5954	0.52871	High

11.3. Level of students' perception towards e-learning service quality

Reflected in Table 3 is the level of students' perception towards e-learning service quality of grade 11 students towards mathematics in Caraga North and South District, Division of Davao Oriental. Overall, the mean score for "E-learning Service Quality" (3.6041) with a standard deviation of 0.50906 and characterize as high. It reflects a generally positive, although not overwhelmingly strong perception of the online learning services.

Table 3. Level of students' perception towards e-learning service quality

Indicators	Mean	SD	Descriptive Level
E-Learning System Quality	3.5278	0.56046	High
E-Learning Instructor and Course Materials Quality	3.6750	0.57159	High
E-Learning Administrative and Support Service Quality	3.6086	0.61190	High
Overall	3.6041	0.50906	High

11.4. Significance on the relationship among perception towards modular distance learning approach, attitude towards mathematics, and e-learning service quality

Table 4 presents the correlation matrix of perception towards modular distance learning approach, e-learning service quality, and students' attitude towards mathematics of grade 11 students towards mathematics in Caraga North and South District, Division of Davao Oriental. The data show that the correlation between perception towards modular distance learning approach and e-learning service quality yields an r-value of 0.673, indicating a moderate and significant positive relationship. Similarly, the correlation between e-learning service quality and students' attitude results in an r-value of 0.666, also reflecting a moderate positive correlation. Lastly, the correlation between perception towards modular distance learning and students' attitude shows an r-value of 0.544, suggesting a moderate to strong positive relationship. All correlations are statistically significant at the 0.05 level, which highlights those improvements in service quality and learning perception are closely associated with more favorable student attitudes.

Table 4. Correlation Matrix of students' perception towards modular distance learning approach, e-learning service quality and attitude towards mathematics

	Perception Towards Modular Distance Learning Approach	E-Learning Service Quality	Students' Attitude
Perception Towards Modular Distance Learning Approach	1	.673**	.544**
E-Learning Service Quality	.673**	1	.666**
Students' Attitude	.544**	.666**	1

***. Correlation is significant at the 0.01 level (2-tailed).*

11.5. Mediation Analysis among variables

Table 5 presents regression results of the variables in the criteria of the presence of mediating effect. In figure 2, the medgraph of the study, it showcases the outcomes of path analysis. The structural equation modeling results reveal that e-learning service quality significantly mediates the relationship between students' perceptions of modular distance learning and their attitudes towards mathematics. The direct effect from perception (IV) to attitude (DV) is significant ($\beta = .168, p = .002$), but this effect becomes substantially stronger when mediated through e-learning service quality (indirect path: $IV \rightarrow MV = .622$; $MV \rightarrow DV = .569$). This suggests that students who perceive modular learning more favorably also tend to perceive e-learning services as better, which in turn boosts their attitude toward learning mathematics.

Table 5. Regression results of the variables in the criteria of the presence of mediating effect

			Estimate	S.E.	C.R.	P	Label
OVMMV	<---	OVMIV	.622	.040	15.746	***	
OVM DV	<---	OVM MV	.569	.060	9.533	***	
OVM DV	<---	OVM IV	.168	.055	3.052	.002	

Variances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
OVMIV			.303	.025	12.227	***	
e1			.141	.012	12.227	***	
e2			.150	.012	12.227	***	

**. Correlation is significant at the 0.01 level (2-tailed).

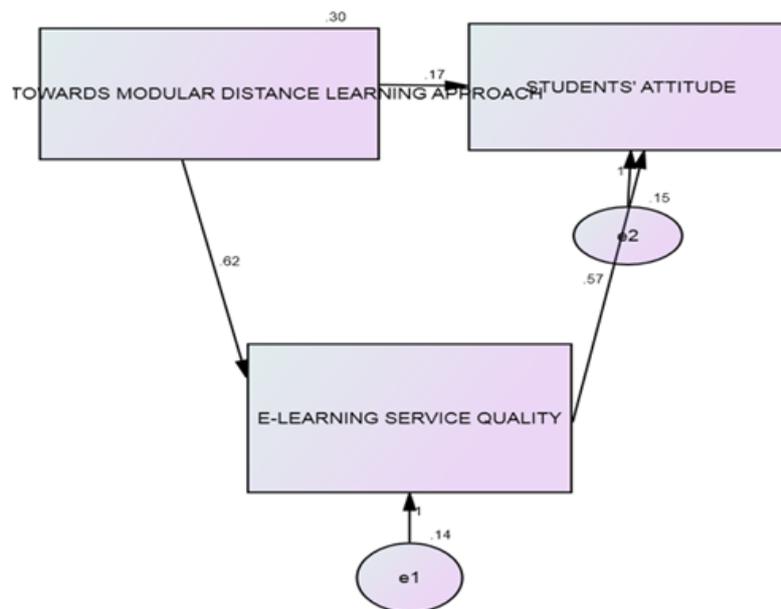


Fig 2. Medgraph

12. DISCUSSION

12.1. Students' perception towards modular distance learning approach

These findings imply that while modular learning materials are effective and well-developed, support mechanisms—both from teachers and at home—need strengthening. The variability in teacher and parental support highlights potential equity issues in distance learning settings, where students without strong home or instructional support may struggle. From a theoretical perspective, these findings align with Vygotsky's Social Development Theory, which emphasizes the critical role of social interaction in learning. Empirically, this supports studies by Bao (2020) and Panigrahi et al. (2018), who found that learner satisfaction in distance learning heavily depends on structured guidance and consistent communication from both instructors and guardians.

12.2. Attitude of students towards mathematics

The highest mean score is found in the "Value of Mathematics" (Mean = 3.7929), indicating that students generally recognize the importance and usefulness of the subject. On the other hand, "Enjoyment in Mathematics" has the lowest mean score (Mean = 3.5081), suggesting that while students may value math, they do not necessarily find it enjoyable.

These results imply that while students understand the importance of math, they may not find it engaging or enjoyable, which could negatively affect long-term motivation and performance. This aligns with the Expectancy-Value Theory (Eccles & Wigfield, 2002), which emphasizes that students' motivation depends not only on how much they value a task but also on the emotional experience associated with it. When students perceive high value but experience negative emotions, such as anxiety or boredom, their motivation may still decline. Recent empirical studies support this perspective; for instance, Schukajlow and Rakoczy (2019) demonstrated that positive emotions like enjoyment significantly contribute to students' willingness to engage in mathematical tasks. Similarly, Tulis and Ainley (2021) emphasized the importance of emotional experiences in shaping students' engagement and learning outcomes in mathematics. Therefore, fostering an emotionally supportive and enjoyable learning environment is essential in promoting more positive attitudes and deeper engagement with the subject.

12.3. Students' perception towards e-learning service quality

The highest mean is found in "E-learning Instructor and Course Materials Quality" (Mean = 3.6750), suggesting students appreciate the instructional and content aspects of their e-learning experience. The lowest mean is associated with "E-learning System Quality" (Mean = 3.5278), pointing to some possible dissatisfaction or technical limitations with the platforms used. Standard deviations are fairly low across all items, with the highest being for Administrative and Support Service Quality (SD = 0.61190), indicating slightly more diverse experiences in this area.

These findings indicate that while instructional quality in e-learning is perceived positively, technical and administrative support structures require improvement. This has practical implications for educational institutions that must prioritize not only teaching quality but also reliable and accessible digital infrastructure. This supports the SERVQUAL model in education, which includes dimensions such as reliability, responsiveness, and assurance. Empirically, these findings echo those of Al-Fraihat et al. (2020), who found that instructor quality and system usability are critical factors influencing learner satisfaction in e-learning contexts.

12.4. Significance on the relationship among perception towards modular distance learning approach, attitude towards mathematics, and e-learning service quality

The findings from the correlation table reveal statistically significant and positive relationships among all three variables: Perception towards Modular Distance Learning Approach, E-Learning Service Quality, and Students' Attitude (interpreted here as attitude towards mathematics, as per the objective). The strongest correlation was found between Perception towards Modular Distance Learning and E-Learning Service Quality ($r = 0.673$, $p < 0.01$), followed closely by E-Learning Service Quality and Students' Attitude ($r = 0.666$, $p < 0.01$). The lowest, yet still significant, correlation was between Perception towards Modular Distance Learning and Students' Attitude ($r = 0.544$, $p < 0.01$). These results suggest that students who perceive e-learning services as high in quality are more likely to have a positive outlook toward both modular learning and their attitude towards mathematics. This pattern highlights a cohesive interplay among the constructs—students' learning attitudes and satisfaction are closely tied to how they perceive the delivery and quality of their educational experience.

The significant and positive correlations among the three variables have meaningful implications for both educators and policymakers. First, the data imply that enhancing the quality of e-learning services—through accessible content, timely feedback, and user-friendly platforms—can foster more favorable perceptions of modular distance learning and potentially improve students' attitudes toward academic subjects like mathematics. This aligns with the Technology Acceptance Model (TAM) and Constructivist Learning Theory, which emphasize the role of perceived usefulness and learning environment quality in shaping attitudes and engagement. Empirical studies (Sun et al., 2008; Martin et al., 2020) also support these findings, suggesting that perceived e-learning service quality

significantly impacts student satisfaction and learning outcomes. Moreover, the more the teachers integrate the e-learning service quality to the students, the more students will be encouraged to aspires to do better. Hence, the students' attitude will improve (Namuag and Orilla 2021). Conversely, if e-learning services are poor, it may diminish students' trust in the modular approach and contribute to negative attitudes toward subjects perceived as challenging. Therefore, the results reinforce the necessity of investing in high-quality e-learning infrastructures and support systems, particularly in mathematics education, to optimize student attitude in a modular distance learning context.

12.5. On the Mediating Effect of E-Learning Service Quality

The regression results reveal several significant relationships among the study variables. First, there is a strong and statistically significant positive relationship between Perception of Modular Distance Learning and E-Learning Service Quality, with an estimate of 0.622 and a p-value less than .001. This suggests that as students' perception of the modular distance learning approach improves, their evaluation of the e-learning service quality also becomes more favorable.

Furthermore, E-Learning Service Quality shows a significant positive effect on Student Attitude towards Mathematics, with an estimate of 0.569 and a p-value also less than .001. This indicates that higher service quality is associated with more positive attitudes toward learning mathematics, emphasizing the role of the e-learning environment in shaping students' learning experiences and attitudes.

Even in the absence of the mediating variable, Perception of Modular Distance Learning independently and significantly predicts Student Attitude towards Mathematics, albeit with a smaller effect size of 0.168 and a p-value of .002. This means that the perception alone still contributes positively to students' attitudes, though its influence is not as strong as when mediated by e-learning service quality.

Given that all p-values are below the threshold of 0.05, we reject the null hypotheses for all examined paths. This confirms that all the relationships among the variables are statistically significant, establishing both direct and indirect pathways influencing students' attitudes toward mathematics.

The mediation appears to be partial, as the direct effect remains significant but is smaller than the indirect path. This implies that while the perception of modular distance learning directly shapes student attitudes, a large portion of this influence is funneled through the perceived quality of the e-learning service quality. Educational institutions can thus enhance students' attitude towards mathematics not only by improving content delivery through modular means but also by ensuring that the supporting e-learning infrastructure is of high quality—intuitive, accessible, and responsive.

The percent of total effect of factors of perception of modular distance learning approach on attitude towards mathematics that is mediated by e-learning service quality is 54.71%. This indicates around 55 out of a hundred is the effect of factors of perception of modular distance learning on attitude towards mathematics of goes through its influence on the e-learning service quality, while the remaining 45 out of a hundred represent direct effects. Since partial mediation took place in this study, it can be understood that the e-learning service quality is not sole reason perception of modular distance learning approach can influence attitude towards mathematics of students.

13. CONCLUSION

Concluded from profound contemplation of the findings of the study, conclusions are drawn in this section. Grade 11 students from the Caraga North and South Districts demonstrated generally high levels of perception toward the modular distance learning approach, e-learning service quality, and attitude toward mathematics. Despite these positive overall results, certain components—such as teacher support in the modular approach and enjoyment in mathematics—received comparatively lower ratings, indicating areas that require targeted intervention. Furthermore, the correlation analysis revealed significant positive relationships among the three main variables, leading to the rejection of the null hypothesis. Of particular note is the result of the mediation analysis, which confirmed that e-learning service quality partially mediates the relationship between students' perception of modular distance learning and their attitudes toward mathematics. This implies that while perceptions of modular learning independently influence students' attitudes, the presence of high-quality e-learning services enhances this effect. The findings support the Self-Determination Theory (Deci & Ryan, 2000), which highlights the importance of autonomy, competence, and relatedness in fostering academic motivation and positive learner attitudes.

14. RECOMMENDATION

In light of these conclusions, several recommendations are proposed for educational stakeholders. First, there is a need to strengthen teacher support mechanisms by providing professional development programs that equip educators with strategies for fostering engagement and emotional support, particularly in mathematics. The integration of more interactive and student-centered instructional practices is also encouraged to increase students' enjoyment and reduce anxiety related to the subject. Second, the quality of e-learning systems should be improved, particularly in terms of technical reliability and platform accessibility, as these factors significantly influence student satisfaction and engagement. Third, efforts to enhance parental involvement must be intensified by conducting orientations, webinars, and distributing instructional resources that help parents effectively support their children in modular learning environments. Furthermore, the establishment of peer support programs and mentorship initiatives is recommended to provide students with academic assistance and emotional reinforcement, contributing to a more inclusive and collaborative learning experience. Lastly, institutional policies should prioritize continuous evaluation and improvement of e-learning services. This includes ensuring the consistency of instructional content, responsiveness of educators, and adequacy of administrative support. By addressing these areas, educational institutions can foster a more effective, equitable, and engaging modular distance learning environment—ultimately improving student outcomes and attitudes, particularly in mathematics.

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dedicated to all teachers and students who remain steadfast in their pursuit of knowledge and deeper understanding in related fields.



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