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Mathematics learning motivated by computer attitude and social media engagement

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Abstract
Purpose: This study aimed to investigate the impact of computer attitudes and social media engagement on students' motivation to learn mathematics.
Methodology: The study followed a descriptive-correlational approach involving 181 Grade 11 students from three private schools. Questionnaires and statistical tools were used to gather the data.
Results: The results revealed a clear connection between positive computer attitudes and active social media engagement. Moreover, significant evidence has indicated the effectiveness of motivated strategies in improving math learning outcomes. Interestingly, while computer attitudes alone did not significantly influence these strategies, social media engagement had a notable impact.
Limitations: Limited generalizability (specific region, Grade 11 private school focus).
Contribution: Enhances understanding of the link between computer attitude, social media, and motivated strategies in math learning. Emphasize integrating social media to boost motivation and learning outcomes. Valuable for students, teachers, administrators, and officials in shaping effective strategies.
Novelty: One key takeaway is the importance of integrating social media platforms into educational practices to enhance motivation and improve learning outcomes. This study provides valuable insights for students, teachers, administrators, and policymakers as they work together to shape effective learning strategies. Moreover, it offers a unique perspective on the role of technology and social media in fostering motivation and enriching learning experiences.
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1. Introduction

Motivated learning strategies are among the main determinants of learning achievement in numerous educational studies (Gbollie & Keamu, 2017). Katz (1964) found that motivation for learning affects students' learning and performance. However, according to Boggiano (2017), there are significant issues in students' motivated strategies for learning that should be explored as one of the essential variables for attaining effective motivation. Hopper (2021) stated that there are students with low self-efficacy showing a negative belief in their mathematical capabilities that may disengage mathematical activities or escape the circumstances. In addition, Hopper (2021) added that these students also have issues with their intrinsic value, such as showing poor interest in learning and often avoiding engaging in challenging mathematics activities. Moreover, according to Dağgöl (2019), some students lack the motivation to study, are unhappy in the learning environment, and soon lose interest in the normal curriculum.

In Malaysia, there are problems with students' motivation to learn mathematics, which affect their academic performance. There are students with low intrinsic value who show poor interest in the subject and negative beliefs in learning and their skills in mathematics, and a lack of cognitive strategy use, such as their critical cognitive capabilities and deficiency of problem-solving strategies in mathematical activities (Wong & Wong, 2019). In addition, some students had weak intrinsic values, showing poor interest and low participation in mathematics classes. However, in Indonesia, Azmidar, Darhim, and Dahlan (2017) discovered that students' self-efficacy in mathematics is low, demonstrating a negative belief in their individual capabilities that contribute to the problems of their individual motivations for learning the subject. Specifically, it has been found to negatively impact students' motivation for learning because of the negative beliefs that mathematics is very difficult, uninteresting, not very practical, and contains a large number of abstract concepts that are extremely difficult to understand. Moreover, in Australia, Harding et al. (2019) discovered an issue regarding students' self-regulation, particularly in a reduced reported utilization of self-regulation learning abilities in grade 7 students compared to grades 5, 6, and 8, owing to age-related differences outweighing performance differences. Furthermore, Harding et al. (2019) suggested that students would exhibit lower or greater degrees of self-regulation, depending on their behaviors and motivations for learning mathematics.

In the Philippines, the quick implementation of online learning due to the COVID-19 pandemic impacts college students' issues regarding their motivation strategies for learning mathematics. In a study involving 200 (66 male and 134 female) students from a private higher education institution in the Philippines, Barrot, Llenares, and Del Rosario (2021) found differences in students' motivated strategies for learning mathematics. First, low self-efficacy and interest in learning mathematics issues were observed among the engineering students. Specifically, there were students who expressed dissatisfaction with online learning in general with communication and question-and-answer formats inside online class discussions and activities. In addition, certain students have low interest in learning mathematics as a result of numerous barriers encountered in a home-learning environment, such as a lack of technological mastery, insufficient technological resources, high Internet costs, and limited interaction or socialization between and among students. Moreover, the results further attested that some students were unmotivated to learn online and demanded standard learning methods instead of enhancing self-paced learning.

Gorenko (2020) stated that several studies have proven that integrating technology in learning improves student outcomes significantly as it opens up new possibilities for home education. However, adapting to technology is complicated. For example, the educational potential of social media, in both formal and informal learning contexts, has been widely acknowledged. However, how social media use in informal contexts might influence students' learning in formal contexts remains underexplored (Lai, 2019). Moreover, Ayanso and Moyers (2020) and Liyanapathirana (2019) argued that there is a lack of research on technology usage by mathematics students. As a result, the primary goal of this research is to conduct a thorough investigation into students' computer attitudes, social media engagement, and motivated strategies for learning mathematics in an attempt to provide teachers, students, educational institutions, and researchers with a more structured view of the potential benefits and drawbacks of using technology in the teaching-learning process, particularly in the field of mathematics.

This study aims to improve students' motivation to learn mathematics. Specifically, the results of this study are essential to students facing a new typical learning environment, as understanding their computer attitudes and social media engagement may play an essential role in their motivated strategies for learning mathematics. Moreover, through this study, mathematics teachers and administrators may discover innovative strategies that will encourage students to improve their motivation strategies for learning mathematics and utilize this study as a valuable way to address the needs and challenges of the modern teaching-learning environment.

The use of technology and its significant advancements have revolutionized many aspects of education. The situations mentioned above prompted the researcher to examine the relevance of whether computer attitudes and social media engagement influence motivated strategies for learning mathematics.

Moreover, the researcher was enthusiastic about participating in and innovating in disseminating the study's findings to immediate beneficiaries, which included both private and public educational institutions.

1.1 Research Objectives

1. What is the level of computer attitude among students concerning the following?
   1.1 Affective component?
   1.2 Perceived usefulness?
   1.3 Perceived control?
   1.4 Behavioral intention?
2. What is the level of social media engagement among students regarding the following:
   2.1 Adoption intention?
   2.2 Perceived usefulness?
   2.3 Perceived ease of Use?
3. What are the levels of motivated strategies for learning mathematics among students concerning the following:
   3.1 Self-efficacy?
   3.2 Intrinsic value?
   3.3 Cognitive strategy Use?
   3.4 Self-regulation?
4. A significant relationship exists between
   4.1 Computer attitude and students' motivation strategies for learning mathematics?
   4.2 Social media engagement and students' motivation strategies for learning mathematics
5. Do computer attitudes and social media engagement significantly influence students' motivation strategies for learning mathematics?

1.2 Hypotheses

The following hypotheses were created to determine whether there is a level of significance and a significant relationship between the variables.

1. There was no significant relationship between computer attitude and motivation strategies for learning mathematics among students.
2. There was no significant relationship between social media engagement and motivated strategies for learning the mathematics of students.
3. Computer attitude and social media engagement did not influence motivation strategies for learning mathematics.

2. Literature review

The following text was taken from several works of writing relevant to the research in terms of motivated strategies for learning mathematics as impacted by students' computer attitudes and social media engagement.

2.1 Computer Attitude and Motivated Strategies for Learning

Several articles and propositions, as part of the related literature in this research, collectively emphasize that one’s behaviors, actions, and motivations in a learning environment with computers are the result of the influence of one’s attitudes (Burger & Blignaut, 2004; Ololube, 2009; Sam, Othman, & Nordin, 2005). As a result, there have been highlights on understanding various dimensions of computer attitude that played significant roles in the teaching-learning environment for both the teachers and students (Mahdizadeh, Biemans, & Mulder, 2008; Mallem, Chavand, & Colle, 1992). Specifically, a focus on the application of educational technology and students' attitudes was observed and stressed. Moreover, Ekizoglu and Ozcinar (2010) and Mahdizadeh et al. (2008) strongly emphasize that teachers are the most critical facilitators in shaping students' attitudes that have a connection with their motivated learning strategies. The works of Stott (2016) and Miller (2005) further emphasized that attitudes towards computers shape one’s experiences that may affect perceptions, particularly in a teaching-learning process.

Efficient use of motivated learning strategies is crucial for effective teaching and learning. Rabinowitz (2017) found that such strategies enhanced students' ability to apply prior knowledge to new learning experiences, leading to improved learning outcomes. To achieve this, a curriculum that emphasizes cognitive and metacognitive development, particularly in subjects such as mathematics and science, is essential (Núñez et al., 2015).The effective use of motivating learning strategies also strengthens students' metacognitive abilities (Ohene-Nyako, Persons, & Napier, 2018). Schools must identify and support their students' motivation for learning practices and implement specialized initiatives to help them reach their academic potential (Abdulrasheed & Bello, 2015). Middleton and Spanias (1999) emphasized the significance of students' perseverance in problem-solving in an effective learning environment. Goal orientation, a motivational characteristic, drives students to participate in activities to learn and perform, influencing their behavior in different situations. Mayer (2016) suggested that motivation for learning is an internal force driving individuals to make changes in their emotions and behaviors to achieve their goals, promoting self-awareness and success. Hannula et al. (2016) argued that students' motivation for learning affects the mathematics teaching-learning environment, influencing their intellect, emotions, and behavior. Positive outcomes such as good test scores can lead to increased motivation and happiness among students.

2.2 Social Media Engagement and Motivated Strategies for Learning

As emphasized by Zepke and Leach (2010) and Alabdulkareem (2015), social media engagement and what social media offers in various ways play significant roles in students' motivation for learning. Hence, multiple studies on the use of social media and its impact on students' education have been conducted (Lau, 2017; Murthy, 2012; Sheikh, Sheikh, & Soomro, 2016). Specifically, social media engagement has demonstrated significant effects on students' learning, motivation, and attitudes, especially in complex subjects, such as mathematics (Liyanapathirana, 2019). Moreover, these emphases are supported by the works of de Araujo, Otten, and Birisci (2017); Kukulska-Hulme and Traxler (2013), which highlight that the emergence and high-technological aspects of digital devices significantly impact the teaching-learning environment, especially in Mathematics subjects.

On the other hand, the works of Mulenga and Marbàn (2020); Gulzar, Ahmad, Hassan, and Rasheed (2022), further emphasized that while various researches proved the benefits of social media engagement to students' learning, motivation, and even performance, there are still solid needs for further research concerning especially on its relation to Mathematics subject that has become a challenge in the fields of education. Furthermore, concerning technology integration in a learning environment, Petit and Carcioppolo (2020) suggested that teachers, curriculum designers, and school administrators must consider integrating mobile features in a classroom setting that may impact students' motivation for learning.

The works of Begum and Hamzah (2017) and Mayer (2016) emphasized that motivation for learning governs students' emotions that affect their behaviors in a teaching-learning process. Hannula et al. (2016) emphasize that these motivations for learning influence students in different ways, particularly in mathematics. Moreover, as it is evident that students' motivation for learning comes from diverse factors, de Araujo et al. (2017) attested that one of the influences of students' learning, particularly in mathematics, is the utilization of social media as part of technology integration in a learning environment. On the other hand, while propositions from Liyanapathirana (2019) specifically suggested that social media engagement has significant effects on students' performance and learning attitudes, it seems that there are opposing views from Gulzar et al. (2022) and Mulenga and Marbàn (2020), which highlight that social media engagement is still viewed as a challenge in the context of mathematics.

Furthermore, as technology integration in a learning environment obviously involves the utilization of computers, Mahdizadeh et al. (2008) proved that there is a vast amount of research concerning the understanding of different variations in students' computer attitudes. In sum, based on the aforementioned propositions and views that draw relationships between students' social media engagement, computer attitudes, and motivated strategies for learning, Ekizoglu and Ozcinar (2010) clearly suggest that there is a need to understand the influences of those areas in technology integration that affect students' motivated strategies for learning, particularly in mathematics.

Social media engagement supports interactive mental representations, enhancing students' motivated strategies for learning (Latif, Hussain, Saeed, Qureshi, & Maqsood, 2019). Educational institutions use social media to broaden their education and boost their motivation (Kafyulilo, 2010). Social media platforms, such as YouTube, Facebook, and Twitter, facilitate information exchange (Mostafa, 2015). Motivation and disposition on social media influence interactive learning (Zepke & Leach, 2010). Students actively engage in social networking sites and share materials and ideas (Alabdulkareem, 2015).

Research on social media in teaching mathematics has been conducted with a focus on Facebook and WhatsApp (Chukwuere & Bonga, 2018; Chun & Lee, 2017; DeLegge & Wangler, 2017; Lau, 2017; Mahmud, Ramachandiran, & Ismail, 2018; Murthy, 2018; Park, Song, & Hong, 2022; Sheikh et al., 2016). These studies reveal significant impacts on student performance and attitudes (Cuesta, Eklund, Rydin, & Witt, 2016; Garcia & Erlandsson, 2011; Gwena, Chinyamurindi, & Marange, 2018; Madge, Meek, Wellens, & Hooley, 2009).

2.3 Theoretical and Conceptual Framework

This study was anchored in the work of Hilty and Huber (2018), who mentioned that by motivating students to explore computer integrated learning resources and understand their computer attitudes, a growing interest leads them to have new experiences, which influences their motivated strategies for learning. Granito and Chernobilsky (2012) further emphasized that computer attitude has a significant and robust relationship with students' motivated strategies for learning Mathematics. Specifically, Simões, Oliveira, and Nunes (2022). also proposed that enhancing computer attitudes and information processes improves students' motivated learning strategies. Teo and Lee (2008). stated that the computer attitudes of students in using a computer as a medium for instruction and their capacity to sustain their motivation for learning are crucial to understanding content beyond the basic education level and advancing in the teaching-learning environment.

On the other hand, Musibau, Oluyinka, and Long (2011) postulated that social media engagement is associated with developing students' motivated strategies for learning by providing an opportunity for them to share ideas even if they are not physically staying in touch. According to Hosen et al. (2021), social media engagement leads to the formation of students' habits that significantly affect their motivated learning strategies. Lai (2019) confirmed that social media engagement in informal settings may influence students' motivated learning strategies in formal contexts.

Larbi-Apau and Moseley (2012). identified computer attitudes as measured by affective components, perceived usefulness, perceived control, and behavioral intention. Silva (2015), Based on his technology acceptance model (TAM), Silva (2015) emphasized that adoption intention, perceived usefulness, and perceived ease of use are the three (3) components of social media engagement. Pajares (2003) identified Self-Efficacy, Intrinsic Value, Cognitive Strategy Use, and Self-Regulation as four (4) measures of motivated learning strategies.

The conceptual paradigm of this study is illustrated in Figure 1. The first independent variable of this study was computer attitude, which involved affective components, perceived usefulness, perceived control, and behavioral intention. The second independent variable was social media engagement with indicators of adoption intention, perceived usefulness, and perceived ease of use. The dependent variable was motivated strategies for learning with indicators of self-efficacy, intrinsic value, cognitive strategy use, and self-regulation. By connecting the findings of several investigations, the researcher arrived at the hypothesized model shown in Figure 1.

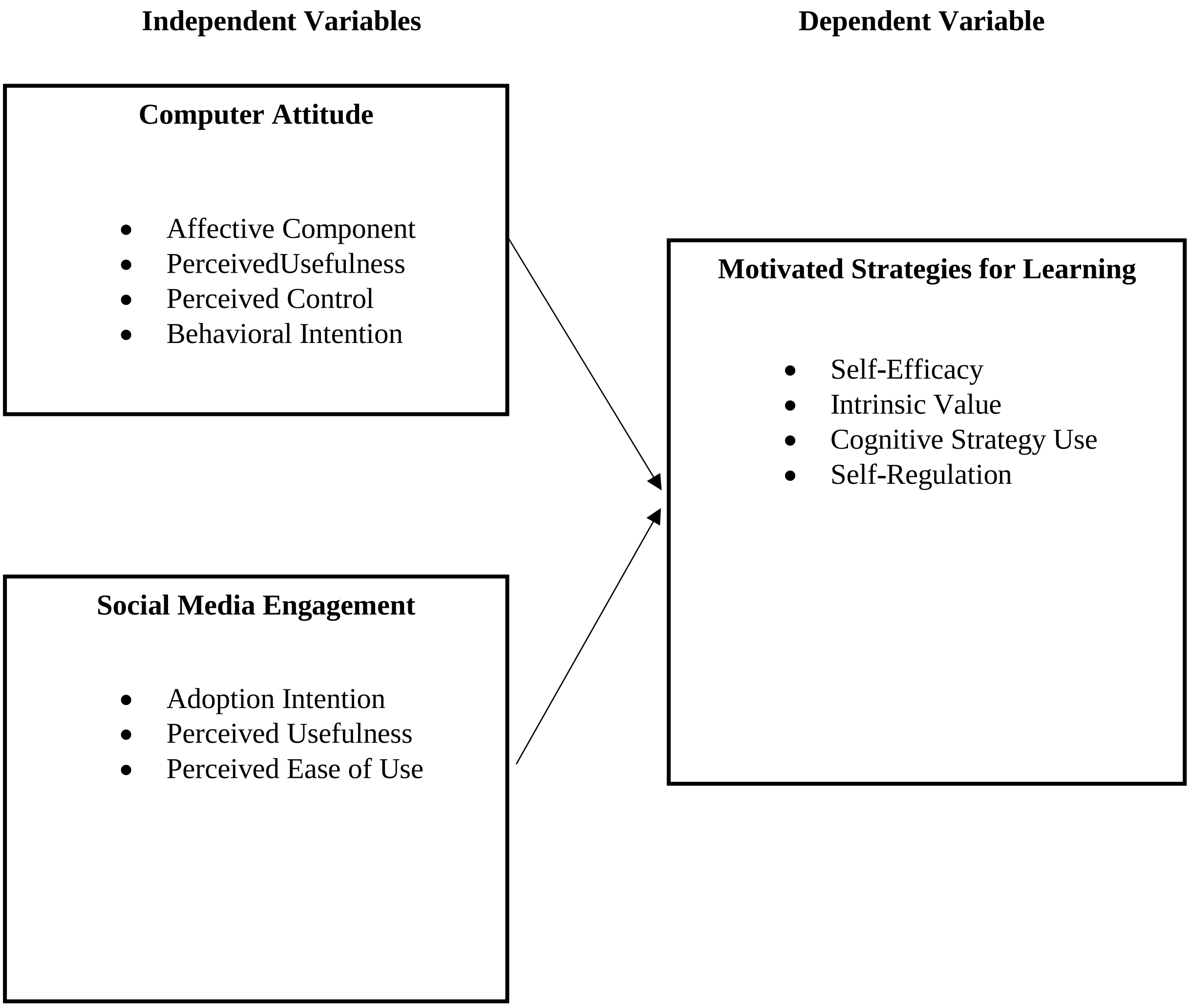

Figure 1. The Conceptual Paradigm of the Study

2.4 Significance of the study

This study aimed to be beneficial to a variety of individuals. This was particularly beneficial to the following beneficiaries:

Students: This study contributed to their recognition of the importance of understanding computer attitudes and social media engagement in improving their motivation strategies for learning mathematics. It empowered them to enhance their learning strategies and engagement, making them better at prioritizing their daily tasks and applying new motivated strategies to excel in mathematics.

Teachers: This research helped them discover innovative ways to assist students in boosting their motivated strategies for learning mathematics and addressing the challenges of modern teaching and learning. As facilitators of the learning process, teachers have gained valuable insights into the relationship between students' computer attitudes, social media engagement, and motivated learning strategies, which are pivotal for effective education.

School Administrators: This study provides a foundation for addressing students' needs in developing motivated learning strategies. This encourages administrators to create enhancement programs and seminars, strengthening their support for mathematics teachers in improving teaching methods to tackle students' learning issues, particularly in mathematics.

DepEd Officials: Equipped with substantial research data, they can develop and implement innovative educational projects and programs. The study's findings serve as academic references, aiding the resolution of students' motivated learning strategy issues. They could use this knowledge to conduct educational training, seminars, and webinars, ultimately producing successful students.

Future Researchers: This study serves as a valuable guide and reference for exploring the relationship among computer attitudes, social media engagement, and motivated learning strategies in mathematics. It aids in formulating comprehensive research plans that contribute to educational success, particularly in mathematics education.

3. Methodology

This chapter discusses the study's methodologies, such as the research design, respondents, instruments, data-gathering procedures, statistical tools, and ethical considerations.

3.1 Research Design

This study applied a quantitative research design that incorporated both descriptive and correlational methods. Quantitative research is concerned with quantifiable data and statistical, mathematical, or numerical analysis of data collected by voting, questionnaires, and surveys or by modifying pre-existing statistical data using computing tools. It involves the collection and generalization of numerical data across sets of individuals, or with the interpretation of a particular phenomenon. Additionally, quantitative research is a technique used to gain knowledge about a specific group of individuals, referred to as the sample population. It uses scientific inquiry to evaluate issues regarding a sample population using observed or measured data (Creswell & Creswell, 2017).

Descriptive research refers to approaches designed to directly describe the characteristics of the variables under investigation. This method concentrates on the "what" rather than the "why" of the studied problem. The primary goal of descriptive research was to describe the features of the study group. (Voxco, 2021).Furthermore, correlational research has aimed to establish correlations among multiple variables. It determines whether a change in one variable corresponds to a change in another (Curtis, Comiskey, & Dempsey, 2016).

The aforementioned design was used by the researcher to address the main interests and objectives of the study. Specifically, the descriptive approach was used by the researcher to determine and describe students' computer attitude, social media engagement, and motivated strategies for learning mathematics. Specifically, it involved the mean test, since the study aimed to measure the level of computer attitude, social media engagement, and motivated strategies for learning mathematics. Moreover, a correlational approach was used to test and determine the relationship between students' computer attitudes and motivated strategies for learning mathematics, as well as their social media engagement and motivated strategies for learning mathematics.

3.2 Research Respondents

The respondents in this study were Grade 11 students from three (3) private schools in Sto. Tomas, Davao del Norte, enrolled in S.Y. 2021-2022. Collectively, the respondents' population size in the study comprised 339 students. Specifically, School A consisted of 60 students, School B consisted of 136 students, and 143 students came from School C. Moreover, this study utilized a stratified sampling technique to determine the sample size and the final total number of respondents. School A had an ideal sample size of 30 students (181×0.17), School B had 74 students (181×0.40), and School C had 77 students (181×0.42). Furthermore, by using the Qualtrics online sample size calculator and specifically allowing a 95% confidence level (Z-Score=1.96) and a 5% margin of error, given the identified collective population size of 339 students, the ideal sample size of this quantitative study was 181 students.

3.3 Research Instrument

Three (3) adopted research tools. These were purposefully selected and modified to fit the objectives of the study. Additionally, the panel validated the three research tools.

Attitudes Towards Computer Attitude Scale (ATCS). The instrument for computer attitude was adopted from the Attitudes Towards Computer Scale (ATCS) Questionnaire. The ATCS is a reliable instrument for measuring attitudes towards computers (Nickell & Pinto, 1986). The ATCS consists of 21 items. Affective Component (six items), Perceived Usefulness component (five items), Perceived Control Component (six items), and Behavioral Intention Component (four items). For reliability, the Cronbach's alpha values of each variable of the questionnaire were as follows: Affective Component (AC)= 0.744, Perceived Usefulness (PU)= 0.590, Perceived Control (PC)= 0.719, and Behavioral Intention (BI)= 0.606, which collectively has 0.779 reliability. The ATCS consists of 21 items. Affective Component (six items), Perceived Usefulness component (five items), Perceived Control Component (six items), and Behavioral Intention Component (four items). Furthermore, this questionnaire was anchored on a 5-point Likert scale ranging from: 5-*Strongly agree - to 4 (Agree-3, Moderately Agree-2, and 1 Disagree). Strongly Disagree.*

The following parameter limits, along with their corresponding descriptions, were applied to the level of students' computer attitudes.

Parameter Limits	Descriptive Equivalent	Interpretation
4.20 – 5.00	Very High	This means that students' computer attitude is very much evident at all.
3.40 – 4.19	High	This means that students' computer attitude is much evident
2.60 – 3.39	Moderate	This means that students' computer attitude is moderately evident.
1.80 – 2.59	Low	This means that students' computer attitude is less evident.
1.00 – 1.79	Very Low	This means that students' computer attitude is least evident.

Technology Acceptance Model (TAM). The instrument for social media engagement was adopted from the Technology Acceptance Model (TAM) initially proposed by Davis (1989) and refined by many others (Venkatesh & Brown, 2001). For reliability, the following are the Cronbach's alpha values of each variable of the questionnaire: Adoption Intention (AI)= 0.714, Perceived Usefulness (PU)= 0.855, and Perceived Ease of Use (PEU)= 0.853, indicating strong reliability. Furthermore, this questionnaire was anchored on a 5-point Likert scale ranging from: 5-*Strongly agree - to 4 (Agree-3, Moderately Agree-2, and 1 Disagree). Strongly Disagree.*

The following parameter limits with their corresponding descriptions were applied to the level of students' social media engagement:

Parameter Limits	Descriptive Equivalent	Interpretation
4.20 – 5.00	Very High	This means that social media engagement is very much manifested.
3.40 – 4.19	High	This means that social media engagement is much manifested
2.60 – 3.39	Moderate	This means that social media engagement is moderately manifested.
1.80 – 2.59	Low	This means that social media engagement is less manifested.
1.00 – 1.79	Very Low	This means that social media engagement is least manifested.

Motivated Strategies for Learning Questionnaires (MSLQ). The Motivated Strategies for Learning instrument was adopted from the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich (1991). There were 40 questions in the questionnaire, which were divided into four categories. It contained questions about *self-efficacy (9 items), intrinsic value (9 items), cognitive strategy use (13 items),* and *self-regulation (9 items)*. For the reliability reported a Cronbach alpha of 0.89 on self-efficacy variables, 0.87 for intrinsic value variables, 0.83 for cognitive strategy, and 0.83 for self-regulation. Furthermore, this questionnaire was anchored on a 5-point Likert scale ranging from: 5- *Strongly agree* **-** *to 4 (Agree-3, Moderately Agree-2, and 1 Disagree). Strongly Disagree.*

The following parameter limits, with their corresponding descriptions, were applied to the level of students' motivation strategies for learning mathematics.

Parameter Limits	Descriptive Equivalent	Interpretation
4.20 – 5.00	Very High	This means that motivated strategiesfor learning are very much observed.
3.40 – 4.19	High	This means that motivated strategies for learning are much observed.
2.60 – 3.39	Moderate	This means that motivated strategies for learning are moderately observed.
1.80 – 2.59	Low	This means that motivated strategies for learning are less observed.
1.00 – 1.79	Very Low	This means that motivated strategies for learning are least observed

3.4 Data Gathering Procedure

The following actions were taken to collect data for this study:

General orientation and consent seeking from research respondents**.** The researcher obtained the necessary permissions from the school authorities and prioritized the ethical principles in this study. Informed consent was obtained from the participants, and the data were kept confidential. Online surveys were conducted securely, following data privacy regulations, and personal information was protected. The study adhered to data privacy laws, and the participants' identities were concealed. Data were retained for three years and then securely destroyed. Anonymity was maintained, and the study aimed to benefit participants while ensuring their well-being throughout the research process.Administration and retrieval of the questionnaire. The study began in March 2021-2022 academic year. Before administering the survey questionnaire, the researcher educated the gatekeeper on the critical nature of ethical issues, especially where the respondents were concerned about data collection. With this, both the gatekeeper and researcher signed a confidentiality agreement.

In this case, the researcher quickly returned the questionnaires. The surveys took 90 min to complete. The researcher was responsible for all contact and distribution of the questionnaire on an individual basis, and promptly provided the Google Form link to the SMCTI-REC. Finally, the questionnaires were gathered when the responders were granted their allocated time for the research.

Checking, collating, and processing the data**.** Finally, the lead investigator collected, verified, and quantified the respondents' scores obtained using an Excel spreadsheet, which were sent to a statistician at a graduate school for data analysis. Subsequently, the lead investigator examined the data in order to provide the study's findings and analysis.

3.5 Statistical Treatment of Data
The study's findings were examined and appropriately comprehended using the following statistical tools:

Mean. This is sometimes referred to as the arithmetic mean, which is a value that summarizes a group of integers. A statistical tool was used to determine the level of students’ computer attitudes, social media engagement, and motivated strategies for learning mathematics. In this study, this tool was utilized to address Research Questions 1, 2, and 3 in particular.

Standard Deviation. Standard deviation is a measure that expresses the dispersion of a dataset from its mean. This statistical tool was used to determine the degree to which the scores were close to the mean. This information was required to respond to questions 1, 2, 3, and 4.

Pearson r. Pearson product-moment correlation, sometimes known as Pearson r, is the most extensively used correlation metric. This statistical technique was utilized to determine whether there was a link between students’ computer attitude and motivated strategies for learning mathematics, as well as social media engagement and motivated strategies for learning mathematics. This was used to respond to the research questions in 4.1, and 4.2.

Multiple Regression Analysis. Regression analysis is a collection of statistical procedures used to evaluate the connections between one or more independent variables and a dependent variable. This statistical technique was used to determine the link between students’ computer attitudes and social media engagement and motivated strategies for learning mathematics. In this quantitative study, this tool was used to answer five, six, and seven research questions.

4. Results and discussions
This section presents the results and discussion of the study. In particular, the data in the tables and their corresponding descriptive interpretations are presented.

4.1 Summary on the Level of Computer Attitude of Students
Table 1 summarizes the students’ computer attitudes. Among the four indicators, perceived usefulness got the highest mean score. Perceived usefulness had a mean of 4.20 with a very high descriptive equivalent. This was followed by behavioral intention with a mean of 3.44, a descriptive equivalent of high. The next behavioral intention was perceived control, with a mean of 3.26. In contrast, the affective component had the lowest mean of 2.96. Additionally, the affective component and perceived control both had a descriptive equivalent of moderate. In certain cases, items in perceived usefulness are evident at all. Items in behavioral intention are much more evident, while items in both the affective component and perceived control are moderately evident.

Furthermore, it had an overall mean of 3.47 with a descriptive equivalent of high. This means that the level of students' computer attitudes is evident. Additionally, this indicates that students have a high attitude and state of feelings towards utilizing technology as a medium for instruction in a teaching-learning environment. The standard deviation of 1.01 in the overall mean indicates that the measures of variability of students computer attitudes are spread out from the mean. This shows the diversity of students' responses to this variable.

Table 1. Summary on the Level of Computer Attitude of Students

Indicators	SD	Mean	Descriptive Equivalent
Affective Component	1.09	2.96	Moderate
Perceived Usefulness	0.86	4.20	Very High
Perceived Control	0.97	3.26	Moderate
Behavioral Intention	1.11	3.44	High
Overall	**1.01**	**3.47**	**High**

Specifically, the results clearly suggest that students' perceived usefulness as part of their attitude toward using computers is evident. This means that students have a very strong personal view of using a computer and the usefulness of a computer in their learning environment. Moreover, behavioral intentions were evident. This means that students have a high personal intention to perform a task as long as they involve a computer in the teaching-learning environment. Collectively, these findings are supported by the works of Rasiah, Kaur, and Guptan (2020) which emphasized that students are satisfied when they complete a computer-related activity. Certain students perceived computer integration to be entertaining and appealing. In addition, the students valued the computer because it made the activity simpler and more delightful.

Furthermore, the students' perceived control and affective components were moderately evident. This means that students have a moderate level of confidence in terms of their capacity to use a computer, as well as their feelings towards using a computer in a teaching-learning environment. These findings confirm the propositions of Wu and Cheng (2019) that while some students have a favorable view of computer use, others have a negative outlook that contributes to a lack of confidence in utilizing computers throughout their entire educational experience.

4.2 Summary on the Level of Social Media Engagement of Students

Table 2 summarizes the level of Social Media Engagement among students. Among the four indicators, perceived ease of use got the highest mean of 3.78. This was followed by perceived usefulness with a mean of 3.75. On the other hand, adoption intention got the lowest mean of 3.67. Additionally, all indicators had a similar descriptive equivalent of high, which indicates that all items were manifested.

Furthermore, it had an overall mean of 3.73 with a descriptive equivalent of high. This means that the level of students'social media engagement is manifested. Additionally, this indicates that students have high engagement in social media and their feelings and perceptions of their experiences in utilizing technology as a medium for instruction in a teaching-learning environment. Moreover, the overall standard deviation of 0.93 in the overall mean indicates that the measures of variability of students'social media engagement are close to the mean. This shows the uniformity of the students' responses in this variable.

Table 2. Summary on the Level of Social Media Engagement of Students

Indicators	SD	Mean	Descriptive Equivalent
Adoption Intention	0.99	3.67	High
Perceived Usefulness	0.93	3.75	High
Perceived Ease of Use	0.88	3.78	High
Overall	**0.93**	**3.73**	**High**

Specifically, the results clearly suggest that students' perceived ease of use as part of their social media engagement was manifested. This means that students have a high personal belief about computer usefulness in terms of satisfaction with their individual needs in a teaching-learning environment. Moreover, the students' perceived usefulness was also manifested. This means that students also had high personal beliefs about using computers and the usefulness of computers in their learning environment. Furthermore, students' adoption intentions were manifested. This result indicates that students have a high frequency of using computers and the ability to recommend them to other students in a teaching-learning environment.

Collectively, these findings are supported by the works of Ikhsan, Saraswati, Muchardie, and Susilo (2019) which emphasized that computers have influenced the learning experiences of students. In addition, a number of academic studies have shown that many students recognize the usefulness and advantages of computers in classroom learning environments. Moreover, the development of information technology and communication, as well as the evolution of the educational paradigm, has affected the process and methodology of learning. Computers also influence students' learning experiences. In addition, a number of academic studies have shown that many students recognize the usefulness and advantages of computers in classroom learning environments.

4.3 Summary on the Level of Motivated Strategies for Learning Mathematics of the students

Table 3 summarizes the level of motivation strategies for learning mathematics among students. Among the four indicators, the intrinsic value had the highest mean (3.70). This was followed by cognitive strategy use, with a mean score of 3.69. On the other hand, self-regulation got a mean of 3.45, while self-efficacy got the lowest mean of 3.01. Additionally, all indicators had a similar descriptive equivalent of high, indicating that all items were observed.

Furthermore, it had an overall mean of 3.46 with a descriptive equivalent of high. This means that the level of motivated strategies for learning mathematics among students was observed. Additionally, this indicates that students have highly different motivational factors that encourage them to engage in a teaching-learning environment. Moreover, the overall standard deviation of 0.96 in the overall mean indicates that the measures of variability of motivated strategies for learning mathematics of the students are close to the mean. This shows the uniformity of the students' responses in this variable.

Table 3. Summary on the Level of Motivated Strategies for Learning Mathematics of the Students

Indicators	SD	Mean	Descriptive Equivalent
Self-efficacy	1.10	3.01	Moderate
Intrinsic Value	0.92	3.70	High
Cognitive Strategy Use	0.90	3.69	High
Self-regulation	0.93	3.45	High
Overall	**0.96**	**3.46**	**High**

Specifically, the results clearly suggest that students' intrinsic value is part of their motivated strategies for learning mathematics is much observed. This means that students have strong personal beliefs and inner feelings towards certain tasks or activities in a teaching-learning environment. This finding confirms the idea that intrinsic value in a learning environment is the value provided by the perspectives of students who perceive it as a successful learning environment. Students with high intrinsic value are able to connect with the environment successfully, actively engage with course tasks, feel more encouraged and pushed to spend more time in the environment, and ultimately learn more effectively (Daradoumis, Marquès Puig, Arguedas, & Calvet Liñan, 2022).

Moreover, students' cognitive strategy use was observed. This means that students also have high thinking ability and perception of using computers in a teaching-learning environment. In addition, students' self-regulation was observed. This means that students have a high ability to manage their thoughts, behaviors, motivations, and emotions when learning mathematics. These findings are supported by the work of Thai, De Wever, and Valcke (2020), who found that there are students with a high degree of cognitive strategies in a learning environment, particularly in advanced topics that need enhanced cognition. These students also possessed the ability to control their behaviors, actions, and thoughts in a classroom setting.

Furthermore, students' self-efficacy was moderately observed. This means that students have a moderate personal belief in accomplishing any task or activity facilitated in a teaching-learning environment. This confirms the emphasis of Chen and Su (2019) that, while self-efficacy seems to correlate with academic success, there are students whose self-efficacy in the learning environment is average or below.

4.4 Significance of the Relationship Between the Variables

Table 4 shows the relationship between computer attitude and motivation strategies for learning mathematics, social media engagement, and motivation strategies for learning mathematics.

The correlation between computer attitude and motivated strategies for learning mathematics showed that computer attitude had no significant relationship with students' motivated strategies for learning mathematics (p>0.05), with a coefficient determination of 0.009. In particular, the degree of correlation of the two variables has a very low positive correlation, and the p-value of the two variables is greater than 0.05, which makes them insignificant. This indicates that there is no significant relationship between computer attitude and motivation strategies for students' mathematics learning. Therefore, the null hypothesis was not rejected.

Specifically, this indicates that students' computer attitudes and motivated strategies for learning mathematics have a very weak relationship. This means that students' attitude towards using computers does not significantly affect their motivational strategies in the context of mathematical learning. In contrast, different motivational strategies for learning a mathematics subject have no direct connection to students' computer attitudes or how students view their usage of computers in a learning setting. Furthermore, this result seems to contradict the work of Granito and Chernobilsky (2012), who emphasized that computer attitude has a significant and robust relationship with students' motivated strategies for learning mathematics.

Table 4. Significance of the Relationship Between the Variables

Variables Correlated	r	p-value	Decision on H_o	Decision on Relationship
Computer Attitude & Motivated Strategies for Learning Mathematics	0.009	0.904	Do not Reject	Not Significant
Social Media Engagement & Motivated Strategies for Learning Mathematics	0.519	0.000	Reject	Significant

On the other hand, the correlation between social media engagement and motivated strategies for learning mathematics showed that social media engagement has a significant relationship with students' motivated strategies for learning mathematics (p<0.05), with a coefficient determination of 0.000. In particular, the degree of correlation between the two variables has a moderate positive correlation, and the p-value of the two variables is less than 0.05 level of significance, which makes them significant. This indicates a significant relationship between social media engagement and motivated strategies for students' mathematics learning. Therefore, the null hypothesis was rejected.

This indicates that students' social media engagement significantly affected their motivational strategies in the context of mathematical learning. In contrast, different motivational strategies for learning a mathematics subject have a direct connection with students' social media engagement in a learning setting. This result confirms the idea of Musibau et al. (2011) that social media engagement is associated with developing students' motivated strategies for learning by providing an opportunity for them to share ideas even if they are not physically staying in touch. Furthermore, this result confirmed that several studies have emphasized that social media engagement has a significant effect on students' performance and motivation for learning complex subjects such as mathematics (Liyanapathirana, 2019).

4.5 Regression Analysis on the Motivated Strategies for Learning Mathematics as Influenced by Computer Attitude and Social Media Engagement of Students

Regression analysis was performed to determine the significant influence of computer attitude and social media engagement on motivation strategies for learning mathematics. The results in table 5 revealed that computer attitude does not appear to be statistically significant predictor of motivated strategies for learning mathematics (p >0.05).

Table 5. Regression Analysis on the Motivated Strategies for Learning Mathematics as Influenced by Computer Attitude and Social Media Engagement of Students

Independent Variable	**Unstandardized Coefficients**		**Standardized Coefficients**	**t-stat**	**p-value**	**Decision@ α = 0.05**
	B	**Standard Error**	**Beta**			
(Constant)	2.362	0.364				
Computer Attitude	0.191	0.102	0.123	1.874	0.063	Not Rejected
Social Media Engagement	0.474	0.057	0.542	8.253	0.000	Rejected
Dependent Variable: Motivated Strategies for Learning Mathematics						
F-ratio: 34.063			***Adjusted R Square***: 0.269			

As computer attitude refers to a student's general evaluation or antipathy towards computer technology and specific computer-related activities (Lee et al., 2014), this finding reveals that students' attitudes towards utilizing technology as a medium for instruction have no direct influence on the different motivational factors that encourage them to engage in a teaching-learning environment. This finding confirms the idea that, while computers have a direct positive impact on the learning experience, research indicates that students' attitudes and views towards computer use do not have a direct impact on their motivation to learn in classes that use technology. This is further confirmed by data indicating that some students may prefer studying alone, whereas others may prefer a dynamic learning environment (Cheah, 2020).

On the other hand, the results revealed that social media engagement appears to be a statistically significant predictor of motivated strategies for learning mathematics (p< 0.005). The beta value (β=0.474) indicates that for every unit increase in social media engagement, motivated strategies for learning mathematics also increase by 0.474 units. Furthermore, based on the level of significance, the results reject the hypotheses of the study.

As social media engagement refers to an act of interacting with an online community and providing students with critical cognitive support to construct dynamic mental models, which engage them in a still conducive processing and better learning that influence their set of individual motivated strategies for learning (Latif et al., 2019), this finding reveals that the engagement of students in social media and their state of feelings and perceptions towards their experiences in utilizing technology as a medium for instruction have a direct influence on their different motivational factors that encourage them to engage in a teaching-learning environment. Furthermore, this is supported by the work of Liyanapathirana (2019), who attested that there has been much emphasis from several studies that social media engagement has a significant effect on students' performance and motivation for learning towards complex subjects such as mathematics.

5. Conclusions

This chapter presents a summary of the major findings of the study, conclusions, and recommendations for possible implementation.

5.1 Summary of Findings

The major findings of this study are as follows.

1. Regarding the students' level of computer attitude, perceived usefulness had the highest mean of 4.20, with a descriptive equivalent of very high and an SD of 0.86. This was followed by behavioral intention with a mean of 3.44, a descriptive equivalent of high, and an SD of 1.11. Next to behavioral intention is perceived control, with a mean of 3.26 and an SD of 0.97. On the other hand, the affective component had the lowest mean of 2.96 and an SD of 1.09. Additionally, the affective component and perceived control both had a descriptive equivalent of moderate. Furthermore, it has an overall mean of 3.47, an SD of 1.01, with a descriptive equivalent of high.
2. For the level of social media engagement, perceived ease of use had the highest mean of 3.78 and an SD of 0.88. This is followed by perceived usefulness with a mean of 3.75 and an SD of 0.93. On the other hand, adoption intention got the lowest mean of 3.67 and an SD 0.99. Additionally, all indicators had a similar descriptive equivalent of high. Furthermore, it had an overall mean of 3.73, an SD of 0.93, and a descriptive equivalent of high.
3. For the students' level of motivated strategies for learning mathematics, intrinsic value had the highest mean of 3.70 and an SD of 0.92. This is followed by Cognitive Strategy Use with a mean of 3.69 and an SD of 0.90. On the other hand, self-regulation had a mean of 3.45 with an SD of 0.93, while self-efficacy had the lowest mean of 3.01, with an SD of 1.10. Additionally, all indicators had a similar descriptive equivalent of high. Furthermore, it had an overall mean of 3.46, an SD of 0.96, and a descriptive equivalent of high.
4. Computer attitude did not affect how students learned math, as there was no strong connection between the two (low correlation, $p > 0.05$). However, social media engagement significantly affected students' math learning strategies, with a moderate positive link (moderate correlation, $p < 0.05$). Therefore, we retained the first hypothesis and rejected the second hypothesis.
5. Computer attitude slightly influences math learning ($\beta = 0.191$, $p < 0.063$), but social media engagement strongly influences it ($\beta = 0.474$, $p < 0.000$). We do not reject the first hypothesis but reject the second hypothesis based on the significance levels.

5.2 Conclusion

The findings from the study led the researcher to draw the following conclusions.

1. The students' computer attitude is evident.
2. Students'social media engagement is manifested.
3. Motivated Strategies for Learning Mathematics of the students are much observed.
4. There was no significant relationship between computer attitude and motivation strategies for learning mathematics among students. On the other hand, Social Media Engagement has a significant relationship with Motivated Strategies for Learning Mathematics.
5. Computer attitude does not significantly influence Motivated Strategies for Learning Mathematics. On the other hand, Social Media Engagement significantly influenced Motivated Strategies for Learning Mathematics among students.

5.3 Recommendations

Based on the findings, analysis, and conclusions drawn in this study, the following recommendations are made:

1. Students, teachers, school administrators, and DepEd officials are encouraged to value the

importance of computer attitudes, social media engagement, and motivated strategies for learning mathematics in a learning setting. Understanding the level of these areas may help strengthen the effectiveness of mathematical learning.

2. Teachers, School administrators, and DepEd officials must establish programs that enhance students' affective components using computers in a classroom environment. This will help students use computers and remove their fear of making mistakes that they cannot correct. On the other hand, students' adoption intentions must be improved when engaging in social media. This will help them to advise other students to use social media for learning. Moreover, students' self-efficacy must be improved as one of their strategies for learning mathematics. Certainly, students must appreciate their mathematics study skills.
3. The study emphasized the significant relationship and influence of social media engagement on motivated strategies for learning mathematics. Thus, there is a strong need to develop a more comprehensive curriculum to cater to students' needs in terms of mathematical learning that concerns social media engagement as part of their learning experience. Mathematics teachers and administrators should aim for a collaborative academic endeavor to develop students' learning experiences when using social media to learn mathematics.
4. Future research must focus on the areas of students' affective components, adoption intention, and self-efficacy in learning mathematics.

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