THE MEDIATING EFFECT OF STUDY HABITS ON THE RELATIONSHIP BETWEEN LEARNING STRATEGIES AND STUDENT ENGAGEMENT IN MATHEMATICS

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ABSTRACT

This study aims to determine whether or not their study habits significantly mediate the relationship between learning strategies and student engagement in mathematics among grade 10 junior high school students in Governor Generoso South District, Division of Davao Oriental. This study employed a quantitative research design, utilizing both correlational and descriptive methodologies. This study selected 241 respondents using a stratified sample method to ensure an equitable distribution of respondents across all schools. Moreover, this research employed three adapted research instruments that were validated and assessed utilizing statistical measures such as mean, standard deviation, Pearson-r, Baron and Kenny Mediation method, and MedGraph with Sobel z-test among grade 10 students. Additionally, the findings demonstrated a noteworthy correlation between learning strategies and student engagement. There exists a significant relationship between study habits and learning strategies, as well as between study habits and student engagement in mathematics. This correlation indicates a significant relationship between these variables. Additionally, the results indicate that study habits partially mediate the relationship between learning strategies and student engagement in mathematics. The findings offer significant implications for educators and policymakers who aim to enhance the educational process. Furthermore, the provision of continuous professional development opportunities for educators helps guarantee their up-to-date knowledge of contemporary research findings and optimal strategies for fostering student learning and academic success.

KEYWORDS: *Study habits, learning strategies, student engagement in mathematics, correlational and descriptive approaches, Baron and Kenny Mediation approach, MedGraph using Sobel z-test, Davao Oriental, Philippines*

BACKGROUND OF TH STUDY

For many years, student engagement has constantly declining due to multiple factors that affect how students engaged in the lessons. Mathematics, being one of the most hated subjects, has been the subject that most students are less engaged (Bringula et al., 2021). Students that are disengaged in mathematics are more likely to stop schooling, accomplish less, and have difficulty absorbing the lesson in mathematics (Alrajeh & Shindel, 2020). Similarly, low engagement of students leads to students not finishing their studies and many drop out of school (Maamin et al., 2022).

In global perspective, low student engagement is evident in developing countries, especially in Southeast Asia (Iqbal et al., 2022). In Malaysia, 28 percent of kids are actively disengaged and unmotivated to learn, especially in mathematics. This manifests itself in a lack of focus and interest in class, as well as the fact that students don't believe they are being cared about. Some teachers say disengaged learners are hard to handle (Maamin et al., 2022). In Indonesia, about 60 percent of students have low engagement in mathematics due to some factors (Jafari et al., 2019). In addition, a study by Khun-Inkeeree (2021) revealed that inadequate learning practices contribute to almost 40% of the students in Thailand having low engagement towards mathematics due to poor learning strategies, lack of self-efficacy, and peer influences. While Naiker et al., (2022) also emphasized that in Australia,

students have low engagement in mathematics as manifested by their lack of physical involvement in problem-solving activities.

In the Philippines, some students in Metro Manila have poor engagement towards mathematics (Bernardo, et al., 2022). Students have a hard time learning since they frequently fall asleep in class. Moreover, a study conducted by Bringula et al., (2021) found that the level of student engagement in mathematics classes during the COVID-19 pandemic has dramatically dropped as a direct result of the increased use of modular and online learning modalities. In Laguna, a study by Flores et al. (2021) found that between 25 and 40 percent of the youth showed signs of disengagement in mathematics, such as not being involved in the subject, being apathetic about it, not making a lot of effort and not focusing in class.

In the Davao Region, a study conducted in Dodongan (2022) on the engagement of students in a local college in Davao Oriental discovered that students are disengaged from mathematics, as evidenced by their lack of interest in the subject. Students have apprehension when it comes to mathematics, as it is a very difficult subject for them. Their lack of cognition, particularly in solving mathematical problems, and low behavioral engagement were attributed to their lack of interest in learning the subject. Also, a study of Alipio (2020) in one of the universities of Davao City found that students who are not interested in their math classes have a high chance of dropping out, with freshmen being the most likely to do so.

Although there are studies related to learning strategies, study habits, and student engagement, there is still an insufficiency of studies related to these variables in terms of their involvement in mathematics. In terms of the relationship and connection between these variables, the researcher found that the associations between learning strategies and study habits (Bickerdike et al., 2019; Cakiroglu, 2019), study habits and student engagement (Tus et al., 2020; Magulod, 2019), and learning strategies and student engagement (Sen, 2022; Ironsi, 2020) are bivariate in nature and that there is no research that connects these three variables in a single study. Furthermore, not enough research has been done on how learning strategies, particularly in Davao Oriental, the Philippines, mediate the relationship between study habits and student involvement. Because of this lack of information, there is a sense of urgency, and the researcher is motivated to carry out the study among junior high school students in the Division of Davao Oriental.

The study could benefit students and teachers, especially in dealing with the engagement of students in mathematics. This study could improve how students engage in the classroom by improving their learning strategies and study habits, given that study habits and learning strategies may play a vital role in student engagement. Furthermore, the findings of this study will provide a foundation for teachers to make interventions in mathematics, such as crafting materials and other instructional materials that would improve students' mastery of mathematical competencies. Similarly, the results of this study will form the foundation for developing mathematics-related programs and will enable the sending of teachers for seminars and trainings. This study would also be beneficial to teachers, students, DepEd officials, and policymakers. In addition to this, the study has relevance in both society and the community because it may serve as a foundation for future trainings and policies that are required to develop students' study habits and learning strategies for the purpose of increasing students' engagement in mathematics.

Furthermore, the findings of this study will be shared with educational decision-makers in the Davao Oriental Division. Additionally, the study will be showcased in a public gathering and during conferences to be held locally or regionally. The students and mathematics teachers will join LAC sessions in the school so they can listen to the findings of the study. This study will also be published in international journals for future research.

STATEMENT OF THE PROBLEM

1. What is the level of learning strategies of students in terms of:
    1.1 cognitive and help-seeking;
    1.2 emotion control;
    1.3 elaboration and practical application; and
    1.4 motivation control?
2. What is the extent of student engagement of students in mathematics in terms of:
    2.1 cognitive;
    2.2 affective; and
    2.3 behavioral?

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3. What is the extent of study habits of learners in terms of:
    3.1 time management;
    3.2 classroom attendance and participation;
    3.3 general study strategies;
    3.4 exam preparation; and
    3.5 note-taking?

4. Is there a significant relationship between:
    4.1 learning strategies and the student engagement?
    4.2 learning strategies and study habits?
    4.3 study habits and student engagement?

5. Does the extent of study habits serve as a significant factor in mediating the connection between learning strategies and student engagement?

METHODOLOGY

RESEARCH DESIGN

This research employed a quantitative design, employing correlational and descriptive approaches all along the way. Information that can be measured is gathered and examined through the process of quantitative research. It is possible to use it to establish patterns and means, evaluate causal linkages, make predictions, and generalize results to larger groups (Bhandari, 2022). On the other hand, descriptive research emphasizes its objective to analyze people, occurrences, or environments by examining them in their natural state. The researcher discussed the sample and variables without changing them (Siedlecki, 2020). Jones (2021) said descriptive research is simple because it evaluates objects in their "natural" context. Hence, descriptive research designs helped build a field database by collecting approximation and characterization data. Likewise, McCombes (2022) asserted that descriptive research provides a detailed and systematic account of a population, setting, or phenomenon. It can answer what, where, when, and how inquiries, but not why queries. It can also use several approaches to study one or more variables. In this type of study, the researcher just tracked and recorded the variables' values.

On the other hand, according to Cherry (2022), a correlational study is a good place to start when obtaining information on a topic. If researchers are unable to carry out an experiment, this method can still be useful. Researchers employed correlations to test for the existence of relationships between two or more variables when the variables themselves are beyond the researcher's control. Bhandari (2022) also mentioned that the extent and direction of a link between two or more variables can be determined by calculating their correlation. Correlations can have positive or negative directions. As a result, the connections between the mediating, independent, and dependent variables of this research are examined and analyzed to identify current trends and structures (Frey, 2018).

Meanwhile, mediation in the presented research refers to the methods by which the relationship between learning strategies and student engagement in mathematics was explained or influenced by study habits. In other words, study habits played a mediating role in the relationship between learning strategies and student engagement in mathematics. Thus, the study suggested that students who employ effective learning strategies in mathematics tend to be more engaged in their studies. However, the scope to which students involve themselves in these strategies may be influenced by their study habits (Creswell, 2017). For instance, students who practice good study habits—such as scheduling dedicated study time, keeping their study materials organized, and avoiding distractions—may be more likely to employ efficient learning techniques and, as a result, be more involved in their academic work.

Since the purpose of this research is to identify whether or not there is a linkage between learning strategies, student engagement, and study habits, a quantitative, descriptive, and correlational methodology will be utilized. No changes were made to the underlying data. This study was well-suited for correlational analysis because its primary objective was to evaluate the links between three different but related factors: learning strategies, student engagement, and study habits.

RESEARCH RESPONDENTS

The respondents of this study were the 241 Grade 10 students in Governor Generoso South District, Division of Davao Oriental, enrolled in the school year 2022-2023. The total population of Grade 10 students is 640. In which a total of 241 respondents were selected at random from a total population of 640 using an internet-based tool called Raosoft's sample size calculator, these are the Grade 10 students, with a marginal error of 0.05. Using such

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a technique, the number of samples from School A was 19, School B was 75, School C was 94, School D was 23, and School E was 30. Additionally, the researcher used a stratified sampling technique to ensure an equal distribution of respondents in every school.

On the other hand, the researcher employed a stratified random sampling method to determine the respondents because there were so many individuals in the population. When each stratum's design was simple random sampling, we term the technique stratified random sampling (Hayes & Westfall, 2022). In order to obtain a good-sized data sample, the respondents identified are drawn from the population's different strata in proportion to their relative numbers. In addition, when considering a stratified random sample method, an equal distribution was appropriate.

In this study, there were five (5) secondary schools in Governor Generoso South District, Division of Davao Oriental. Every school was regarded as a stratum for the purposes of simple random sampling. In this study, all Grade 10 students had the opportunity to be selected. As to the inclusion criteria, only those who were Grade 10 students in the Governor Generoso South District were considered. If one or more students withdraw from the survey during its administration, the availability of another student of similar gender at the same school was considered a suitable replacement, along with their willingness to participate.

STATISTICAL TREATMENT OF DATA

The following statistical tools were utilized in order to provide an interpretation and analysis of the data that were more comprehensive and accurate.

Mean. This was used to measure the levels of learning strategies, study habits, and student engagement. This served as the foundation for addressing research questions 1, 2, and 3.

Standard Deviation. A standard deviation was a statistical tool that measures the distribution of a dataset in relation to its mean. This tool was used to determine whether or not the scores were highly dispersed or whether they were relatively close to the mean. This was used as an answer for questions numbers 1, 2, and 3.

Pearson Product-Moment Correlation. This was used to determine if there was a significant relationship between learning strategies and study habits, study habits and student engagement, and learning strategies and student engagement. Study habits was also utilized to ascertain the substantial relationship between learning strategies and student engagement.

Baron and Kenny Mediation Approach. This method of mediation had two paths for the dependent variable. Thus, this was used to determine whether the independent variable study habits would predict student engagement, the dependent variable, and the mediator learning strategies.

MedGraph using Sobel z-test. The Sobel test was used to figure out whether or not including a mediator (M) in the regression analysis substantially decreased the impact of the independent variable (X) on the dependent variable (Y) (Preacher, 2020; Bader & Jones, 2021). Meanwhile, Ozdil and Kutlu (2019) agreed that if there are more than 100 study groups, the results of this method had significant values. This method of mediation analysis was also utilized by a study conducted by Bautista (2020) to test the significance of the study. In this study, this method was used to determine the mediating effect of study habits on the relationship between learning strategies and student engagement.

RESULTS AND DISCUSSION

The following are the results of the study

Summary of the Extent of Learning Strategies of Students

Table 1. Summary of the Extent of Learning Strategies of Students

Indicators	Mean	SD	Descriptive Equivalent
Cognitive and Help-seeking	3.71	0.98	Highly Extensive
Emotion Control	3.58	1.01	Highly Extensive
Elaboration and Practical Application	3.54	0.93	Highly Extensive
Motivation Control	3.82	1.01	Highly Extensive
Overall	**3.66**	**0.98**	**Highly Extensive**

The descriptive equivalent of highly extensive and an overall mean of 3.66 indicate that the students' extent of learning strategies is apparent. Based on the students' responses, the standard deviation of their learning strategies is 0.98. This suggests that the responses were uniform. This also implies that their learning strategies are clustered around the mean. This suggests a comprehensive and dynamic approach to learning that encompasses a wide range of cognitive, metacognitive, and affective processes. This also implies a deep understanding of individual learning preferences and strengths, allowing students to adapt their strategies to different learning contexts and challenges.

Moreover, the results are corroborated by the research conducted by Vega et al. (2019), which asserted that learning strategies are essential for enhancing the abilities and knowledge required to perform and learn as an adult where rhythms, styles, and motivation converge. Identifying the learning strategies used by the students depends on their motivation and the methods and approaches employed by the teachers in teaching the subject. Khanal et al. (2021) also supported the findings that learning strategies encompass a broad spectrum of techniques and approaches aimed at enhancing academic performance. This also underscores the multifaceted nature of learning strategies, highlighting their role not only in improving memory retention for effective studying but also in facilitating help-seeking behaviors.

Summary of the Level of Student Engagement in Mathematics
Table 2. Summary of the Level of Student Engagement in Mathematics

Indicators	Mean	SD	Descriptive Equivalent
Cognitive	3.85	0.92	High
Affective	3.85	0.97	High
Behavioral	3.72	0.94	High
Overall Mean	**3.81**	**0.94**	**High**

The total mean of 3.81 falls into the category of "high", which suggests significant observation of student engagement in mathematics. The standard deviation of 0.94 indicates a consistency in responses, with most respondents providing similar answers. This implies that student engagement is concentrated around the mean. Additionally, the findings suggest that students demonstrate a proactive approach toward comprehending mathematics and make a concerted effort to do so. This implies that students are actively participating, interested, and emotionally invested in their mathematical learning experiences. Moreover, high student engagement implies a positive attitude towards mathematics, a sense of confidence in one's abilities, and a willingness to actively contribute to mathematical discussions and activities.

The aforementioned findings align with the research conducted by Bond and Bedenlier (2019), which demonstrates that students who actively participate in their mathematics classes have enhanced knowledge acquisition due to their heightened engagement, captivation, fascination, and inspiration towards the subject matter. It is manifested by their state of focus, keen interest, optimistic thinking, and enthusiasm for gaining knowledge and achieving excellence in their studies, as well as their driving force to master and develop their own learning. Likewise, the findings are also supported by the study of Fazza and Mahgoub (2021) that engaged students have a vibrant perspective on finishing the specified task while maintaining their colleagues' encouragement throughout the entire process.

Summary of the Extent of Study Habits of Students
Table 3. Summary on the Extent of Study Habits of Students

Indicators	Mean	SD	Descriptive Equivalent
Time Management	3.48	1.01	Highly Extensive
Classroom Attendance and Participation	3.99	0.91	Highly Extensive
General Study Strategies	3.76	0.94	Highly Extensive
Exam Preparation	3.72	1.01	Highly Extensive
Note-taking	3.85	1.03	Highly Extensive
Overall	**3.76**	**0.98**	**Highly Extensive**

Furthermore, the overall mean score is 3.76, which corresponds to the descriptive equivalent of "highly extensive." This indicates that the student's study habits are manifested to some extent. The standard deviation of study habits of students is 0.98, which is below 1, which means the variance is homogeneous. This suggests that the majority of the respondents have comparable answers. This shows a concentration of student study habits around the mean. This suggests that students are actively engaged in their learning process, demonstrating a strong commitment to academic excellence. They likely exhibit proactive behaviors such as effective time management, classroom attendance and participation, general study strategies, exam preparation, and note-taking. These students are often characterized by disciplined study routines and a growth mindset, valuing effort and persistence in the face of academic challenges.

The aforementioned findings are corroborated by the research conducted by Tus et al. (2020), which asserts that students prioritize their studies and invest considerable effort into their learning endeavors. Students demonstrate positive behaviors across various aspects of academic life, including effectively managing their time to balance study commitment with other responsibilities, consistently attending classes, and actively participating in classroom discussions and activities. Furthermore, this notion is confirmed by the research conducted by Jafari et al. (2019), which shows that student's commitment to academic excellence allowed them to study rigorously through exam preparation, where they engage in structured review sessions, practice tests, and utilize effective study aids to maximize their study routines, adhering to a consistent schedule and allocating sufficient time for studying each day.

Relationship Between Variables

Table 4 presented the result of the relationship between the variables. Results showed that learning strategies significantly corelates with student engagement (r-value= 0.666, $p<0.05$). The r-value of 0.666 implies a strong positive correlation between the variables. This means that when learning strategies is high, the student engagement is also high. This means that the null hypothesis (Ho_1) is rejected.

Moreover, learning strategies significantly correlates with study habits (r-value = 0.661, $p<0.05$). The r-value of 0.661 means that there is a strong positive significant relationship between learning strategies and study habits. As learning strategies increases, study habit also increases. This also means that the null hypothesis (Ho_2) is rejected.

Likewise, study habits significantly correlate with student engagement (r - value= 0.662, $p<0.05$). The r-value of 0.662 indicates a strong positive significant relationship between study habits and student engagement. This also means that as study habits becomes high, the student engagement also becomes high. This means that the null hypothesis (Ho_3) is rejected.

Table 4. Significance of the Relationship Between the Variables

Variables Correlated	r	p-value	Decision on Ho	Decision on Relationship
Learning Strategies & Student Engagement	0.666	0.000	Reject	Significant
Learning Strategies & Study Habits	0.611	0.000	Reject	Significant
Study Habits & Student Engagement	0.662	0.000	Reject	Significant

The results on the relationship between learning strategies and student engagement conform the preposition of Bickerdike et al. (2019) who claimed that there exists a substantial connection involving learning strategies and study habits, where an increase in the learning strategies improves the study habits of the students. This is also supported by the study of Olson and Peterson (2021) who emphasized that effective learning strategies enhance the efficacy of study habits by optimizing how students study their course materials and provide the structure and consistency needed to implement and reinforce learning effectively.

Moreover, the results of the relationship between learning strategies and study habits conform to the proposition of Magulod (2019) who highlighted that learning strategies motivate students to study in a well-managed time, allowing them to concentrate on their lessons. This is also supported by Tus et al. (2020) who claimed that when students have good learning strategies, they can have good study habits, which enhance their way of acquiring knowledge and ideas.

Furthermore, the results of the relationship between study habits and student engagement are parallel to the adversity quotient theory of Reeve and Tseng (2011) who claimed that students who have poor study skills and habits can have lower engagement inside the classroom. Poor study skills can lead to difficulties in comprehending and retaining lessons, resulting in feelings of disinterest during lectures or class discussions. This is also supported by the study of Lingling (2023) who emphasized that well-developed study habits have improved student

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engagement as students can follow their lesson, synthesize information, and make connections between concepts which allows them to actively participate in class.

RECOMMENDATIONS

Based on the findings and conclusions presented, the following recommendations are made according to the data provided and the conclusions suggested:

1. Given that learning strategies were found to be highly extensive among Grade 10 students, educators should continue to emphasize and promote the development of effective learning strategies. This could involve providing explicit instruction on various learning techniques, encouraging students to utilize metacognitive strategies for self-regulated learning, and creating a supportive learning environment where students feel empowered to experiment with different approaches to learning.

2. With student engagement being high among Grade 10 students, it is important to maintain and further cultivate this positive aspect of the learning experience. Educators can achieve this by implementing interactive teaching methods, incorporating real-world applications of mathematical concepts, and offering opportunities for student collaboration and inquiry-based learning. Additionally, providing regular feedback and recognizing students' efforts can help sustain their motivation and enthusiasm for learning.

3. Since study habits were also found to be highly extensive among Grade 10 students, it is essential to reinforce and build upon these habits to support long-term academic success. Educators can facilitate this by teaching students effective study skills and time management techniques, encouraging consistent review and practice, and fostering a culture of accountability and self-discipline. Moreover, providing resources and support for students to develop personalized study plans tailored to their individual needs can further enhance the effectiveness of their study habits.

4. Given the significant relationship observed between learning strategies and both student engagement and study habits, curriculum developers and educational policymakers should consider integrating explicit instruction on learning strategies into the curriculum across various subjects. This can help students develop transferable skills that not only enhance their academic performance in mathematics but also facilitate their learning across other disciplines.

5. Further research into the dynamic associations between learning strategies, study habits, and student engagement can provide valuable insights for educators and policymakers seeking to optimize the learning experience for Grade 10 students and beyond. Additionally, ongoing professional development opportunities for educators can ensure that they remain abreast of current research findings and best practices in promoting student learning and academic achievement.

CONCLUSIONS

The study's findings led to the following conclusions being made:

1. Learning strategies is highly extensive among Grade 10 students.
2. Student engagement is high among Grade 10 students.
3. Study habits is highly extensive among Grade 10 students.
4. Learning strategies and students' interest in mathematics are significantly correlated.
5. Study habits and learning strategies have a substantial correlation.
6. Study habits and student engagement in mathematics are significantly correlated.
7. The relationship between learning strategies and students engagement in mathematics is partially mediated by study habits.

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