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ASSESSING MOTIVATIONAL STRATEGIES, STUDENT ENGAGEMENT AND ACADEMIC PERFORMANCE OF STUDENTS IN MATHEMATICS

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ABSTRACT

This study was conducted to assess the relationship between motivational strategies, student engagement and academic performance of students in mathematics. It utilized a quantitative design using the descriptive-correlational method of research. The respondents were 144 first year to third year BSED Mathematics students in one state colleges in the Davao Region. The stratified random sampling technique was used in selecting the respondents. There were two sets of standardized instruments and a researcher-made instrument used in the study. That three questionnaires underwent validation and pilot testing. Statistical tools used were the mean and Pearson r. Findings suggested that motivational strategies and student engagement is manifested. On the other hand, students' academic achievement in mathematics is very satisfactory. The result showed that motivational strategies and student engagement have no significant relationship to academic performance in mathematics. It is recommended that future researchers may use different variables that could influence students' academic performance in mathematics. Additionally, they may measure other variable such as determining the general weighted average of the student's math scores rather than administering a summative test and looking at the results.

KEYWORDS: *Motivational Strategies, Student Engagement, Academic Performance In Mathematics, Quantitative Research, Mean, Pearson R, Davao Del Norte, Philippines*

INTRODUCTION

Mathematics, often regarded as the universal language of logic and precision, occupies a central role in the academic journey of students and serves as a fundamental pillar of intellectual development. The academic performance of students is an observable proof of students' cognitive ability, drive, and aptitude for studying. Competency in mathematics is crucial to any individual and nation in domestic and corporate negotiations, scientific discoveries, technological breakthroughs, problem-solving, and decision-making in various scenarios in life (Ayebale et al., 2020). However, despite concerted efforts in curriculum development and teaching strategies, numerous reports highlight low academic performance in mathematics among students.

LITERATURE REVIEW

Academic performance refers to a student's achievement and success in their educational endeavors. It is typically measured by assessing a student's grades, test scores, and overall academic accomplishments (Thornton, 2022). Academic performance serves as an indicator of a student's mastery of subject matter, their ability to apply knowledge, their level of engagement and effort in their studies. Furthermore, students' academic performance directly correlates with the country's social and economic development. Academic performance is crucial for developing high-quality graduates who can lead the country's economic and social development (Ali et al., 2009).

Motivational Strategies

Motivational strategies describe methods and strategies that are employed in teaching and learning activities to increase motivation and engagement. These strategies seek to foster an upbeat and enthusiastic environment in order to enhance the learning process's interest, efficacy, and success (Leyva-Rodriguez et al., 2022). It has been discovered that motivational strategies work well for improving academic performance (Pulana & Perez, 2022). Furthermore, Navío et al. (2023) found that learning strategies, academic motivation, and optimum motivation towards schoolwork are favorably associated to students' total their academic performance. These findings suggest that implementing motivational strategies can lead to better academic performance of students (Martínez-Vicente et al., 2023).

Self-Reinforcing. The concept of self-reinforcing, also known as Self-Predictive Representations (SPR), has been identified as a significant predictor of academic performance. It demonstrated the influence of motivation and adaptation on students' subjective well-being, meaning in life, and academic performance. The results indicated that self-reinforcing predicts academic performance (Bailey & Phillips, 2015). Additionally, Richardson, Abraham, and Bond (2012) study findings also suggested that self-reinforcing strategies can significantly impact students' motivation and academic performance.

Implication. Implication is considered as a predictor of academic performance (Arifin et al., 2023). Implication can be used as an indicator to assess academic performance. Composite indicators are useful tool for summarizing overall performance and facilitating decision-making (Blasco-Blasco et al., 2021). Additionally, the use of motivational strategies is positively related to overall academic performance (Martínez-Vicente et al., 2023).

Positive Association. Motivational Strategies have a positive association with academic performance in general (Wild & Neef, 2023). The findings of Richardson et al. (2012) study revealed a significant positive correlation between motivational strategies and academic performance. This suggests that students who are highly motivated tend to perform better academically. Additionally, according to Kahn (2022), students who use learning strategies and have optimal motivation towards schoolwork tent to achieve higher academic performance. Furthermore, Culin et al., (2014) also emphasized the positive association between motivational strategies and academic performance.

Applicability. The relationship between students' engagement with educational applications and their academic performance has been explored in several studies. There is a study focused on the influence of academic performance on students' willingness and ability to complete work placements. It found that academic performance had a significant impact on students' decision (Anwar et al., 2022). Maintaining focus, and work-balance can improve their motivation to learn (Trunk, 2023). Additionally, Basri (2022) asserted that motivational strategies could modulate attention and concentration, leading to enhanced cognitive control and decision-making. This is supported by a study of Sobral and Menezes (2012), stating that an increased motivation of the students leads to higher level of concentration, and as a consequence, they learn more.

Gradual Approach. Panadero (2017) discussed the concept of a gradual approach in motivational strategies. The literature review identified the gradual approach as a potential research direction for investigating the effectiveness of incremental motivational interventions. By gradually introducing motivational strategies, educators can assess their impact on students' motivation and academic performance over time. Different strategies positively influence academic performance, and teachers should be regularly trained in pedagogical and instructional methods to improve teaching practices and enhance students' academic performance (Salim et al., 2019).

Student Engagement

Student engagement is the level of involvement that students invest in their learning. It helps in understanding the antecedents and consequences of how students think, behave, and feel in school. It is often regarded as one of the best predictors of academic performance (Abubakar et al., 2018). Many studies have shown a connection between a student's academic performance and student engagement, making it a crucial component of a supportive educational environment (Fuertes et al., 2023)

Cognitive Engagement. Doğan (2015) suggested that cognitive engagement predicts academic performance. It has been shown that students who are engaged in learning are more willing to invest time and effort in their studies (Wang & Eccles, 2013). Additionally, students that are highly cognitively engaged perform better academically because they are more likely to internalize the material and apply it in real-world contexts (Gul et al., 2022). When presented with a decision, students who are cognitively engaged can put their own effectiveness ahead of their academic performance (Zhou et al., 2022).

Behavioral Engagement. Maamin et al. (2021) showed a positive correlation between behavioral engagement and academic performance in mathematics suggesting that children' attention and effort in math learning are crucial. These findings suggest that students' attention and perseverance throughout the subject instruction can improve their performance. Students who pay attention and learn diligently have good academic performance, whereas students who do not pay attention and learn diligently acquire poor academic performance. Students who work hard to overcome the struggle of a given topic are more likely to succeed as they seek to comprehend the questions and employ various ways to find the answer. Also, Delfino (2019) revealed that the majority of responders worked hard to earn good scores, which they did by paying attention to the lesson and staying up

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during the class. They therefore valued the timely written or verbal comments on their academic success from their instructors.

Emotional Engagement. Emotional engagement is an essential technique for students to develop feelings towards their peers, teachers, and institutions which would provide them the sense of connectedness and belonging while also providing them numerous opportunities to grow and develop (Bensimon, 2009). Students who are emotionally engaged in their academics are more likely to be efficient in coping with the demands of studying and to be more persistent when faced with obstacles than students who are not emotionally engaged (Wang & Eccles, 2013). A study for the effectiveness of emotional engagement in academic performance showed that students who were more interested and enthusiastic about what they were learning tend to achieve better academic performance and satisfaction. Higher level of emotional engagement implied higher levels of intrinsic motivation, which may result in students contributing high task values throughout the learning process (Xu et al., 2023).

Social Engagement. According to Finn & Zimmer (2012), social engagement represents students' potential to obey in-class written or unwritten rules. It contains, for instance, behavioral of whether or not they attend classes in time or not, their communication with their teachers and classmates or hindering their friends' studies. The degree of social engagement affects students' learning. Thus, students with higher social engagement learn easier whereas the opposite has reverse effects. In addition, Li et al. (2021) conducted a comprehensive analysis of 1,843 studies on social engagement and academic performance spanning from 2001 to 2019. Their findings concluded that school engagement is a crucial mediator between social relationships and academic performance.

METHODOLOGY

Theoretical and Conceptual Framework

This study adopted the Self-Determination Theory (SDT) developed by Edward L. Deci and Richard M. Ryan in 1985. SDT posited that individuals were driven by intrinsic motivation, which arose from a sense of autonomy, competence, and relatedness. When students autonomously engaged in mathematics learning with a genuine interest and a perceived sense of control over their educational choices, they were more likely to develop a sustained and meaningful interest in the subject. Self-determination theory was a comprehensive motivation theory that had been studied in the context of mathematics education. Several studies have explored the relationship between self-determination theory and motivational strategies in mathematics students.

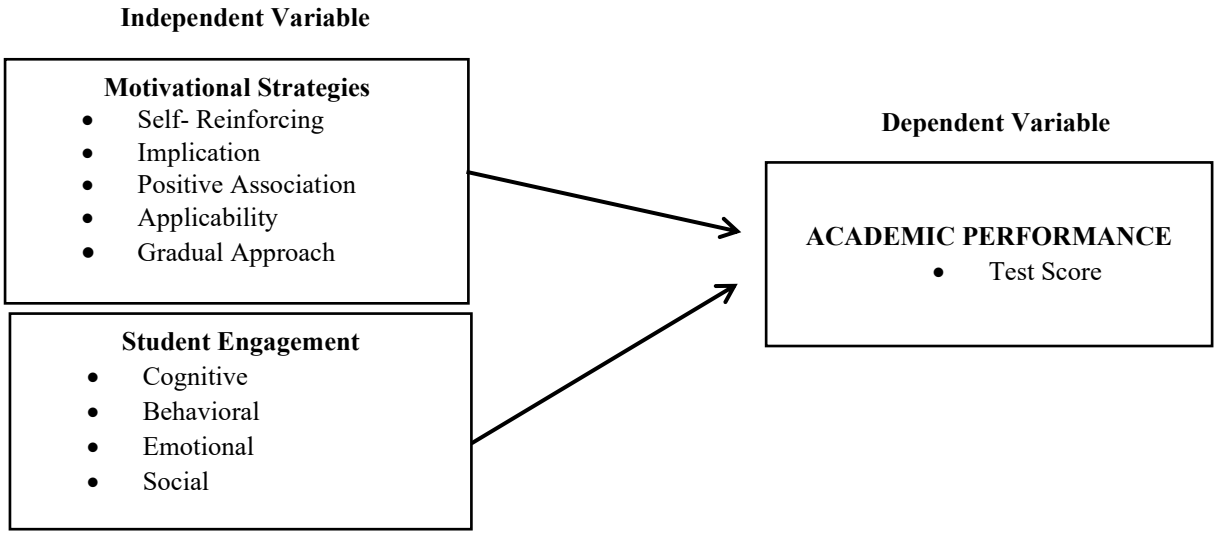


Figure 1. Conceptual Framework

Research Design

This study employed a quantitative research design utilizing descriptive and correlational approaches. McCombes (2022) defined descriptive research design as a type of quantitative research that aimed to accurately and systematically describe a population, situation, or phenomenon. In addition, according to AECT, descriptive research also involved gathering data that described events and then organizing, tabulating, depicting, and describing the data collection (The Association for Educational Communications Technology AECT, 2001). In this study, a total of 229 students as a population size were used. With a confidence level of 95% and a margin of error of 5%, the total sample of respondents was 144 students based on the computation. With that, the first-year had 49 respondents, the second-year had 35 respondents, and the third-year had 60 respondents.

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Research Instrument

This study used an adapted research instrument from Motivational Strategies Scale by Cabrera et al. (2007), an adopted research instrument from the Student Engagement Scale of Wang et al. (2016) and researcher-made summative assessment is utilized in the process of gathering data. These were purposively chosen according to the focus of the study. Each questionnaire underwent validity and reliability testing to assess the instrument's appropriateness, validity and consistency by using the Cronbach's Alpha and item analysis.

Motivational Strategies Scale. In measuring motivational strategies, the researcher utilized an adapted instrument from the Motivational Strategies Scale of Cabrera et al. (2007). It was an 18-item questionnaire with the following domains: self- reinforcing (4 items), implication (4 items), positive association (4 items), applicability (3 items) and gradual approach (3 items). The Motivational Strategies Scale Cronbach's alphas were robust, ranging from .69 to .84, indicating good psychometric validity and reliability. The response options structure was a 5-point likert scale ranging from 1 to 5, with 1 "strongly disagree" to 5 for "strongly agree".

The following parameter limits, with its corresponding descriptions, were applied for the level of motivational strategies.

Parameter Limit	Descriptive Equivalent	Interpretation
4.20 – 5.00	Very High	This indicates that motivational strategies are very much manifested.
3.40 – 4.19	High	This indicates that motivational strategies are manifested.
2.60 – 3.39	Moderate	This indicates that motivational strategies are fairly manifested.
1.80 – 2.59	Low	This indicates that motivational strategies are less manifested.
1.0 – 1.79	Very Low	This indicates that motivational strategies are least manifested.

Student Engagement Scale. In measuring student engagement, the researcher utilized an adopted instrument from the student engagement scale of Wang et al. (2016). It is a 33-item questionnaire with the following domains: cognitive engagement (8 items), behavioral engagement (8 items), emotional engagement (10 items) and social engagement (7 items). The instrument has a value of Cronbach's alpha of 0.90, which indicates good psychometric validity and reliability. The response options structure is a 5-point Likert scale ranging from 1 to 5, with 1 "strongly disagree" to 5 for "strongly agree".

The following parameter limits, with its corresponding descriptions, were applied for the level of student engagement.

Parameter Limit	Descriptive Equivalent	Interpretation
4.20 – 5.00	Very High	This indicates that student engagement is very much manifested.
3.40 – 4.19	High	This indicates that student engagement is manifested.
2.60 – 3.39	Moderate	This indicates that student engagement is fairly manifested.
1.80 – 2.59	Low	This indicates that student engagement is less manifested.
1.0 – 1.79	Very Low	This indicates that student engagement is least manifested.

Researcher-made Summative Assessment. In measuring students' academic performance in mathematics, the researcher utilized a 30-item multiple-choice researcher-made summative assessment. In addition, all the items were crafted based on the Plane and Solid Geometry course syllabus for the second semester, S.Y. 2023 – 2024, and were reflected in the table of specification.

The researcher-made summative examination underwent pilot testing, item analysis, validation, and reliability test to determine the appropriateness, validity, and consistency of the instrument

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Responses for the multiple-choice questions were coded as follows:

Point	Description
1	The student answered the question correctly
0	The student answered the question incorrectly

The percentage of the test score was computed by dividing the number of correct responses over the total highest possible score by multiplying it by 100. The highest score is 30.

In evaluating the level of academic performance of students in mathematics, the following parameter limits were used to interpret the data.

Parameter Limits for Academic Performance

Parameter Limit	Descriptive Equivalent	Interpretation
80.01 – 100.00	Very High	This means that academic performance of students in mathematics is outstanding.
60.01 – 80.00	High	This means that academic performance of students in mathematics is very satisfactory.
40.01 – 60.00	Average	This means that academic performance of students in mathematics is satisfactory.
20.01 – 40.00	Low	This means that academic performance of students in mathematics is fair.
0.00 – 20.00	Very Low	This means that academic performance of students in mathematics is very poor.

Statistical Treatment of Data

The study employed the following statistical tools:

Mean. This was used to measure the level of motivational strategies, student engagement and academic performance of students in mathematics. This answered research questions 1, 2, and 3.

Standard Deviation. This statistical instrument was used to determine the scores' dispersion to the mean value. This answered research questions 1, 2, and 3.

Pearson Product-moment Correlation r or Pearson r. This was used to determine the significant relationship between motivational strategies and academic performance in mathematics, and student engagement and academic performance in mathematics. This answered research question 4.

RESULTS AND DISCUSSION

Level of Motivational Strategies of Students

Summary on the Level of Motivational Strategies of Students

Indicators	SD	Mean	Descriptive Equivalent
Self-reinforcing	0.82	3.93	High
Implication	0.76	4.09	High
Positive Association	0.71	4.24	Very High
Applicability	0.78	3.82	High
Gradual Approach	0.85	3.85	High
Overall	**0.78**	**3.99**	**High**

The analysis of students' motivational strategies reveals several key findings based on the collected data. The mean score for self-reinforcing strategies was high at 3.93, with a standard deviation of 0.82, indicating that students frequently use self-reinforcement to motivate themselves. This aligns with Artino (2011), who notes that self-reinforcement involves individuals rewarding themselves for meeting or exceeding performance standards, thereby fostering academic motivation.

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Level of Student Engagement

Summary on the Level of Student Engagement

Indicators	SD	Mean	Descriptive Equivalent
Cognitive	0.86	3.82	High
Behavioral	0.82	3.87	High
Emotional	0.86	3.71	High
Social	0.80	3.90	High
Overall	**0.84**	**3.83**	**High**

In relation to these results, a study by Joshi et al. (2022) showed that the students have a high social, emotional, and cognitive engagement while behavioral has a moderate mean, which shows that they have a high level of engagement when learning. Also, Foster (2023) said that a common concern among institutions today is to maintain the engagement of students during classes. Those students who are active and put effort to learn new things together such as groups and pair activities, can engage in a comfortable class discussion. Many respondents agree with this, as indicated by low variation in their responses, showing a standard deviation of 0.84.

Level of the Academic Performance of Students in Mathematics

Level of the Academic Performance of Students in Mathematics

Variable	SD	Mean	Descriptive Equivalent
Academic Performance	10.04	75.86	High

Achieving high academic performance in mathematics had higher expectation of success (Leal et al., 2022). The students' performance in Mathematics highly depends on the way they think and feel about learning the course (Abalde & Oco , 2023). Students with high mathematics performance were mostly exposed to tension free classrooms with teachers that adopt instructional approaches that can help enhance their mathematics ability (Mazana et al., 2020)

SUMMARY, CONCLUSION, AND RECOMMENDATION

1. For the level of students' motivational strategies, among the five indicators, positive association attained the highest mean of 4.24 with a standard deviation of 0.71. This indicated a very high level of students' motivational strategies in terms of positive association. Second, implication had an average mean of 4.09 and a standard deviation of 0.76, indicating a high level of motivational strategies in terms of implication. Third, self-reinforcing had an average mean of 3.93 and a standard deviation of 0.82, reflecting a high level of self-reinforcing motivational strategies among students. Fourth, the gradual approach had an average mean of 3.85 and a standard deviation of 0.85, also indicating a high level of motivational strategies in terms of gradual approach. Lastly, applicability had an average mean of 3.82 and a standard deviation of 0.78, showing a high level of motivational strategies in terms of applicability. The overall mean of the motivational strategies was 3.99 with a standard deviation of 0.78, confirming that the overall level of students' motivational strategies is high.
2. The level of student engagement, among the four indicators, social engagement attained the highest mean of 3.90 with a standard deviation of 0.80. This indicated a high level of student engagement in social activities. Second, behavioral engagement had an average mean of 3.87 and a standard deviation of 0.82, showing a high level of student engagement in behavioral activities. Third, cognitive engagement had an average mean of 3.82 and a standard deviation of 0.86, also reflecting a high level of cognitive engagement among students. Lastly, emotional engagement had an average mean of 3.71 and a standard deviation of 0.86, indicating a high level of emotional engagement. The overall mean of student engagement was 3.83 with a standard deviation of 0.84, confirming that the overall level of student engagement is high. For the level of students' academic performance in mathematics. It had a high descriptive equivalent with a mean of 75.89 and a standard deviation of 10.4. This means that academic performance of students in mathematics is very satisfactory.
3. The significant relationship between motivational strategies and academic performance result showed that it has no significant relationship with a p-value of 0.093 and a Pearson correlation coefficient (r) of 0.141 therefore, the decision on null hypothesis was not rejected. Similarly, no significant relationship between student engagement and academic performance with a p-value of 0.971 and a Pearson correlation coefficient (r) of 0.003 therefore, the null hypothesis is not rejected.

Conclusions

For the discussion of the findings of this research investigation, the conclusions are presented in the following:

1. The level of motivational strategies of the students is high in terms of self-reinforcing, implication, positive association, applicability, and learning strategies.
2. The level of student's engagement is high in terms of cognitive, behavioral, emotional, and social.
3. The level of academic performance of the students in mathematics is very satisfactory. This indicates that students' knowledge and ability on the concepts of mathematics is beyond moderate level.
4. There is no significant relationship between motivational strategies and academic performance, the result indicates that there is no sufficient data that these motivational strategies can solely affect the students' academic performance in mathematics. Also, there is no significant relationship between student engagement and academic performance. Despite having high cognitive, behavioral, emotional, and social level of motivational strategies, their interactions, and optimistic approach in learning, are still not enough to indicate that it can influence the students' academic performance. Furthermore, motivational strategies and student engagement cannot significantly affect the students' academic performance in mathematics.

Recommendations

In connection with the study's results and findings, the following have been recommended:

1. Positive association was found to be the most effective motivational strategy, therefore, schools are encouraged to continue using positive reinforcement techniques, such as praise and recognition, and creating a supportive classroom environment. Similarly, connecting mathematical concepts to real-life situations can enhance student motivation. Teaching self-regulation techniques and encouraging self-reflection are also beneficial. Additionally, adopting a gradual approach by breaking down complex concepts into manageable steps and allowing students to progress at their own pace can further support learning. Although applicability scored lowest, it remains important to demonstrate the relevance of math through practical examples and interdisciplinary projects.
2. In terms of student engagement, the researchers found that social and behavioral engagement are the most prominent. To foster these, educators should be promoting group work, peer-to-peer learning, and a collaborative classroom culture. Cognitive and emotional engagement also play crucial roles, suggesting the need for challenging tasks that encourage critical thinking, providing emotional support, and creating a safe environment for students to express their thoughts and feelings.
3. For further study in this same context, the researchers recommend using students' GPAs instead of scores from the personally made questions to see if there will be difference in the result.
4. The researchers recommend furthering the study of the relationship of motivational strategies and student engagement to academic achievement in different academic domain. The research only focuses on mathematics, and it is therefore limited for motivational strategies and student engagement inclined towards mathematics.
5. For future researchers should explore additional factors influencing students' academic performance in mathematics beyond motivational strategies and student engagement. Investigate the impact of various teaching methods, socio-economic factors, and classroom environments. Conducting longitudinal studies could provide valuable insights into the long-term effects of different strategies and interventions. Employ mixed-methods research to incorporate qualitative data, offering a deeper understanding of students' experiences and perspectives. Additionally, utilizing larger and more diverse sample sizes across various educational settings will enhance the generalizability and applicability of the findings.

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