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Article

Unraveling The Mediating Influence of Self-Efficacy and Learning Sessions on Students' Performance in Mathematics

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Abstract: This study investigates the relationship between self-efficacy, learning sessions, and academic achievement in mathematics among Grade 9 students. Utilizing a descriptive quantitative research design, data were collected through surveys and standardized tests, and analyzed using statistical methods. The findings indicate a balanced distribution of students between morning and afternoon learning sessions, with no significant differences in self-efficacy or academic performance based on session timing. Students exhibited moderate self-efficacy overall, but their academic achievement was generally low, with most students falling into the "Developing" category. Furthermore, the correlation analysis revealed a negligible positive relationship between self-efficacy and academic achievement, which was not statistically significant. These results suggest that factors other than self-efficacy and session timing may play more critical roles in influencing students' mathematics performance, highlighting the need for further research and targeted educational interventions to improve outcomes in this subject.

Keywords: Self-efficacy, academic achievement, mathematics education, learning sessions

Introduction

Self-efficacy, a term coined by psychologist Albert Bandura, refers to an individual's belief in their ability to succeed in specific situations or accomplish a task (Bandura, 1997). This concept is crucial as it influences motivation, thought patterns, emotional reactions, and behaviors. High self-efficacy can enhance human accomplishment and personal well-being in many ways. Individuals with strong self-efficacy are more likely to set challenging goals and persist in the face of difficulties (Schunk & DiBenedetto, 2020). Moreover, self-efficacy affects how people feel, think, motivate themselves, and behave, thus playing a pivotal role in how one approaches goals, tasks, and

challenges (Maddux & Kleiman, 2018). As such, understanding and fostering self-efficacy is essential for enhancing personal and professional development.

In the educational context, self-efficacy is particularly important as it directly influences students' motivation and learning. Students with high self-efficacy are more likely to engage in learning activities, persist longer, and achieve higher levels of performance (Usher & Pajares, 2008). This is because they believe in their capabilities to succeed in academic tasks, which enhances their motivation and perseverance. For example, a student who believes they can master algebra is more likely to tackle challenging problems and persist through difficulties (Zimmerman, 2000). Moreover, educational strategies that enhance self-efficacy, such as mastery experiences, social modeling, and verbal persuasion, can lead to improved academic outcomes (Schunk & Pajares, 2010). Therefore, fostering self-efficacy is a critical component of effective teaching and learning practices.

The relationship between self-efficacy and academic performance is well-documented in educational research. Studies have shown that self-efficacy is a significant predictor of students' academic success (Richardson, Abraham, & Bond, 2012). Students with higher self-efficacy tend to set higher academic goals, exert greater effort, and demonstrate greater resilience in the face of setbacks (Chemers, Hu, & Garcia, 2001; Suson et al., 2020). This positive correlation is evident across various subjects, including mathematics, where students' belief in their ability to solve problems significantly impacts their performance (Pajares & Miller, 1994). Moreover, self-efficacy influences students' academic behaviors, such as attendance, time management, and help-seeking, all of which contribute to better academic outcomes (Komarraju & Nadler, 2013). Therefore, enhancing students' self-efficacy is a vital strategy for improving their academic performance.

Numerous researchers have explored the role of self-efficacy in education and its impact on academic performance. For instance, Zimmerman (2000) conducted extensive studies on self-regulated learning and highlighted the role of self-efficacy in motivating students to engage in self-regulatory processes. Similarly, Schunk and Pajares (2010) reviewed various interventions designed to enhance self-efficacy in educational settings and found that these interventions significantly improve academic outcomes. Other studies, such as those by Usher and Pajares (2008), examined the sources of self-efficacy beliefs in students and their influence on academic motivation and achievement. More recent research by Honicke and Broadbent (2016) provided a meta-analytic review of the relationship between academic self-efficacy and academic performance, confirming the significant impact of self-efficacy on students' academic success. These studies collectively underscore the importance of self-efficacy in educational research and practice.

Despite the extensive research on self-efficacy and academic performance, several gaps remain. One notable gap is the need to explore the specific effects of learning sessions in mathematics on students' self-efficacy. While many studies have examined general academic self-efficacy, few have focused on how targeted interventions in mathematics can enhance students' beliefs in their mathematical abilities (Pajares, 2005). Additionally, there is a lack of research on the current level of self-efficacy among students specifically in learning mathematics, which could provide insights into tailored interventions. Furthermore, understanding the level of academic achievement in mathematics in relation to self-efficacy could help educators develop more effective teaching strategies. Addressing these gaps can provide a more comprehensive understanding of how to support students in achieving better academic outcomes in mathematics.

Research at Madridejos National High School and Apas National High School aims to address these gaps by investigating the relationship between learning sessions in mathematics and students' self-efficacy. This research will involve assessing the current levels of self-efficacy among students and examining how specific interventions, such as peer tutoring, formative assessments, and interactive learning activities, impact their beliefs and academic performance. Additionally, the study will measure the academic achievement of students in mathematics before and after these interventions to determine their effectiveness. By focusing on these aspects, the research aims to develop evidence-based strategies to enhance self-efficacy and academic outcomes in mathematics, ultimately contributing to improved educational practices and student success in these schools.

Methodology

This study employed a descriptive quantitative method to collect and analyze data, aiming to describe and summarize specific phenomena within a population. According to Creswell and Creswell (2018), descriptive quantitative design is effective for exploring relationships between variables and assessing the prevalence of certain characteristics. The researchers used simple random sampling to select respondents from Grade 9 students at Madridejos National High School and Apas National High School in Cebu. Grade 9 was chosen as it represents students who have completed nearly three years in Junior High School, allowing for the identification of issues impacting their preparation for Senior High School. Data collection involved surveys and questionnaires, specifically a Likert Scale questionnaire adapted from Nicolaidou and Philippou (2014) titled "Self-Efficacy towards Learning Mathematics". This instrument consisted of two parts: the first part gathered demographic information, and the second part contained ten affirmative statements measuring self-efficacy in learning mathematics. Additionally, to assess the students' level of math

achievement, a standardized test comprising 40 multiple-choice questions from the Department of Education's validated modules, covering the first to fifth week of the third quarter of the Grade 9 K-12 Mathematics curriculum, was administered. The collected data was then processed through statistical analysis to obtain numerical summaries and descriptive statistics.

Results and Discussion

Table 1. Respondents' Learning Session in Mathematics

Learning Session	f	%
Morning	149	50.85
Afternoon	144	49.15
Total	293	100.00

Table 1 presents the distribution of respondents according to their learning sessions in mathematics. The data indicates that out of the 293 Grade 9 students surveyed, 149 students (50.85%) attended mathematics sessions in the morning, while 144 students (49.15%) attended in the afternoon. This nearly even distribution suggests that both morning and afternoon sessions are equally utilized for teaching mathematics. The slight majority attending morning sessions may imply a preference or scheduling necessity for some students, but overall, the balance between the two sessions reflects a well-distributed approach to accommodating students' needs in terms of learning schedules. This balanced distribution ensures that the findings related to self-efficacy and academic performance are representative across different times of the day, providing a comprehensive understanding of students' experiences and outcomes in mathematics learning sessions.

Table 2. Level of Self-Efficacy of the Respondents in Learning Mathematics

S/N	Indicators	WM	Verbal Description
1	I am one of the best students in Mathematics.	2.73	Moderate
2	I believe that I have a lot of strengths in Mathematics.	2.85	Moderate
3	Compared to other students, I am a smart student in Mathematics.	2.45	Low
4	Mathematics is one of my strengths.	2.92	Moderate
5	I usually can help my classmates, when they ask me for help in problem-solving.	3.11	Moderate
6	I can usually solve any mathematical problem.	2.83	Moderate
7	I feel sure about myself in solving Mathematical problems.	2.77	Moderate
8	When I start answering a mathematical question, I usually feel that I would manage to give a solution.	2.89	Moderate
9	I can easily understand Mathematical problems.	2.95	Moderate
10	I am capable of making good grades in Math.	2.95	Moderate
Aggregate Weighted Mean		2.84	Moderate

Legend: 4.21-5.00-Very High; 3.41-4.20-High; 2.61-3.40-Moderate; 1.81-2.60-Low;1.00-1.80-Very Low

Table 2 provides a detailed assessment of the self-efficacy levels among Grade 9 students in learning mathematics, measured through ten specific indicators. The aggregate weighted mean of 2.84 falls within the "Moderate" range, indicating that overall, students have a moderate level of confidence in their mathematical abilities. The highest individual mean score (3.11) pertains to students' belief in their ability to help classmates with problem-solving, suggesting a sense of competence and peer support in this area. Other indicators, such as the belief in making good grades (2.95) and understanding mathematical problems (2.95), also received moderate ratings, reflecting a generally positive but not exceedingly high self-efficacy. Notably, the lowest score (2.45) was for the perception of being a smart student in mathematics compared to peers, indicating some students may feel less competitive or confident relative to others. Most indicators hover around the moderate range, showing that while students possess a reasonable level of self-assurance in their mathematical skills, there is still room for improvement to elevate their confidence to a higher level. This data underscores the importance of targeted interventions to enhance students' self-efficacy in mathematics, potentially leading to better academic outcomes.

Table 3. Level of Academic Achievement of the Respondents in Mathematics

Level	Range of Scores	f	%
Advanced	33-40	0	0.00
Proficient	25-32	2	0.68
Approaching Proficiency	17-24	53	18.09
Developing	9-16	203	69.28
Beginning	0-8	35	11.95
Total		293	100.00
Mean		13.03	
St. Dev.		3.92	

Table 3 outlines the academic achievement levels of Grade 9 students in mathematics, based on their scores from a standardized test. The data reveals that the majority of the respondents fall within the "Developing" category, with 203 students (69.28%) scoring between 9 and 16 points. This is followed by 53 students (18.09%) who are "Approaching Proficiency," scoring between 17 and 24 points. A small number of students, 35 (11.95%), are at the "Beginning" level, scoring between 0 and 8 points. Only 2 students (0.68%) reached the "Proficient" level with scores ranging from 25 to 32, and none of the students scored within the "Advanced" range (33-40 points). The mean score for the respondents is 13.03, with a standard deviation of 3.92, indicating a relatively low overall performance with a moderate spread of scores around the mean. This distribution highlights significant challenges in achieving higher levels of proficiency in mathematics among the

students, suggesting the need for enhanced instructional strategies and support to improve their academic outcomes in this subject area.

Table 4. Test of Difference on the Self-efficacy of the Respondents when grouped by Learning Sessions

Source of Difference	Mean	Standard Deviation	Mean Difference	Computed t- value	p-value	Decision	Result
Morning	12.69	3.64	-0.68	-1.495	0.136	Do not reject Ho	Not Significant
Afternoon	13.37	4.17					

*Significant at p<0.05

Table 4 presents the results of a t-test conducted to determine if there is a significant difference in the self-efficacy of Grade 9 students in mathematics when grouped by their learning sessions (morning vs. afternoon). The mean self-efficacy score for students attending morning sessions is 12.69 with a standard deviation of 3.64, while the mean score for those attending afternoon sessions is 13.37 with a standard deviation of 4.17. The mean difference between the two groups is -0.68. The computed t-value is -1.495, and the p-value is 0.136, which is greater than the significance level of 0.05. As a result, we do not reject the null hypothesis (Ho), indicating that there is no statistically significant difference in self-efficacy between students attending morning and afternoon learning sessions. This suggests that the time of day during which students attend their mathematics classes does not significantly impact their self-efficacy levels. Consequently, other factors beyond the timing of the learning sessions might play a more crucial role in influencing students' self-efficacy in mathematics.

Table 5. Test of Difference on the Academic Achievement of the Respondents in Mathematics when grouped by Learning Sessions

Source of Difference	Mean	Standard Deviation	Mean Difference	Computed t- value	p-value	Decision	Result
Morning	28.24	7.65	-0.41	-0.469	0.639	Do not reject Ho	Not Significant
Afternoon	28.65	7.07					

*Significant at p<0.05

Table 5 illustrates the comparison of academic achievement in mathematics between students attending morning and afternoon learning sessions. The mean score for students in the morning session is 28.24, while the mean score for students in the afternoon session is

slightly higher at 28.65. Although the mean scores suggest a marginal difference favoring the afternoon session, the table does not provide additional statistical details such as the standard deviation, t-value, or p-value to determine if this difference is statistically significant. However, based on the notation "*significant at p<0.05," it is implied that the difference was tested for statistical significance. Without the specific p-value, it is challenging to conclusively determine the significance of this difference. Nonetheless, the close mean scores indicate that the time of day for learning sessions does not have a substantial impact on students' academic achievement in mathematics. This finding suggests that factors other than the timing of the sessions are likely more influential in determining students' performance in mathematics.

Table 6. Test of Relationship between Self-efficacy and Academic Achievement of the Respondents in Mathematics

Variables	r-value	Strength of Correlation	p - value	Decision	Remarks
Self-efficacy and Academic Achievement	0.099	Negligible Positive	0.091	Do not reject Ho	Not Significant

*Significant at p<0.05 (two-tailed

Table 6 presents the results of a correlation analysis between self-efficacy and academic achievement among Grade 9 students in mathematics. The computed r-value is 0.099, indicating a negligible positive correlation between the two variables. This suggests that there is a very weak association where higher self-efficacy is slightly related to higher academic achievement in mathematics, but the relationship is not strong. The p-value of 0.091 exceeds the significance threshold of 0.05, leading to the decision to not reject the null hypothesis (Ho). This indicates that the observed correlation is not statistically significant. Therefore, based on this analysis, self-efficacy does not have a significant impact on academic achievement in mathematics among the respondents. This finding implies that other factors beyond self-efficacy may play a more substantial role in influencing students' performance in mathematics, and these factors should be explored in further research to better understand the determinants of academic success in this subject.

Conclusion

The study provides a comprehensive analysis of the factors influencing the self-efficacy and academic achievement of Grade 9 students in mathematics. The study provides several key important findings. First, students are evenly distributed between morning and afternoon learning sessions, showing no significant impact of session timing on their self-efficacy or academic performance. The overall self-efficacy levels are moderate, indicating some confidence in mathematics but

highlighting the need for further improvement. Academic achievement is generally low, with most students classified as "Developing" and a mean score of 13.03, pointing to a need for targeted educational support. Additionally, the negligible positive correlation between self-efficacy and academic achievement suggests that self-efficacy alone does not significantly predict academic success in mathematics, emphasizing the importance of exploring other influencing factors. These findings underline the necessity of comprehensive strategies to enhance both self-efficacy and academic performance in mathematics.

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