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Self-Efficacy in Mathematics: A predictor in the Mathematics performance of grade 8 learners

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Abstract
Purpose: This study was conducted to determine the respondents' mathematics self-efficacy and their mathematics performance. It also pursues predicting the academic performance in mathematics of Grade 8 learners through their mathematics self-efficacy.
Research methodology: The study was conducted on 159 Grade 8 students at Matucay National High School and examined the relationship between the learners' mathematics performance and their self-efficacy towards mathematics and looked for its impact on their academic performance using regression analysis.
Results: The study reveals that students have average performance in mathematics and moderate confidence in their mathematics self-efficacy. The study also found that students' mathematics self-efficacy predicts their academic performance in mathematics. Thus, it is suggested that the students' mathematics self-efficacy should be boosted to have a higher academic achievement.
Conclusions: A formula for predicting learners' mathematics performance based on self-efficacy was derived, showing a positive predictive effect and indicating that self-efficacy was a key factor in the academic performance of the learners in mathematics.
Limitations: The study investigates the link between students' mathematics self-efficacy and academic performance, emphasizing the need for effective teaching strategies to enhance students' perception of mathematics as a fun and interesting subject.
Contribution: The study analyzed grade 8 students, examining if academic self-efficacy predicts academic performance. Results of the study may vary based on grade level and subject learning area.

Keywords: *Mathematics Performance, Predictor, Regression Analysis, Academic Self-efficacy, Self-efficacy*

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1. Introduction

Mathematics is an integral part of all areas of life. Mathematical skills can be used to solve problems in daily living related to time, sports, travel, money management, science, and art. Mathematics is part of human history particularly important to the history of the Philippines. Mathematical values and habits of mind go beyond numbers and symbols; they help us connect, create, communicate, visualize, reason, and solve. Mathematical thinking makes it possible to analyse new and complex problems from various perspectives to consider possible solutions and evaluate the effectiveness of the solution. They build self-confidence in their ability to solve everyday problems without doubt or fear of math when these habits of mind are developed at an early age.

Everyone needs to learn math because it can give young people a powerful tool that can be useful when they face problems and challenges in life and at work. Confidence is a person's assessment that he can perform a certain action. This is their "I can" or "I can't" belief towards working with mathematics problems. Unlike self-esteem, self-efficacy reflects how confident students are in completing certain

tasks which reflects how students feel about their value or worth. High self-confidence in one area does not necessarily equal high self-efficacy in another. Just as high confidence in skiing does not necessarily correlate with high confidence in baseball, high confidence in math does not necessarily correlate with high self-efficacy in spelling. Self-efficacy matches the task being attempted. However, high self-confidence does not necessarily mean that students believe they can do it. Although self-confidence reflects how strongly students believe they have the skills to succeed, they may believe that other factors prevent them from succeeding.

One of the most well-known theories that aims to understand and explain the elements that direct and coordinate human activity is the theory of social cognition (Bandura, 1977). According to Schunk (2022), the social cognitive theory states that an individual's thinking and the external world in which they live influence their behaviour. Self-efficacy (SE) is a crucial cognitive component that directs and guides behaviour through individual cognitions. Self-efficacy, according to Bandura (1977), is an assessment of an individual's ability to perform tasks involving goals, activities, and the environment. Many fields, including academic achievement, addiction recovery, leadership effectiveness, and drug treatment, have extensively explored the concept of self-efficacy. In the field of education, self-efficacy is often referred to as academic self-efficacy (ASE), which refers to confidence in one's ability to learn or behave in a certain way. Academic self-efficacy is the epitome of self-efficacy in the field of education. Also, studies have found that academic self-efficacy has been identified as a key factor in determining and predicting academic success among college students in various areas. In addition, academic self-efficacy is one of the characteristics of students' psychological well-being.

Moreover, academic performance refers to students' success or failure in school. This is consistent with Adenike and Oyesoji (2020) and Akomolafe, Ogunmakin, and Fasooto (2023) research results, where they show that low-achieving students have higher high school failure rates. According to Bhagat (2023), academic success is the result of the learning and teaching process in an educational setting, where students and teachers are involved in the achievement of teaching and learning goals. Similarly, VandenBos (2015) revealed that academic success is a series of individual activities related to their performance in academic tasks.

In addition, this study will explain why and how academic achievement is correlated with students' mathematical self-efficacy. One of them is the findings of the study of Richardson, Abraham, and Bond (2012) that five aspects influence academic success, namely: (1) personality traits; includes five personality traits, especially conscientiousness; (2) motivating factors; includes measurable aspects of motivation such as academic self-efficacy, locus of control, extrinsic and intrinsic academic motivation; (3) self-regulated learning strategies; refers to individual strategies for motivation, thinking, emotions, time management and focus on learning; (4) students' approaches to learning; includes cognitive strategies for academic tasks such as memorization and practice; (5) psychosocial contextual influence; includes individual characteristics and experiences, individual social interactions with academic Pintrich (Fun, 2021) is a key motivational variable that explains the social, contextual, motivational and cognitive interactions that affect academic performance, such as exam performance or course performance and Grade Point Average (GPA). Self-efficacy is one of the factors influencing the academic success of students, as cited by some studies. Self-efficacy is an individual's belief in his ability to do something effectively (Hall, 2019). The research results of Agustiani, Cahyad, and Musa (2016), Akram and Ghazanfar (2024), Alci (2015), Maropamabi (2024), Akomolafe et al. (2023), Shkullaku (2023), and Stajkovic, Bandura, Locke, Lee, and Sergent (2018) show that self-efficacy plays a role in improving academic performance.

Nothing has ever changed when it comes to Mathematics because students think of it as one of the most boring and difficult subjects. The fact that students want to skip math class and do not listen when teachers are explaining in front is one of the reasons why their academic performance is poor. Although some students look forward to learning mathematics, they tend to lose interest when they see that it is very difficult to understand and that the complexity of the lesson is beyond their grasp. This is the reason why students give up and their self-confidence in learning math falls for a reason that is directly proportional to the effect of low or high math performance on their academic performance.

More so, the general weighted average (GWA) for mathematics among grade 8 students at Matucay National High School for the 2022–2023 school year is 84.50, the lowest of all their subject areas. This means that out of all the essential competencies that grade 8 students should be able to master, mathematics has the least amount of mastery, and at worst, some of it is not mastered. Their least-mastered competency problems from quarters one through four of their mathematics class, which are shown in the item analysis of their exams, further corroborate this. According to Grade 8 students' perceptions, opinions, and interviews about the subject conducted by other grade-level researchers last year, there is another reason why the students detest mathematics: they find it to be extremely dull, boring, uninteresting, and hard to grasp.

Thus, it was the longest line that the researcher conceived of for a study whose main purpose was to determine if the students' self-efficacy was correlated with their academic performance in mathematics. Also, it sought to determine if the mathematical self-efficacy of learners could predict their performance in mathematics. If it could have been established that self-efficacy could predict the mathematics performance of the respondents, then the students, teachers, and administrators had to be made aware of the ways taken to boost self-efficacy.

1.1 Research Questions

1. What is the mean performance of the respondents in Mathematics?
2. What is the Mathematics self-efficacy of the respondents?
3. Is there a significant relationship between the respondents' self-efficacy and their academic performance in Mathematics?
4. What is the Least Square Regression Equation that relates self-efficacy in Mathematics and performance in Mathematics?
5. What is the coefficient of determination of the dependent variable that is explained by the Least Square Regression Equation and the independent variable?

1.2 Hypotheses

There is no significant relationship between the respondents' Mathematics self-efficacy and their performance in Mathematics.

2. Literature Review

The following text was taken from several works of writing relevant to the research in terms of error pattern analysis and attitude toward Mathematics as impacted by students' problem-solving skills.

2.1 Self-Efficacy and Mathematics

It has been perceived that the self-efficacy of learners is connected to how they perform in certain subject areas, one of which is mathematics. Well, we can't deny the fact that students do really hate mathematics and find it boring and uninteresting because they just always deal with symbols, formulas, and numbers repeatedly. As previously stated, Bandura (1997) defined perceived self-efficacy not by the number of skills a person possesses but by what the person believes he can do with the skills. According to Satici and Can (2016), academic self-efficacy is a student's personal belief in their capacity to achieve educational tasks at specified levels. Efficacy plays a part in human competence and contributes to what people believe they can accomplish. Individuals with high levels of academic self-efficacy view complex tasks as manageable and do not give up easily. Robert (2018) found out that once students were admitted into an associate in science nursing program, their motivation and self-efficacy levels continued to develop and increase, which led them to achieve their academic goal of becoming nurses. The nursing students' motivational processes were apparent as they persisted toward admission into their desired degree program. Student motivation continued to increase as their acceptance moved to course completion. Meanwhile, in the academic setting, students who lack academic self-efficacy are unable to perform well and are less likely to persist, as stated by Thompson and Verdino (2019). Research about community and technical college students can expand knowledge concerning the relationship between academic self-efficacy, persistence, and academic achievement. Beatson, Berg, and Smith (2018) demonstrated that enactive mastery feedback received by students in

their midterm examinations would positively affect their self-efficacy through three different aspects: academic success, help-seeking, and academic organization. The study demonstrated that active mastery feedback in the form of a midterm grade given to a class of accounting students was likely to affect students' beliefs in their ability to achieve academically in the course and alleviate the feelings of becoming stressed and overwhelmed. Thus, students with higher levels of self-efficacy study more and manage complex academic tasks more effectively than those with low levels of academic self-efficacy (Satici & Can, 2016); thus, self-efficacy is related to persistence, tenacity, and achievement in educational settings.

2.2 Relationship between Self-efficacy and Academic Achievement

Students' self-efficacy and anticipation towards mathematics are directly related to their academic achievement. This is because students do know how well or how they will behave during the class lectures and sessions and how they will take the subject, which will eventually result in either a good or bad performance in the subject area. Further, their attitude toward mathematics will reveal how they will take it, whether positive or negative and will subsequently reflect on their performance in it. According to a study that has been proposed by Shah et al. (2023), learners' attitudes influence their mathematical achievement. Also, a study conducted in Malaysia discovered that employing a cooperative learning strategy improves students' attitudes toward mathematics, leading to improved performance (Zakaria, Chin, & Daud, 2010). Plus, Almagro and Edig (2024) revealed a clear connection between positive computer attitudes and active social media engagement, which indicates 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. This was also supported by Mohammed, Philip, and Labaran (2024), who found that the use of social media has a significant impact on students' learning abilities, writing skills, and academic performance. However, some investigations yielded slightly different outcomes. An analysis conducted by Khaneghahi, Nasripour, and MahmoudZehi (2022) also showed that there is a positive and significant relationship between academic motivation and students' academic enthusiasm. The intensity of this relationship is very strong, and academic motivation has the power to predict academic enthusiasm. According to Marchiş (2013), learners' attitudes toward mathematics are related to their problem-solving abilities. According to Mensah, Okyere, and Kuranchie (2013), people with good attitudes toward mathematics are more likely to express their excitement to tackle mathematical problems. In the study conducted by Bart, Can, and Hokanson (2020), the results indicated that the relationship between high creativity and high academic achievement varies among eighth and eleventh graders. High mathematics and high reading achievement are related to high creativity among both eighth- and eleventh-grade students but with small effect sizes. This is also true with the study conducted by Chukwuka and Pius (2024), wherein their findings revealed a significant positive association between the competitive learning approach and students' academic performance in cost accounting in federal universities in the south-south region of Nigeria. On the other hand, factors regarding how students use the means of ICT tools make a difference in their motivation, as Caratiquit and Caratiquit (2023) found that the influence of ChatGPT as an educational aid on students' academic performance is fully mediated by their learning motivation. According to Inoncillo (2024), both mathematics test anxiety and numerical anxiety predict mathematics achievement [$F(2, 94)=8.450$, $p<0.005$] through multiple regression analysis. Furthermore, results showed that between the two dimensions of mathematics anxiety, numerical anxiety highly predicts mathematics achievement ($b = -8.710$, $p = 0.001$). Thus, inversely significant relationships exist between mathematics test anxiety and mathematics achievement and between numerical anxiety and mathematics achievement. Moreover, mathematics test anxiety and numerical anxiety, when combined, significantly predict mathematics achievement. Furthermore, between mathematics test anxiety and numerical anxiety, it is numerical anxiety that predicts mathematics achievement when taken individually. However, the study of Ganzon and Edig (2022) indicated that time management is manifested most of the time and self-directed learning is often observed. Moreover, the academic performance in mathematics is not proficient. Further, time management and self-directed learning were found to have no significant relationship with academic performance in mathematics. Thus, time management and self-directed learning do not significantly predict academic performance in mathematics. However, with the research conducted by Ubaidillah, Saifullah, Hitomi, and Bulut (2023) on self-efficacy and academic performance of

vocational high school students, it was clear and indicated that self-efficacy has a significant role in academic performance. Thus, it provides concrete evidence that academic self-efficacy can predict students' academic performance.

2.3 Evidence for Predictive Validity of Academic Self-Efficacy

This study identified and found evidence that academic self-efficacy is able to predict students' academic performance based on how they perceive and then approach a specific subject. Early research identified elements of self-efficacy and social cognitive theory as influencing student persistence and academic success (Chemers, Hu, & Garcia, 2001; Majer, 2009; Schunk & Pajares, 2002; Zimmerman, Schunk, & DiBenedetto, 2017). In the early 2000s, academic self-efficacy and its relationship to academic achievement were studied. However, there has been little research on the relationship between academic achievement and self-regulation in two-year public and technical colleges. According to the results of Majer (2009), academic self-efficacy and GPA were significantly correlated, suggesting that further research is needed to better understand the relationship between self-efficacy, academic achievement, and demographic characteristics of community and technical college students. Similarly, Ramos-Sánchez and Nichols (2007) argued that the need to determine a student's level of self-efficacy in correlation with academic performance can lead to greater effort and a greater likelihood of learning. According to the findings of Sari, Yaniawati, and Kartasasmita (2019), students' understanding of mathematical problem-solving affects their mathematical learning outcomes. Similarly, Sinaga, Sitorus, and Situmeang (2023) showed that students' understanding of solving mathematical problems has a positive and significant effect on their mathematical performance. In conclusion, it has a really big impact on how students feel about mathematics and how they perform tasks related to their academic performance later. Macaso and Dagohoy (2022) also found that there is a significant positive relationship between mathematical attitude, reflective thinking skills, and mathematical performance. However, it was found that there is a negative, non-significant relationship between problem-solving skills and math performance, but research strongly believes that math self-efficacy is an important predictor of math performance.

2.4 Theoretical Underpinnings of the Study

The strategy for reviewing journals is to conduct a literature search and collect articles using the keywords reasoning, mathematical reasoning, and reasoning in school learning that relate to the underpinning theories that impact the student's self-efficacy towards mathematics and how it affects their academic performance. It is not news that numerous studies have been established to find the correlation between the self-efficacy of learners and their academic performance, contributing to a successful or failed study. One critical factor that has gained significant attention is the role of self-efficacy, which refers to an individual's beliefs or perceptions about their abilities to perform specific tasks or achieve desired outcomes (Ubaidillah et al., 2023; Ryan et al., 2022; Cuevas & Berou, 2016). Self-efficacy and mathematical performance have been the subject of several studies, and the results consistently point to a substantial positive correlation between the two. Students with high levels of self-efficacy in mathematics tend to be more motivated, persistent, and willing to engage in challenging tasks, ultimately leading to better academic performance.

Self-efficacy is derived from the theoretical framework of social cognitive theory (Schunk & Pajares, 2022). The social-cognitive approach emphasizes that human achievement is dependent upon one's behaviors, personal factors, and environmental conditions (Bandura, 1986; 1997). As a framework to study academic self-efficacy in community and technical colleges, social cognitive theory is most connected to human achievement within academia. Social cognitive theory encompasses learners who obtain information to assess their level of self-efficacy from their performance, experiences, others' influences, and physiological reactions. Learner self-efficacy beliefs influence task choice, effort, persistence, resilience, and achievement (Schunk, 1995; Bandura, 1997). Students with high levels of self-efficacy are more likely to perform a task, work harder, persist longer when confronted with adversity, and achieve at high levels.

Bandura's social cognitive theory, which provides a framework for understanding the sources of self-efficacy, highlights four key factors that contribute to an individual's sense of self-efficacy: mastery

experiences, vicarious experiences, verbal persuasion, and physiological states (Ubaidillah et al., 2023). Mastery experiences, such as past successes in mathematics, can boost an individual's confidence and self-belief, while vicarious experiences, such as observing the success of peers, can also influence self-efficacy. According to Ubaidillah et al. (2023), verbal persuasion, in the form of encouragement, feedback, and guidance from teachers, can also play a significant role in shaping students' self-efficacy beliefs.

Additionally, the interaction between student and classroom context can also shape the development of adaptive self-efficacy. As highlighted in the study by Câmpean et al. (2024), emphasizes the importance of incorporating positive feedback strategies in educational settings to foster a supportive and motivating learning environment for students. Thus, the amount and form of successful experiences, as well as the type of feedback and support provided by teachers, can have a significant impact on the self-efficacy of individual students within the same classroom. By understanding the factors that contribute to the development of self-efficacy, educators can implement strategies to foster a positive learning environment that supports the growth of students' self-belief and, ultimately, their mathematics performance.

The literature, studies, and theoretical underpinnings provided a foundation for the conceptualization of the research paradigm presented in Figure 1. The independent variable is the mathematics self-efficacy of the respondents, while the dependent variable is their average grade in mathematics. These variables are presumed to be related to each other in that the self-efficacy in mathematics of the respondents affects their mathematics performance.

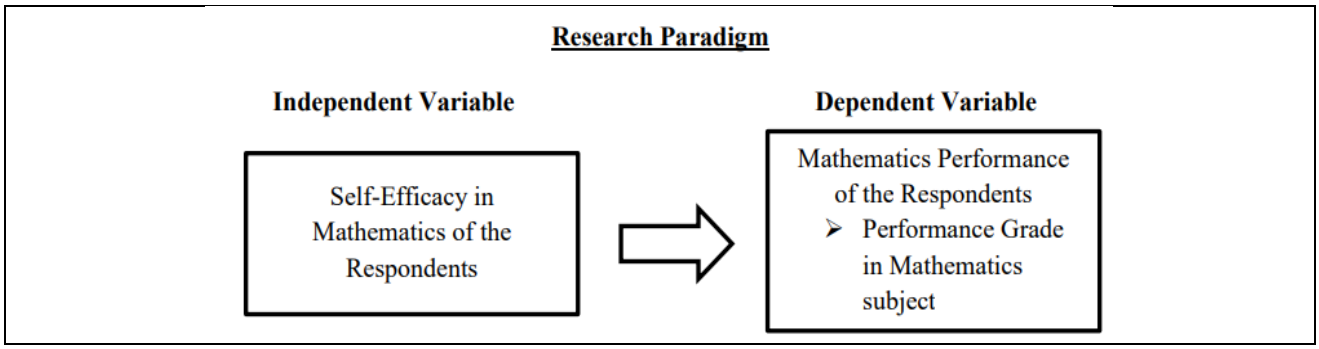

Figure 1. Paradigm of the study

2.5 Scope and Delimitation

This study focused on the self-efficacy of Grade 8 students as a predictor of their mathematics performance. The relationship between the self-efficacy in mathematics of the respondents and their academic performance will be determined. The study used a survey questionnaire adopted and validated by Mullis, Martin, Foy, and Arora (2012) and PISA 2012 (Organization for Economic Co-operation and Development, 2012), wherein holds the concept of confidence in learning mathematics. The respondents of the study were the 159 Grade 8 students who are currently enrolled at Matucay National High School, and it was conducted during the Fourth Quarter of the School Year 2023-2024 from March to May 2024. The said school is located along the National Highway in Matucay, Allacapan, Cagayan.

3. Methodology

This chapter discusses the study's methodologies, such as the research design, participants, instrumentation, and data analysis.

3.1 Research Design

This study used a descriptive-correlational design. A descriptive design was used to present the mean performance grade in mathematics and the weighted mean average of the respondents' self-efficacy in mathematics. A correlational design was used to test the relationship between respondents' self-efficacy in mathematics and their performance grades in mathematics.

Moreover, regression analysis was used to determine the Likert square regression that relates the respondents' self-efficacy in mathematics to their average grade in mathematics.

3.2 Participants

The respondents of the study were the 159 Grade 8 students of Matucay National High School who are officially enrolled during the school year 2023-2024. The school is located along the Maharlika Highway in Matucay, Allacapan, Cagayan, and has a total enrollment of 935 learners for the current school year. The school is very famous within the congressional district since its campuses are separate from each other, particularly the senior high school area and junior high school area. Furthermore, a total enumeration was used to determine the respondents to the study.

3.3 Instrumentation

Written permission was secured from the Schools Division Superintendent of the Schools Division Office of Cagayan in order to obtain full cooperation from the respondents. As soon as permission was granted, the researchers personally administered the set of questionnaires, facilitating the elicitation of further reliable data and additional information.

Upon completion of the form to obtain basic demographic information and the study instrument, the researchers personally collected and entered the data gathered in an Excel spreadsheet for data cleaning and easier computation.

Also, the main data-gathering instrument that was used in the study was a survey questionnaire. The checklist to determine the profile of the learners was made by the researchers. The self-efficacy of the learners was determined and analyzed using the Mathematics Self-Efficacy Questionnaire. It consists of 30-item statements on a 5-point Likert scale [(5) Strongly Agree, (4) Agree, (3) Undecided, (2) Disagree & (1) Strongly Disagree] in which 10 out of the 30-item were on general mathematics self-efficacy and 20 on content-specific mathematics self-efficacy items. These items were adopted from TIMSS 2011 (International Association for the Evaluation of Educational Achievement, 2011) and PISA 2012 (Organization for Economic Co-operation and Development, 2012) and were further modified by the researchers to suit the learners.

3.4 Data Analysis

Frequency and percentage distribution, as well as a weighted mean, were used to present the respondents' sex and respondents' self-efficacy in mathematics, and a mean was used to present their performance grades in mathematics.

A Likert scale was used to determine the self-efficacy of the respondents in mathematics. The interval and interpretation of the scale are shown below.

Scale	Range	Descriptive Value	Level of Attitude
5	4.20 – 5.00	Strongly Agree	Very High Confidence
4	3.40 – 4.19	Agree	High Confidence
3	2.60 – 3.39	Undecided	Moderate Confidence
2	1.80 – 2.59	Disagree	Low Confidence
1	1.00 – 1.79	Strongly Disagree	Very Low Confidence

Also, the Pearson-r Moment Correlation was used to test the significant relationship between the respondents' self-efficacy in mathematics and their mathematics performance.
Furthermore, Regression analysis was used to determine the least squares regression that relates the respondents' self-efficacy in mathematics to their performance in mathematics.

4. Results and Discussions

4.1 Profile Variables

Sex. The distribution of learners in terms of sex is presented in Table 1. It shows that there are more male learners, as revealed by their frequency of 85, or 53.46 percent, than female learners. Additionally, of the 33 students in section Aquamarine, 20 or 23.53 percent were male and 13 or 17.57 percent were female; of the 36 students in section Diamond, 15 or 17.65 percent were male and 21 or 28.38 percent were female; of the 32 students in section Emerald, 18 or 21.18 percent are male and 15 or 20.27 percent are female; of the 29 students in section Pearl, 16 or 18.82 percent are male and 13 or 17.57 percent are female; and of the 28 students in section Sapphire, 16 or 18.82 percent are male and 12 or 16.21 percent are female. This finding means that the Grade 8 learners at Matucay National High School are male-dominated. This is in line with the Philippine population facts as of the January 2024 census, which show that 50.8 percent were male, and 49.2 percent were female. This finding is also supported by the enrolment data for SY 2023-2024, wherein there are more male learners enrolled in Grade 10 than female learners.

Table 1. Distribution of Learners in terms of Sex per Class Section

Class Section	**Sex (n=159)**			
	Male (n=85)		**Female (n=74)**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Aquamarine	20	23.53	13	17.57
Diamond	15	17.65	21	28.38
Emerald	18	21.18	15	20.27
Pearl	16	18.82	13	17.57
Sapphire	16	18.82	12	16.21
Overall	**85**	**53.46**	**74**	**46.54**

Performance Grade in Mathematics. Apparent in Table 2 is the distribution of the learners' performance grades in mathematics. As presented, 92, or 57.86 percent, of the learners are satisfactory in their performance grade in mathematics, ranging from 80 to 84; 36, or 22.64 percent, are very satisfactory, ranging from 85 to 89; 19, or 11.95 percent, are fairly satisfactory, ranging from 75 to 79; and 12, or 7.55 percent, are outstanding in mathematics, ranging from 90 to 100, in accordance with the K–12 grading system. This finding means that most of the learners have a satisfactory performance in mathematics, with a mean of 83.15 and a standard deviation of 3.66. This then implies that the learners have average performance in mathematics. Thus, this is a clear indication that low achievement in mathematics is a perennial problem in the Philippine educational system. More so, this finding is supported by the performance of the Programme for International Student Assessment (PISA), which showed a dismal bottom ranking for the Philippines—78/78 in 2018 and 77/81 in 2022.

Table 2. Distribution of Learners in terms of Performance Grade in Mathematics

Description	**Scale**	**Frequency (n=145)**	**Percentage**
Outstanding	90-100	12	7.55
Very Satisfactory	85-89	36	22.64
Satisfactory	80-84	92	57.86
Fairly Satisfactory	75-79	19	11.95
Did Not Meet Expectations	Below 75	0	0.0
Mean = 83.15 (Very Satisfactory)		***SD = 3.66***	

4.2 Self-Efficacy Results

Learners' Self-efficacy towards Mathematics. Learners' self-efficacy towards mathematics is presented in Table 2. As shown, the learners have very high confidence in mathematics since they are assured of passing their next mathematics class test (4.58) in which they are confident in getting an "A" mark (4.43). Moreover, they are very confident that they can do 50% (4.50) to 100% of their homework

on their own (4.55). However, whenever they are studying for a mathematics test, they plan a study schedule and finish revising all the topics before the test (4.52) so that they can tell which concepts or skills they are weak at (4.58), and if it happens that they do badly at their class test, they learn from those mistakes and try harder towards their next tests (4.35) by asking people for help whenever they are stuck on a mathematics problem (4.53). Thus, boosting their confidence in solving simple inequality $(3x \geq 5)$ (4.45) and quadratic equations by completing the square (4.62) and further calculating or identifying the mean, mode, and median for a set of data (4.62), standard deviation for a set of data (4.51), the area of a segment (4.56), the volume and surface area of a cube (4.48), and listing all possible outcomes in a simple chance situation can be easy for them. Also, they can tell when two events are mutually exclusive and how that will affect probability (4.62), determine whether two triangles are congruent or similar (4.59), interpret Venn diagrams (4.64), list two properties of similar polygons (4.59), and reduce a plane figure by using a scale factor (4.55). This suggests that the students are very confident in their ability to pass a math class examination by making sure all of their notes are prepared well for their review and asking for assistance when needed in order to overcome their difficulties and receive an "A" grade.

Further, they are highly confident that they can understand new mathematics topics when taught (4.19) in such a way that they can put in greater efforts to get better results in math (4.02), wherein they can easily calculate the arc length of a circle (4.08) and the gradient of a linear graph (3.79). Likewise, plotting a graph of a quadratic function $(y = ax^2 + b)$ (3.79) and differentiating between when to add probabilities and when to multiply probabilities (3.45) was easy. This then implies that whenever a lesson is taught properly within their range of learners' expectations, there is a greater confidence level that they will have, which will put the learners in a position of collective effort for better results in their mathematics performance.

On the other hand, they seem to have moderate confidence when they are trying to solve fractional equations like $\left(\frac{6}{x+4} = x + 3\right)$ (2.94) and $\left(\frac{x}{3} + \frac{x-2}{4} = 24\right)$ (3.30). Also, they are rational when it comes to using the mean and standard deviation to compare two sets of data (2.81) plotting a graph for an exponential function (ka^x), and find x when $y = 4$ (2.62). This finding shows that the learners are logical when it comes to calculating fractional equations, standard deviations, and exponential functions, which further requires a teaching strategy that could uplift their confidence in learning the concepts of these topics.

Additionally, the total weighted mean (4.19) indicates that students have a high degree of confidence in the statements made regarding their mathematical self-efficacy. Since their answers show a connection between their personal goals and learning mathematics, it follows that Matucay National High School students have a high level of confidence in their mathematical abilities. Aryana (2010) concluded that students who are more confident are less nervous and learn better than students who lack confidence. Naderi, Abdullah, Aizan, Sharir, and Kumar (2009) similarly noted that research has repeatedly shown a favorable relationship between individual confidence and academic achievement. They argue that confident students perform better than those who do not, and the former achieve more. Corresponding to this result, students have positive self-efficacy towards mathematics if they think that the lessons and topics they learn in class meet their expectations and learning goals.

Table 3. Learners Self-Efficacy towards Mathematics

Statements	**Weighted Mean**	**Descriptive Value**
1. I can understand new mathematics topics when taught.	4.19	High Confidence
2. I can plot a graph of a quadratic function $(y = ax^2 + b)$.	3.79	High Confidence
3. I can calculate the arc length of a circle.	4.08	High Confidence
4. I can put in greater effort to get better results in math.	4.02	High Confidence
5. I can calculate the gradient of a linear graph.	3.79	High Confidence

6. I can differentiate when to add probabilities and when to multiply probabilities.	3.45	High Confidence
7. When I am stuck on a mathematics problem, I can solve it by asking people for help.	4.53	Very High Confidence
8. I can plot a graph for an exponential function (ka^x) and find x when y = 4.	2.62	Moderate Confidence
9. I can use the mean and standard deviation to compare two sets of data.	2.81	Moderate Confidence
10. When I am studying for a mathematics test, I can plan a study schedule and finish revising all the topics before the test.	4.52	Very High Confidence
11. I can do 50% of my mathematics homework on my own.	4.50	Very High Confidence
12. I can do 100% of my mathematics homework on my own.	4.55	Very High Confidence
13. I can tell when two events are mutually exclusive and how that will affect probability.	4.62	Very High Confidence
14. I can solve simple inequality ($3x \geq 5$).	4.45	Very High Confidence
15. I can determine whether two triangles are congruent or similar.	4.59	Very High Confidence
16. I can calculate or identify the mean, mode, and median for a set of data.	4.62	Very High Confidence
17. I can get an "A" in the next mathematics class test.	4.43	Very High Confidence
18. I can solve fractional equations $\left(\frac{x}{3} + \frac{x-2}{4} = 24\right)$	3.30	Moderate Confidence
19. I can pass the next mathematics class test.	4.58	Very High Confidence
20. I can calculate the area of a segment.	4.56	Very High Confidence
21. I can calculate the standard deviation for a set of data.	4.51	Very High Confidence
22. I can list two properties of similar polygons.	4.59	Very High Confidence
23. When I do badly in a class test, I can learn from my mistakes and try harder in the next test.	4.35	Very High Confidence
24. I can solve quadratic equations by completing the square.	4.62	Very High Confidence
25. I can interpret Venn diagrams.	4.64	Very High Confidence
26. I can calculate the volume and surface area of a cube.	4.48	Very High Confidence
27. I can reduce a plane figure by a scale factor.	4.55	Very High Confidence
28. I can calculate the probability by listing all the possible outcomes in a simple chance situation.	4.63	Very High Confidence
29. When I am studying for a mathematics test, I can tell which concepts or skills I am weak at.	4.58	Very High Confidence
30. I can solve fractional equations $\left(\frac{6}{x+4} = x + 3\right)$	2.94	Moderate Confidence
Overall weighted mean = 4.19		**High Confidence**

4.3 Correlation Results

Correlations Between the Learners' Performance in Mathematics and Self-Efficacy towards Mathematics. The study hypothesized that there is no significant relationship between the learners' mathematical self-efficacy and their performance in mathematics. Thus, based on the presented results of the correlation test illustrated in Table 3, the computed coefficients of learners' self-efficacy towards mathematics and learners' mathematics performance have associated probabilities less than the 0.05 significance level. The correlation analysis also revealed that learners' performance in mathematics problem solving is significantly related to the learners' self-efficacy towards mathematics, as shown by the computed correlation value of 0.338, which means that the higher the learners' self-efficacy towards mathematics, the higher the academic performance of the learners in mathematics, and the lesser the learners' self-efficacy towards mathematics, the lesser the academic performance of the learners in mathematics. This supports the fact that if the learners perceive a positive vibe and feel confident in learning mathematics, then their academic performance in mathematics will be excellent, and if otherwise, their academic performance in mathematics will be poor. Further, it has a probability of 0.000, which means that the null hypothesis is rejected, which has a very high significance level. Thus,

it means that there is really a relationship between the learners' self-efficacy towards mathematics and their academic performance in mathematics. This is the same as the study conducted by Mazana, Suero Montero, and Olifage (2019), which found that initially students exhibit a positive attitude toward mathematics, but their attitude becomes less positive as they move forward to higher levels of education. Thus, it indicates that the self-efficacy of learners towards learning mathematics does relate to the learner's academic performance in mathematics problems, which requires teaching and learning strategies that would maintain or further boost their confidence in mathematics.

Table 4. Correlations Between the Learners' Performance in Mathematics and Mathematics Self-Efficacy

Variables	Correlations	p-value	Statistical Inference
Learners' Mathematics Performance ***Learners' Mathematics Self-efficacy***	0.338*	0.000	**Significant**

Source: Processed data by Campanilla (2024) using SPSS

4.4. Regression Analysis Results

Model Summary and P-P Plot of Regression Residual. Table 4 emphasizes the model summary of the self-efficacy of the learners towards mathematics as a predictor of the learners' academic achievement in mathematics. It further shows that the computed r values of 0.338 indicate a direct proportionality wherein the higher the learners' self-efficacy towards mathematics, the higher the academic performance of the learners in mathematics, and the lesser the learners' self-efficacy towards mathematics, the lesser the academic performance of the learners in mathematics. Thus, it indicates that 0.114, or 11.40 percent, of the mathematics self-efficacy of learners contributes to their academic performance in mathematics. Further, as can be seen in Figure 2, the standardized residuals in the P-P plot are along the diagonal line, which means that the normality assumptions in this study are met. The regression line shows a positive slope, indicating a positive linear relationship between self-efficacy and learners' academic performance in mathematics. The clustering of learners' mathematics self-efficacy around the regression line indicates a strong linear relationship. The findings of the study are similar to the findings of the study conducted by Ubaidillah et al. (2023), in which they examined the role of self-efficacy on the academic performance of vocational high school students and found that academic self-efficacy does really predict academic performance. Thus, preserving or improving this relationship through efficient and interesting teaching-learning procedures is crucial for students' academic success.

Table 5. Model Summary of Learners' Mathematics Self-Efficacy as a Predictor of their Mathematics Performance

Model	R	R Square	Adjusted R Square	Percentage of Contribution
Learners' Mathematics Self-efficacy ***Learners' Mathematics Performance***	0.338*	0.114	0.109	11.40

Source: Processed data by Campanilla (2024) using SPSS

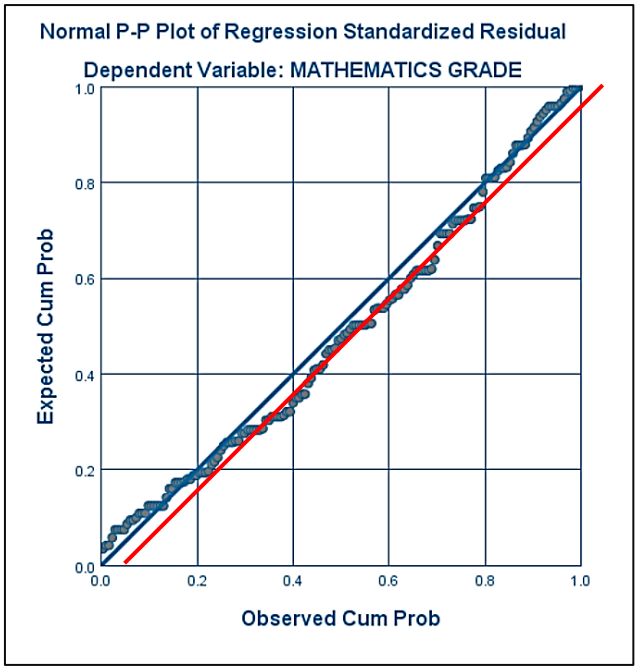

Figure 2. Normal P-P Plot of Regression of Standardized Residual

Derived Formula in Determining the Learners' Mathematics Performance Based on their Self-Efficacy. Table 5 shows the derived formula for predicting the learners' mathematics performance based on their computed mathematics self-efficacy. The formula was derived on the basis of a linear equation formula, which is in the form of $y = mx + b$ where y is the performance grade of the learners in mathematics, m is the slope (significant value between mathematics self-efficacy and performance in mathematics), x is the self-efficacy of the learners, and b is the constant (the mean computed performance grade in mathematics). The derived formula in predicting the learners' mathematics performance is in the form of $y = mx + b$, where:

- y = the predicted performance in Mathematics according to the corresponding self-efficacy of learners,
- m = the slope of the academic performance in Mathematics and their Mathematics self-efficacy is 2.754,
- b = the constant which is equal to 71.587, and
- x = the mean of the learners' self-efficacy towards Mathematics.

Table 6. Derived Formula in Determining the Learners' Mathematics Performance Based on their Self-Efficacy

Formula ($y = mx + b$)	**Mathematics Performance Predictor**
y = predicted performance grade in Mathematics x = self-efficacy towards Mathematics	$y = 2.754x + 71.587$

Source: Processed data by Campanilla (2024) using SPSS

Coefficient of Determination of the Dependent Variable. The coefficient of determination of the dependent variable is illustrated in Table 6, which shows how the derived formula in Table 5 is obtained. It also further shows that the constant coefficient of the dependent variable is 71.587 and the coefficient of learners' self-efficacy is 2.754, which is moderate confidence in their perception of learning mathematics. Moreover, the table presents the significant positive predictive effect of learners' mathematics self-efficacy on the academic performance of learners in mathematics ($\beta = 0.338$; $t = 4.498$; $p<0.000$). The study's conclusions demonstrate the strong relationship between mathematics self-efficacy prediction and the dependent variable's coefficient of determination, or performance in the subject area of mathematics. This conclusion is further corroborated by research conducted by Muenks et al. (2017) and Steinmayr et al. (2018), which discovered that students' motivation is a major factor

in their academic success. They emphasized that, even when all predictors were evaluated domain-specifically, learners' ability self-concept emerged as the most significant motivating predictor of their grades, surpassing disparities in their intellect and previous grades.

Table 7. Coefficient of Determination of the Dependent Variables

Predictor	Unstd Coefficients Std. Error	Std Coefficients Beta(β)	T	Sig – value
(Constant)	71.587		27.704	.000
Self-Efficacy in Mathematics	2.754	.338	4.498	.000

Source: Processed data by Campanilla (2024) using SPSS

5. Conclusion

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

5.1 Synthesis

This study aimed to explore the relationship between learners' academic performance in mathematics and their self-efficacy towards mathematics. It involved 159 Grade 8 students from Matucay National High School in Allacapan, Cagayan, for the 2023–2024 school year. The researcher used a survey tool from TIMSS 2011 and PISA 2012, modified by the researchers, to determine the relationship between the two variables and how self-efficacy can predict mathematics academic achievement. The study aimed to understand how self-efficacy can predict academic achievement in mathematics.

A regression analysis was used to analyze the data, which involved the observation of scatter plots to determine whether the self-efficacy of learners toward mathematics could predict their academic performance in mathematics. For the data on learners' academic performance in mathematics, simple frequency counts, percentage distribution, and weighted mean were used. When all the data were gathered, they were tabulated and treated statistically. For the assessment of the learners' self-efficacy towards mathematics, an individual and category-weighted mean computation was applied using the 5-point Likert scale. Meanwhile, the Pearson product-moment correlation was utilized to determine the relationship between the two variables in the study. Likewise, the SPSS software application was used to analyze the data that was gathered in the study, and it was interpreted at the 0.05 level of significance. Moreover, male learners at Matucay National High School are more prevalent than female learners, with a frequency of 85.45%. This is consistent with the Philippine population data as of January 2024, which showed a male-dominated population of 50.8 percent and 49.2%, and the enrollment data from SY 2023-2024, which showed more male learners in Grade 10 than females. Likewise, 35.9% of learners scored Very Satisfactory, 49.8% Satisfactory, and 30.33% Outstanding in Mathematics, respectively, according to the K–12 Grading System in the Philippines. This indicates an average performance in mathematics, a persistent issue in the Philippine educational system, as evidenced by the Philippines' dismal ranking in the Programme for International Student Assessment (PISA) between 2018 and 2022.

Further, the study reveals that Matucay National High School students have high confidence in mathematics, with a high level of confidence in passing class tests and completing homework independently. They plan their study schedules, revise topics before tests, and learn from mistakes by asking for help. They excel at solving simple inequalities, quadratic equations, and calculating data. They are confident in understanding new mathematics topics when taught within their range of expectations, putting in greater effort for better results. However, they have moderate confidence when solving fractional equations and are logical when comparing data. This suggests that a teaching strategy that uplifts students' confidence in learning these concepts is needed.

Also, the study shows a connection between students' personal goals and learning mathematics, with a high degree of confidence in their abilities. Research has shown a favorable relationship between individual confidence and academic achievement, with confident students performing better than those

without confidence. Therefore, students have a positive sense of self-efficacy towards mathematics if they believe that the lessons and topics, they learn in class meet their expectations and learning goals. In addition, there is a significant relationship between learners' mathematical self-efficacy and their academic performance. The correlation test showed that higher self-efficacy leads to better academic performance, while lower self-efficacy results in poorer performance. This supports the idea that a positive attitude towards learning mathematics leads to excellent academic performance. The null hypothesis was rejected, indicating a strong relationship between self-efficacy and academic performance. This supports previous research suggesting that initially positive attitudes toward mathematics decrease as students' education progresses. Therefore, teaching strategies should focus on maintaining or boosting learners' confidence in mathematics.

In the same vein, the study reveals a direct relationship between learners' self-efficacy towards mathematics and their academic performance. The higher the self-efficacy, the higher the academic performance, while the lower the self-efficacy, the lower the performance.

Thus, a formula for predicting learners' mathematics performance based on their self-efficacy has been derived. The formula is, where represents the learners' performance grade, represents the slope between self-efficacy and academic performance, represents self-efficacy, and is the mean computed performance grade. The formula is based on 2.754 academic performance and 71.587 self-efficacy, which gives the formula. It has also revealed a strong relationship between learners' self-efficacy in learning mathematics and their academic performance. The constant coefficient is 71.587, and learners' self-efficacy is moderately confident. Thus, a positive predictive effect is significant, which shows that self-efficacy is a key factor in academic performance, especially in mathematics.

5.2 Conclusion

In conclusion, the data analyzed in the study found that Matucay National High School learners have average performance in mathematics, and learners had high confidence in mathematics, excelling in passing class tests and completing homework independently. However, they had moderate confidence when solving fractional equations and were logical when comparing data. The study also found that there is a connection between learners' personal goals and learning mathematics, with a high degree of confidence in their abilities. A significant relationship was found between learners' mathematical self-efficacy and academic performance, with higher self-efficacy leading to better academic performance. A formula for predicting learners' mathematics performance based on self-efficacy was derived, showing a positive predictive effect and indicating that self-efficacy was a key factor in the academic performance of the learners in mathematics.

5.3 Recommendations

Given the previously described results and the study's conclusion, the following actions are highly recommended:

1. Future researchers who conduct the same study could expand the scope of their study to other grade levels or other schools. Likewise, they can use the study as a basis for conducting research on other subject areas and comparing whether there is a significant difference or relationship between their respondents' academic performance and self-efficacy toward learning areas.
2. Mathematics educators who are teaching the same mathematics subjects can use the derived equations to predict the performance grades of their future students. Thus, they need to engage in training and seminars to learn how to boost the self-efficacy of students, as the current study found that it is a valid predictor of a math grade.
3. Students can use the derived equations to predict their performance grades in mathematics according to their mathematical self-efficacy. Thus, it helps them to know how they will behave on the subject and how they will attain a high performance in their mathematics class.
4. School authorities should provide professional development opportunities for mathematics teachers. Training sessions, seminars, and workshops that focus on effective teaching and learning strategies that would boost and uplift their self-confidence toward mathematics.
5. College administrators can enhance the study and use the equations derived from the study to predict the respondents' performance in taking the college admission test. Likewise, they can use

the derived equations as a basis for directing the students as to whether they are suitable to take in the field of mathematics or redirecting them to a field that suits their specialization.

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