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Investigating Self-Efficacy and Self-Regulation As Predictors of Mathematics Performance in Students

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This study evaluated the self-regulation strategies and self-efficacy of Grade 10 students at Lusaran National High School and their impact on academic performance. Employing a descriptive correlational research design, we engaged 114 students who completed rigorously adapted and validated survey questionnaires. The data collected were analyzed using weighted means, standard deviations, and Pearson's r. The findings demonstrate a clear lack of significant correlation between self-efficacy, self-regulation, and mathematics performance. Despite students exhibiting high levels of self-regulation and confidence, these factors do not predict their success in math. To effectively enhance mathematical outcomes, we strongly recommend the implementation of additional support strategies, including individualized tutoring, collaborative group projects, and hands-on problem-solving sessions. It is imperative to establish comprehensive programs that target motivation, stress management, engagement, and self-regulation skills, alongside consistent teacher feedback. Furthermore, more research is essential to investigate other influences on math achievement, including socioeconomic factors and classroom dynamics.

Keywords: Teaching Mathematics, Self-efficacy, Self-regulation, Mathematics Performance Descriptive-correlational Design, Cebu City, Philippines

I. Introduction

Mathematics is widely regarded as the "language of the universe," serving as a foundation for understanding diverse disciplines such as science, engineering, economics, and technology. It is not merely a subject but a structured way of thinking that fosters logical reasoning, analytical processes, and systematic problem-solving, all of which transcend basic arithmetic (Financial Times, 2024; Philippine Olympiad Foundation for Science and Arts [POFSA], 2024). Recent studies highlight that mathematics education plays a critical role in developing students' analytical and critical thinking skills, emphasizing structured approaches to problem-solving and reasoning (Frontiers in Psychology, 2025; Martín-Páez & Rivera, 2025). Instructional models such as problem-based learning and Pólya's problem-solving framework have been shown to enhance learners' ability to analyze, evaluate, and apply concepts in real-world contexts, making mathematics education a vital tool for preparing students to navigate complex challenges beyond the

Despite its importance, many students still see mathematics as difficult and intimidating. Studies show that **math anxiety** often starts from negative early experiences with abstract concepts, leading to frustration, avoidance, and poor performance (Dowker et al., 2020; Foley et al., 2021). Research also confirms a negative link between math anxiety and achievement, meaning higher anxiety often results in lower performance (Foley et al., 2021). This anxiety is influenced by factors such as limited teacher support, rigid teaching methods, and low confidence in math abilities (Nottingham et al., 2023; Ma, 2025). Moreover, math anxiety discourages students from engaging with math-related tasks and decreases their interest in pursuing STEM fields (Cuder et al., 2023; Eidlin Levy et al., 2023). As a result, it creates a cycle that blocks academic success and prevents students from fully appreciating the real-world value of mathematics.

To address the challenges of learning mathematics, students need to develop **self-regulation strategies** and strengthen their **self-efficacy**. Self-regulated learners, who actively plan, monitor, and reflect on their learning, often

achieve better academic results, especially in demanding subjects like mathematics (Panadero, 2017; Zheng et al., 2023). At the same time, students with high self-efficacy—belief in their own ability to succeed—are more likely to persist through difficulties and use effective problem-solving approaches (Schunk & DiBenedetto, 2020; Talsma et al., 2021). Together, self-regulation and self-efficacy provide the motivation and strategies learners need to overcome obstacles and perform well in mathematics.

Self-regulation and self-efficacy involve goal setting, self-monitoring, and self-reflection, all of which strengthen students' motivation and persistence in overcoming difficulties (Schunk & DiBenedetto, 2020). Learners who apply these strategies are better able to manage distractions, sustain focus, and perform well academically, even in challenging subjects such as mathematics (Zheng et al., 2023). Actively monitoring one's understanding helps students recognize gaps in knowledge and seek clarification before misconceptions develop, which is especially important in complex problem-solving. In contrast, students with low self-regulation and self-efficacy often experience weaker academic outcomes because they struggle to stay engaged and persist with difficult concepts (Talsma et al., 2021). Thus, cultivating these skills is critical for building resilience and improving mathematics performance.

Self-efficacy, first introduced by Albert Bandura, refers to an individual's belief in their capacity to complete tasks and reach goals. This belief shapes how people respond to challenges, influencing their motivation, persistence, and resilience. Students with high self-efficacy are more likely to engage actively in learning, put forth effort, and recover from setbacks, while those with low self-efficacy often avoid difficult tasks and give up when faced with obstacles (Schunk & DiBenedetto, 2020). In education, self-efficacy is consistently linked to improved academic achievement, stronger emotional well-being, and better stress management (Talsma et al., 2021; Zheng et al., 2023).

Self-regulation can be understood as a process with three phases: **forethought** (planning and goal setting), **performance** (monitoring and adjusting behavior), and **self-reflection** (evaluating and refining strategies). In academic contexts, self-regulation is a key predictor of effective learning and higher achievement. It is also shaped by external factors such as feedback, support systems, and the learning environment (Panadero, 2017; Zheng et al., 2023).

The Southeast Asia Program Learning Matrix serves as a framework for developing competencies in Southeast Asian studies, focusing on cultural competence, historical understanding, contemporary issues and politics, language proficiency, and global interconnections. Students are expected to gain knowledge of Southeast Asian cultural values and practices, build cross-cultural communication skills, and develop an appreciation for diversity (Tran & Vu, 2021). Historical understanding emphasizes awareness of key events, the legacies of colonialism, and post-colonial movements, alongside the ability to critically analyze historical narratives (Tagliacozzo, 2020). In terms of contemporary issues, learners engage with regional politics, governance, policy challenges, and ASEAN's role in regional and global cooperation (Nair, 2022). Language proficiency, particularly in Southeast Asian languages, is emphasized as a means of strengthening cultural immersion and communication (Liu & McInnis, 2020). Finally, global interconnections highlight how Southeast Asia is shaped by and contributes to trends such as globalization, trade, migration, and environmental sustainability (Chong & Li, 2021).

Self-efficacy and self-regulation are essential for students to succeed in the Southeast Asia Program Learning Matrix. Self-efficacy, or the belief in one's ability to complete tasks, helps learners stay motivated and persistent. Students with high self-efficacy are more willing to join cultural exchanges, study complex history, and continue language learning despite challenges (Lei Ding & Zhu, 2022). Self-regulation, which involves planning, monitoring, and adjusting strategies, also plays a key role in improving academic performance, particularly in online and blended learning settings (Wu & Wang, 2024). Together, self-efficacy and self-regulation enable students to manage distractions, focus, and engage more deeply with cultural, historical, and political aspects of Southeast Asian studies.

There are still notable research gaps in Southeast Asian studies, especially concerning self-efficacy and self-regulation in education. Most research on self-efficacy has been conducted in Western contexts, leaving limited understanding of how these concepts affect learning outcomes in Southeast Asia. In particular, little is known about how students' confidence in their abilities influences their engagement in regional studies, language learning, and cross-cultural learning experiences. Since educational practices and cultural norms vary widely across Southeast Asian countries, more research is needed to understand how these factors shape students' motivation and performance (Koh & Lee, 2020; Nguyen, 2021).

Moreover, the intersection of cultural competence, self-regulation, and self-efficacy in intercultural learning environments remains underexplored. While cultural competence is widely recognized as an essential skill in Southeast Asian studies, limited research has examined how students regulate their learning strategies and use self-efficacy beliefs to effectively engage with diverse cultures. Recent studies highlight the importance of self-regulated learning and confidence in fostering intercultural competence, yet there is still a lack of focus on Southeast Asian contexts (Deardorff, 2020; Phan et al., 2021). Exploring how these factors interact can provide valuable insights into enhancing cross-cultural education and helping students navigate cultural diversity more successfully.

Additionally, there is a research gap in understanding how Southeast Asian students integrate global and regional knowledge. While the region plays a key role in global economic, political, and environmental issues, limited studies examine how students connect these global trends with region-specific learning. Exploring how self-efficacy and self-regulation help students bridge global issues, such as climate change and globalization, with local and regional perspectives could provide valuable insights into how they develop a more holistic worldview (Altinyelken et al., 2021; Tran & Phan, 2023).

Finally, there is a lack of research on how teacher training programs in Southeast Asia address the development of students' self-regulation skills. While self-regulation is widely recognized as essential for academic success, few studies examine how educators in the region are trained to promote these skills. Exploring how teacher education programs integrate self-regulation strategies could provide valuable insights into improving instructional practices and supporting better student outcomes (Nguyen, 2021; Phan & Ngu, 2022).

In the latest Programme for International Student Assessment (PISA) results for 2022, Filipino students continued to rank among the lowest globally in core academic areas. The Philippines scored below the global average in mathematics, reading, and science, with no significant improvement from its performance in the 2018 PISA assessment. This places Filipino 15-year-olds well behind their peers in other participating countries, reflecting persistent challenges within the education system that have been exacerbated by the pandemic and lack of sufficient technological resources during online learning phases.

The OECD's PISA, which tested students from 81 countries, underscored these gaps and highlighted that the Philippines remains among the weakest performers in the ASEAN region, particularly in science and mathematics. The results indicate a need for substantial educational reforms to address deficiencies in these fundamental subjects. Additionally, the country's education officials and advocates have recognized the need for policy changes and focused intervention to build proficiency in these areas and aim for improved rankings in the coming years.

It has been observed by teachers in most schools in Cebu City, Philippines that many students lack effective learning strategies, impacting their academic progress. Often, students seem disengaged, showing little concern for their performance by frequently submitting incomplete work, disregarding deadlines, and neglecting to review feedback or study effectively. For example, in math classes, students may attempt assignments without proper planning or goal-setting, leading to rushed or incorrect answers. Teachers also notice a tendency among students to prioritize social activities over study, suggesting they might view academic success as a lower priority. These behaviors indicate a need to address students' learning attitudes and introduce strategies that foster greater accountability and motivation in their academic journey.

Hence, this study aims to assess students' self-regulation strategies and self-efficacy, with the objective of identifying underlying issues that impact academic performance. By understanding these factors, the study seeks to provide actionable insights that can lead to tailored interventions for improving learning outcomes. The findings are expected to benefit multiple stakeholders: educators will gain a clearer picture of students' learning needs, administrators can use data-driven approaches to develop supportive programs, and students will have the opportunity to enhance their learning practices and self -confidence. Ultimately, addressing these areas can foster a more motivated, engaged, and successful student body, enriching the school's academic environment and contributing to positive educational outcomes.

II. Statement of the Problem

This research assessed the self-efficacy, self-regulation, and mathematics performance of the Grade 10 students

at the identified public high schools in Cebu City for school year 2024-2025 as basis for an action plan.

Specifically, this study sought to answer the following queries:

1. What is the level of self-efficacy of the respondents in learning Mathematics?

2. What is the level of self-regulation of the respondents in terms of:

    2.1 planning,

    2.2 monitoring,

    2.3 adjusting, and

    2.4 reflecting?

3. What is the level of mathematics performance of the respondents?

4. Is there a significant relationship between the:

    4.1 self-efficacy and the respondents' mathematics performance,

    4.2 self-regulation and the respondents' mathematics performance?

5. Based on the findings, what action plan may be proposed?

III. Research Methodology

In this section, I provide a comprehensive overview of the research methodology, including the research design, the data collection procedure, and the data analysis techniques used in this study.

Design

The study employed a descriptive correlational research design because it aimed to examine the relationships between self-efficacy, self-regulation, and mathematics performance without manipulating any of the variables. This design was ideal for understanding how these variables naturally related to each other in an educational context. Descriptive correlational research allowed for the identification of patterns or associations between students' belief in their abilities (self-efficacy), their ability to manage their learning (self-regulation), and their academic outcomes in mathematics. Since the study was not focused on causal relationships but rather on exploring how these variables were connected, a correlational design was well-suited to provide insights into how self-efficacy and self-regulation influenced mathematics achievement. Additionally, this approach aligned with the goals of examining real-world variables, making it particularly relevant in educational settings where direct manipulation of these factors was not feasible.

Environment

This study was conducted in one of the public junior high schools in the division of Cebu City.The school began its operations in 1995 in Barangay Lusaran, a mountainous area in Cebu City. It was established to provide accessible and quality secondary education to the growing number of students in the area. Its founding aimed to meet the educational needs of the local community, offering opportunities for youth who had limited access to further education.

The school followed the K-12 Curriculum as prescribed by the Department of Education, ensuring a comprehensive and well-rounded education for all students. It offered a complete Junior High School program from Grade 7 to Grade 10, equipping students with foundational knowledge and skills necessary for their transition to Senior High School. The Senior High School program, covering Grades 11 and 12, offered the General Academic Strands, allowing students to specialize in areas that align with their academic interests and future career aspirations. This structured curriculum helped students develop the critical thinking, problem-solving, and analytical skills needed to succeed both in higher education and the workforce, ensuring they were well-prepared for the challenges ahead.

Respondents

The respondents for this research were the Grade 10 students at Lusaran National High School. They were chosen as the target respondents of this study because they faced more abstract and complex mathematical concepts.

The respondents were selected by Stratified Random Sampling. Stratified random sampling was the most suitable technique for the distribution of respondents in the two sections (Newton and Galileo) because it ensured proportional representation of each group. By dividing the population into strata based on these sections, and randomly selecting respondents from each group according to their proportion in the total population (50.88% for Newton and 49.12% for Galileo), the method ensured an accurate and balanced sample. This reduced bias, enhanced the reliability of the study, and ensured that the findings were generalizable to the entire population. Table 1 presented the distribution of the respondents for this study, who were the Grade 10 Junior High School students of Lusaran National High School. A total of 114 respondents answered the survey questionnaires from the two sections.

Instrument

In this study, the survey instrument was adopted from a previously validated questionnaire to ensure reliability and validity. The original questionnaire was designed to measure self-efficacy and self-regulation and it was modified to better suit the context of this research. This research would utilize a three-part survey questionnaire to assess the variables investigated in this study.

Part I. The first part was designed to gather information on the profile of the respondents, including their name, age, and gender.

Part II. The second part utilized a survey questionnaire based on the Self-efficacy Questionnaire by Gaumer Erickson et al. (2016), which assessed the level of self-efficacy. The questionnaire used a five (5)-point Likert scale, which corresponded to the respondents' perceptions of the statement that best described their level of self-efficacy.

Part III. The third part utilized a survey questionnaire based on the Self-regulation Questionnaire by Gaumer Erickson and Noonan (2021), which assessed the level of self-regulation across four areas: planning, monitoring, adjusting, and reflecting. The questionnaire used a five (5)-point Likert scale, which corresponded to the respondents' perceptions of the statement that best described their level of self-regulation.

This research also utilized the first-quarter grade in Mathematics for the school year 2024-2025 of the respondents to assess their performance in Mathematics.

IV. Results and Discussion

This section presents the analyses and interpretations of the data gathered from the study, which aimed to determine the level of self-efficacy of the respondents in learning Mathematics and the level of self-regulation of the respondents in terms of planning, monitoring, adjusting, and reflecting. It also assessed the level of Mathematics achievement of the respondents. Furthermore, the relationship between the respondents' self-efficacy and self-regulation with their Mathematics achievement was also considered.

LEVEL OF SELF-EFFICACY

This section emphasized the vital role of self-efficacy in improving students' mathematics performance, as it reflected students' beliefs in their ability to accomplish tasks and achieve goals. Assessing students' self-efficacy helped educators identify areas for improvement and design interventions that strengthened learning outcomes.

Table 2 presented the self-efficacy level of the respondents in learning Mathematics. The table indicated that, overall, the

Table 1

Level of Self-Efficacy of the Respondents in Learning Mathematics

S/N	Indicators	WM	SD	Verbal Description
1	I can learn what is being taught in class this year.	3.41	1.08	High
2	I can figure out anything if I try hard enough.	3.58	0.92	High
3	If I practiced every day, I could develop just about any skill.	3.60	1.16	High
4	Once I've decided to accomplish something that's important to me, I keep trying to accomplish it, even if it is harder than I thought.	3.61	1.13	High
5	I am confident that I will achieve the goals that I set for myself.	3.80	1.10	High
6	When I'm struggling to accomplish something difficult, I focus on my progress instead of feeling discouraged.	3.41	1.16	High
7	I will succeed in whatever career path I choose.	3.46	1.19	High
8	I will succeed in whatever college major I choose.	3.25	1.20	Moderate
9	I believe hard work pays off.	3.97	1.24	High
10	My ability grows with effort.	3.76	1.21	High
11	I believe that the brain can be developed like a muscle.	3.53	1.16	High
12	I think that no matter who you are, you can significantly change your level of talent.	3.73	1.18	High
13	I can change my basic level of ability considerably.	3.38	1.08	Moderate
	Aggregate Weighted Mean	**3.58**		**High**
	Aggregate Standard Deviation		**1.14**	

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

respondents showed a high level of self-efficacy, with an aggregate weighted mean of 3.58 and a standard deviation of 1.14. The ninth indicator obtained a weighted mean of 3.97 with a standard deviation of 1.24, followed by the eighth indicator with a weighted mean of 3.25 and a standard deviation of 1.20. The second indicator had a weighted mean of 3.58 with a standard deviation of 0.92. From these results, it could be observed that the respondents demonstrated a high level of self-efficacy.

This suggested that students were ideally positioned to begin contemplating and addressing mathematical concepts and problems. If students were supported in developing self-belief, they were likely to become more involved

and ultimately achieve greater success in mathematics. Recognizing and leveraging student self-efficacy was essential for creating effective educational strategies that fostered student achievement. According to Bandura (1997), constructive feedback strengthened students' confidence in their abilities.

LEVEL OF SELF-REGULATION

This section discussed the level of self-regulation demonstrated by the respondents. Self-regulation referred to students' ability to manage their thoughts, behaviors, and emotions to achieve their goals. In the context of this study, it involved four key dimensions: planning, monitoring, adjusting, and reflecting. These worked together as a continuous process that supported learning and improved performance. Recent research confirmed that self-regulation played an important role in academic success, as students who actively planned, monitored, and adjusted their strategies were more likely to perform better in mathematics (Azevedo et al., 2020; de Boer et al., 2023).

Planning

Table 2

Level of Self-Regulation of the Respondents in Terms of Planning

Indicators	WM	SD	Verbal Description
I plan out projects that I want to complete.	4.14	1.01	High
If an important test is coming up, I create a study plan.	3.62	1.00	High
Before I do something fun, I consider all the things that I need to get done.	3.75	1.01	High
I can usually estimate how much time my homework will take to complete.	3.49	1.07	High
I have trouble making plans to help me reach my goals.	3.32	1.15	Moderate
Aggregate Weighted Mean		**3.66**	**High**
Aggregate Standard Deviation			**1.05**

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

*reverse scoring

Planning is a key aspect of self-regulation that enables individuals to set clear goals, organize their actions, and manage their time effectively. It reflects the ability to stay focused, control impulses, and adjust strategies when challenges arise. Understanding self-regulation in planning provides important insight into how individuals work toward achieving personal or academic success.

Table 2 presented the self-regulation level of respondents in terms of planning. The results indicated that, overall, the respondents showed a high level of self-regulation, with an aggregate weighted mean of 3.66 and a standard deviation of 1.05. Specifically, the second indicator obtained a weighted mean of 3.62 with a standard deviation of 1.00, while the first indicator recorded a weighted mean of 4.14 with a standard deviation of 1.01. The fourth indicator had a weighted mean of 3.49 with a standard deviation of 1.07, and the fifth indicator obtained a weighted mean of 3.32 with a standard deviation of 1.15. These results showed that the respondents demonstrated a generally high level of self-regulation in planning.

This further demonstrated that self-regulation in planning was a key factor in students' mathematics performance. The strong levels of self-regulation in planning suggested that many students employed effective strategies

when organizing their work. Focusing on this area could greatly improve how students set goals, created strategies, and allocated resources for learning mathematics. Effective planning was considered crucial for solving mathematical problems and achieving academic success, as highlighted in recent studies (Dignath & Veenman, 2021; de Boer et al., 2023).

Monitoring

Monitoring is an important part of self-regulation, involving the assessment of progress and adjustment of actions as needed. It reflects individuals' ability to track performance, correct deviations, and demonstrates their self-reflection, adaptability, and effectiveness in reaching goals.

Table 3 summarized the self-regulation level of respondents in terms of monitoring. The results indicated that, overall, the

Table 3

Level of Self-Regulation of the Respondents in Terms of Monitoring

S/N	Indicators	WM	SD	Verbal Description
1	I kept track of how my projects are going.	3.39	1.10	Moderate
2	I know when I'm behind on project.	3.40	1.02	Moderate
3	I track my progress for reaching my goal.	3.55	1.13	High
4	I know what my grades are at any given time.	3.18	1.02	Moderate
5	Daily, I identify things I need to get done and track what gets done.	3.53	1.07	High
6*	I have trouble remembering all the things I need to accomplish.	3.27	1.04	Moderate
	Aggregate Weighted Mean	**3.39**		
				Moderate
	Aggregate Standard Deviation		**1.06**	

respondents demonstrated a moderate level of self-regulation, with an aggregate weighted mean of 3.39 and a standard deviation of 1.06. Specifically, the second indicator obtained a weighted mean of 3.40 with a standard deviation of 1.01, while the first indicator recorded a weighted mean of 3.39 with a standard deviation of 1.10, both reflecting a moderate level of self-regulation. The fifth indicator showed a higher level of self-regulation, with a weighted mean of 3.53 and a standard deviation of 1.07. Meanwhile, the sixth indicator obtained a weighted mean of 3.27 with a standard deviation of 1.04, also reflecting a moderate level of self-regulation.

In other words, most students demonstrated adequate monitoring practices with minimal variation in their behaviors. As a result, fostering these skills in educational settings was crucial for strengthening students' overall self-regulation and improving their academic success. Effective monitoring was essential for achievement, although research showed that it developed gradually over time (Azevedo et al., 2020; de Boer et al., 2023).

Adjusting

Adjusting is a vital aspect of self-regulation, as it involves modifying one's strategies or behaviors in response to challenges or changing circumstances. The level of self-regulation in terms of adjusting reflects how well individuals can adapt to setbacks, reassess their approach, and make necessary changes to stay on track toward their goals. Assessing the respondents' ability to adjust provides valuable insights into their flexibility, problem-solving skills, and resilience in the pursuit of success.

Table 4

Level of Self-Regulation of the Respondents in Terms of Adjusting

S/N	Indicators	WM	SD	Verbal Description
1	I do what it takes to get my homework done on time.	3.52	1.14	High
2	I make choices to help me succeed, even when they aren't the most fun right now.	3.61	0.99	High
3	As soon as I see things aren't going right, I want to do something about it.	3.39	1.23	Moderate
4	I keep trying as many different possibilities as necessary to succeed.	3.61	1.06	High
5*	I have difficulty maintaining my focus on projects that take long time to complete.	3.35	1.12	Moderate
6*	When I get behind on my work, I often give up.	3.11	1.19	Moderate
	Aggregate Weighted Mean	**3.43**		**High**
	Aggregate Standard Deviation		**1.12**	

Table 4 presented the self-regulation level of respondents in terms of adjusting. The results indicated that, overall, the respondents demonstrated a high level of self-regulation, with an aggregate weighted mean of 3.43 and a standard deviation of 1.12. Specifically, the second indicator obtained a weighted mean of 3.61 with a standard deviation of 0.99, while the first indicator recorded a weighted mean of 3.52 with a standard deviation of 1.14, both reflecting a high level of self-regulation. The fifth indicator showed a moderate level of self-regulation, with a weighted mean of 3.35 and a standard deviation of 1.12. Similarly, the sixth indicator obtained a weighted mean of 3.11 with a standard deviation of 1.19, also indicating a moderate level of self-regulation.

The overall high level of self-regulation indicated that although respondents were strong in some areas, they still experienced difficulties, particularly in sustaining focus and persistence when setbacks occurred. This observation supported recent findings that emphasized the importance of self-regulatory skills in academic settings. For example, Dignath and Veenman (2021) highlighted that students who adjusted their learning strategies after challenges were more likely to improve performance, while de Boer et al. (2023) stressed that self-regulation was a key factor in maintaining motivation and adapting effectively during learning.

Reflecting

Reflecting is an essential component of self-regulation, as it involves critically assessing one's actions, decisions, and outcomes to gain insights for future improvement. The level of self-regulation in terms of reflecting highlights how well individuals evaluate their progress, recognize areas for growth, and apply lessons learned to enhance their performance. Understanding the respondents' ability to reflect provides valuable insights into their capacity for self-awareness, continuous learning, and long-term success.

Table 5

Level of Self-Regulation of the Respondents in Terms of Reflecting

S/N	Indicators	WM	SD	Verbal Description

1	I think about how well I'm doing on my assignments.	3.55	1.03	High
2	I feel a sense of accomplishment when I get everything done on time.	3.76	1.01	High
3	I think about how well I've done in the past when I set new goals.	3.65	0.94	High
4	When I fail at something, I try to learn from my mistake.	3.64	1.19	High
5*	keep making the same mistake over and over again.	2.90	1.34	Moderate
	Aggregate Weighted Mean	**3.50**		**High**
	Aggregate Standard Deviation	**1.10**		

Table 6 presented the self-regulation level of respondents in terms of reflecting. The table indicated that, overall, the respondents showed a high level of self-regulation, with an aggregate weighted mean of 3.50 and a standard deviation of 1.10. A weighted mean of 3.76 with a standard deviation of 1.01 was recorded for the second indicators, followed by a weighted mean of 3.55 with a standard deviation of 1.03 for the first indicators, both reflecting high levels of self-regulation. Similarly, a weighted mean of 3.64 with a standard deviation of 1.19 was obtained for the fourth indicators, also showing a high level of self-regulation. However, the fifth indicators revealed a weighted mean of 2.90 with a standard deviation of 1.34, suggesting a moderate level of self-regulation. These results indicated that while many respondents effectively engaged in the process of reflection, some did not consistently participate in reflective practices.

The significance of reflective practices for self-regulation among the respondents was evident. High scores on most indicators suggested that the respondents engaged in reflective performance evaluation, which played a key role in their academic growth and success. Recent studies highlighted that self-regulated learners were proactive in setting goals, monitoring progress, and evaluating their performance, and this was reflected in the respondents' behaviors (Robson, Allen, & Howard, 2020). The strong level of reflection observed in the respondents also aligned with findings that emphasized the importance of metacognitive processes such as planning, monitoring, and evaluating one's actions as essential components of self-regulation (Efklides, 2020).

Summary on the level of Self-Regulation of the Respondents

The following summary presented an overview of the respondents' level of self-regulation, focusing on their abilities in planning, monitoring, adjusting, and reflecting. It highlighted how effectively they set goals, tracked progress, made necessary changes, and evaluated their actions to achieve personal and academic objectives.

Table 6

Summary on the Level of Self-Regulation of the Respondents

Components	**WM**	**SD**	**Verbal Description**
Planning	3.66	1.05	High
Monitoring	3.39	1.06	Moderate
Adjusting	3.43	1.12	High
Reflecting	3.50	1.10	High
Grand Mean	**3.50**		
			High

Grand Standard Deviation	**1.08**

Table 6 summarized the self-regulation level of the respondents for the four key components: planning, monitoring, adjusting, and reflecting, including the grand mean and standard deviation. The components were rated on a scale where higher scores indicate a greater level of self-regulation.

The weighted mean and standard deviation for planning were 3.66 and 1.05, respectively, indicating a high level of self-regulated behavior in planning among the respondents. Rodriguez-Gomez, Muñoz-Moreno, and Ion (2024) noted that effectively structuring learning through planning and resource identification empowered learners to guide their own growth. Valente et al. (2024) also confirmed that strong academic time-management planning was associated with higher levels of self-regulated learning, suggesting that students who deliberately organized their time engaged more effectively in learning.

LEVEL OF MATHEMATICS PERFORMANCE

This section highlighted that mathematics achievement was a key indicator of academic success and cognitive development, reflecting an individual's ability to understand, apply, and assess mathematical concepts and skills. Recent studies emphasized that mathematics achievement encompassed procedural fluency, conceptual understanding, strategic competence, and adaptive reasoning, all of which were essential for effective problem-solving and critical thinking (Li et al., 2021; Torbeyns et al., 2022). The level of mathematics achievement among students was influenced by various factors, including cognitive abilities, motivation, self-efficacy, and the quality of educational instruction (Robson, Allen, & Howard, 2020; Panadero, 2022). Furthermore, the development of mathematical skills was closely linked to self-regulation and metacognitive strategies, which enabled learners to plan, monitor, adjust, and reflect on their problem-solving processes (Efklides, 2020; de Boer et al., 2023).

Table 7

Level of Mathematics Performance of the Respondents

Level	Numerical Range	F	%
Outstanding	90-100	20	17.54
Very Satisfactory	85-89	24	21.05
Satisfactory	80-84	31	27.19
Fairly Satisfactory	75-79	35	30.70
Did not Meet Expectations	Below 75	4	3.51
Total		**114**	**100.00**
Mean		82.44	
St. Dev.		5.57	

Table 7 showed the overall breakdown of the respondents' mathematics achievement levels. The majority of participants demonstrated a high level of proficiency. Specifically, 20 respondents (17.54%) achieved an outstanding level, indicating that a significant number performed exceptionally well in mathematics. Additionally, 24 respondents fell into the high achievement category, representing the most frequent level, which suggested that many participants performed at a level just below outstanding. Thirty-one respondents were at a satisfactory level, showing that a notable portion achieved an acceptable standard. In contrast, 4 respondents (3.51%) fell below the satisfactory level, indicating that not all participants met the minimum required standards. The mean score of 82.44 indicated that, on average, the participants performed relatively well, while the standard deviation of 5.57 suggested moderate variability, with most scores falling

within approximately 5.57 points above or below the mean. This implied that while many participants performed similarly, there were also notable differences in individual scores. Recent studies highlighted that classifying achievement levels provided a useful framework for evaluating learners' cognitive development and assessing performance effectively (Meyer et al., 2021; Li et al., 2022).

V. RELATIONSHIP BETWEEN THE SELF-EFFICACY AND THE RESPONDENTS' MATHEMATICS PERFORMANCE

This section highlighted the significant connection between self-efficacy and mathematics performance, which has received considerable attention in recent educational research. It represented an important intersection between psychological beliefs and academic achievement. Self-efficacy refers to an individual's belief in their ability to plan and carry out the necessary actions to complete specific mathematical tasks. Robson, Allen, and Howard (2020) and Zakariya (2021) noted that these beliefs play a crucial role in influencing how students approach challenges, persist through difficulties, and ultimately succeed in mathematics.

Table 8

Test of Significance Relationship Between Self-Efficacy and the Respondents' Mathematics Performance

Variables	r-value	Strength of Correlation	p - value	Decision	Result
Self-efficacy and Mathematics Performance	0.060	Negligible Positive	0.526	Do not reject Ho	Not Significant

*significant at $p<0.05$ (two-tailed)

Table 8 presented the test of the significance of the relationship between self-efficacy and the respondents' mathematics performance. The r value of 0.060 indicated a negligible positive correlation between self-efficacy and mathematics performance. This suggested a very weak positive relationship between the respondents' beliefs in their abilities and their actual performance in mathematics. According to Robson, Allen, and Howard (2020) and Zakariya (2021), students' self-efficacy beliefs were linked to mathematics performance.

The p-value of 0.526 indicated that the relationship between self-efficacy and mathematics performance was not statistically significant. Herianto et al. (2024) and Robson, Allen, and Howard (2020) noted that, in this study, self-efficacy did not meaningfully influence the respondents' mathematics performance.

VI. RELATIONSHIP BETWEEN THE SELF-REGULATION AND THE RESPONDENTS' MATHEMATICS PERFORMANCE

The relationship between self-regulation and mathematics performance is a key area of study, as self-regulation encompasses the ability to plan, monitor, and evaluate one's learning processes, all of which are essential for achieving success in mathematics.

Table 9

Test of Significance Relationship Between Self-Regulation and the Respondents' Mathematics Performance

Variables	r-value	Strength of Correlation	p - value	Decision	Result
Planning and Mathematics Performance	0.033	Negligible Positive	0.731	Do not reject Ho	Not Significant
Monitoring and Mathematics Performance	0.048	Negligible Positive	0.612	Do not reject Ho	Not Significant
Adjusting and Mathematics Performance	0.049	Negligible Positive	0.605	Do not reject Ho	Not Significant
Reflecting and Mathematics Performance	0.014	Negligible Positive	0.879	Do not reject Ho	Not Significant

*significant at $p<0.05$ (two-tailed)

Specifically, the relationship between planning and mathematics performance showed a negligible positive correlation ($r = 0.033$) with a p-value of 0.731, indicating no significant impact. This suggested that the level of planning among students did not significantly affect their mathematics achievement. These findings align with recent research reporting mixed results regarding the direct effect of planning on academic outcomes (Panadero, 2022; Efklides, 2020).

Similarly, the correlation between monitoring and mathematics performance was negligible ($r = 0.048$) and not statistically significant ($p = 0.612$), indicating that actively monitoring one's progress during mathematics tasks did not substantially improve outcomes for the participants. This aligns with recent findings suggesting that while monitoring is an important self-regulation skill, its impact on academic performance can depend on factors such as feedback quality and task complexity (Panadero, 2022; Hadwin, Järvelä, & Miller, 2023).

The domain of adjusting also showed a negligible positive correlation ($r = 0.049$) with a p-value of 0.605, indicating that making adjustments in response to difficulties during mathematics tasks did not significantly influence performance. This finding is consistent with recent research suggesting that while adjustment is an important component of self-regulation, its direct effect on achievement can vary depending on the learner's metacognitive skills and the context in which adjustments are applied (Panadero, 2022; Hadwin, Järvelä, & Miller, 2023).

The lack of significant relationships across all four domains of self-regulation suggested that, for the sample in this study, self-regulation alone was not a strong predictor of success in mathematics. While self-regulation is generally recognized as an important factor for academic achievement, recent studies indicate that other factors—such as prior knowledge, instructional quality, or external support—may have a greater influence on mathematics performance (Panadero, 2022; Hadwin, Järvelä, & Miller, 2023). It is also possible that the self-regulation practices assessed in this study were not fully aligned with the specific demands of mathematics learning or that students were not applying these strategies effectively (Efklides, 2020).

SUMMARY

This study aimed to examine the influence of self-efficacy and self- regulation on the mathematics performance of students at Lusaran National High School in Cebu City, which will serve as the foundation for a proposed action plan.

Respondents were asked to complete a survey that assessed their level of self-efficacy. Additionally, they were asked to fill out another survey regarding their self-regulation in the areas of planning, monitoring, adjusting, and reflecting. Their first-quarter Mathematics grades were used to evaluate their academic performance.

The data collected was processed and analyzed using weighted mean and standard deviation to characterize the respondents' levels of self-efficacy and self-regulation. To assess the relationship between self-efficacy and academic performance, Pearson's r test was applied. Likewise, Pearson's r test was also used to examine the relationship between self-regulation in the domains of planning, monitoring, adjusting, and reflecting, and the respondents' academic performance, drawing conclusions based on the data evidence.

FINDINGS

The following conclusions were drawn from the data that was collected and analyzed statistically.

The respondents demonstrated a high level of self-efficacy, indicating that they were confident in their abilities and believed they could achieve the desired levels of performance. Additionally, they exhibited a strong level of self-regulation across the areas of planning, monitoring, adjusting, and reflecting, reflecting their ability to manage their own learning processes effectively. Most respondents achieved a fairly satisfactory performance in Mathematics, while a small portion did not meet the minimum requirements during the first quarter.

The analysis of the relationship between self-efficacy and mathematics performance revealed a strong positive correlation. However, the study found no significant relationship between the two variables, leading to the acceptance of the null hypothesis.

Similarly, the relationship between self-regulation (in terms of planning, monitoring, adjusting, and reflecting) and mathematics performance showed a negligible positive correlation. Therefore, the results indicate that there is no significant relationship between self-regulation and the academic performance of the respondents.

VII. CONCLUSION

The study indicates that while respondents exhibited high levels of self-efficacy and self-regulation, these factors did not significantly impact their mathematics performance. Despite the respondents demonstrating confidence in their abilities and effective strategies for managing their learning processes, statistical analysis revealed no significant correlation between self-efficacy or self-regulation and their academic performance in mathematics. This suggests that other factors may be more influential in determining success in mathematics, and further research is needed to explore additional variables that could contribute to improved performance in this subject.

RECOMMENDATION

To effectively address mathematical challenges, it is recommended that schools and educators implement the output action plan developed in this study. This plan includes strategies such as personalized tutoring, group projects, and hands-on problem-solving activities to provide targeted support for students. It also emphasizes designing comprehensive programs that focus on motivation, stress management, engagement, and self-regulation skills to offer a holistic approach to improving mathematics performance. Active teacher involvement and feedback are crucial, as they allow for interventions tailored to students' specific difficulties.

References:

[1.] Abriel, M., et al. (2020). How does self-regulated learning affect students' mathematics anxiety? Pedagogical Research, 5(2), 1–15. https://doi.org/10.20935/eduped/2020.2.5

[2.] Academia Today. (2023). Understanding the role of mathematics in daily life. https://academiatoday.com/mathematics-in-daily-life/

[3.] Aljuaid, F. (2021). Self-efficacy and self-regulation as predictors of academic motivation among undergraduate students in the United States. Dissertations, 1744. https://dx.doi.org/10.32597/dissertations/1744

[4.] Altinyelken, H. K., Suryadarma, D., & Wee, V. (2021). Global and local dynamics in education reforms: A Southeast Asian perspective. International Journal of Educational Development, 80, 102308. https://doi.org/10.1016/j.ijedudev.2020.102308

[5.] Anadero, E. (2022). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology, 13,* 840232. https://doi.org/10.3389/fpsyg.2022.840232

[6.] Cao, X., & Han, Y. (2024). The effect of students' feedback perception on online learning engagement via academic self-efficacy and test anxiety.

[7.] Casinillo, L. (2023). Modeling students' self-efficacy in mathematics during the COVID-19 pandemic. Canadian Journal of Family and Youth / Le Journal Canadien de Famille et de la Jeunesse. https://www.researchgate.net/publication/366789907

[8.] ccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. *Contemporary Educational Psychology, 61,* 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

[9.] Cera, R., Mancini, M., & Antonietti, A. (2013). *Relationships between metacognition, self-efficacy and self-regulation in learning*. ECPS Journal, 7, 115–141.

[10.] Chen, X., et al. (2025). Mobile phone distraction: Effects on immediate and lecture recall. Educational Psychology Review. https://utdanningsforskning.no/artikler/2025/smartphones-media-multitasking-and-cognitive-overload/

[11.] Chen, Y. H. (2023). Test anxiety, self-efficacy and academic performance among senior three students: Basis for a psychological counseling program. International Journal of Research Studies in Psychology, 9(1), 11–21.

[12.] Chong, A., & Li, M. (2021). Southeast Asia and the challenges of global interconnection. Routledge.

[13.] Cuder et al. (2023) connects math anxiety with avoidance of math tasks and its role in discouraging STEM pathway choices. BPS Psych Hub

[14.] Deardorff, D. K. (2020). Manual for developing intercultural competencies: Story circles. UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000370336

[15.] Ding, L., & Zhu, J. (2022). Self-efficacy and student engagement in higher education: A review of contemporary research. Frontiers in Psychology, 13, 870232. https://doi.org/10.3389/fpsyg.2022.870232

[16.] Dowker, A., et al. (2020). Anxiety, avoidance behaviors, and cognitive distractions. RSIS International.

[17.] Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on motivation. Contemporary Educational Psychology, 61, 101859. https://doi.org/10.1016/j.cedpsych.2020.101859

[18.] Edubirdie. (2023). 15 uses of mathematics in our daily life. https://hub.edubirdie.com/examples/15-uses-of-mathematics-in-our-daily-life/

[19.] Educational Psychology. (2024). The impact of self-efficacy and self-regulated learning strategies on performance in STEM disciplines.

[20.] Eidlin Levy et al. (2023) explores how math anxiety influences students' career decisions, especially steering them away from math-intensive fields over time. SpringerOpen

[21.] Erturan, S., & Jansen, B. R. J. (2022). The role of self-efficacy and motivation in mathematics performance.

[22.] Fan, Y., Tang, L., Le, H., Shen, K., Tan, S., Zhao, Y., & Gašević, D. (2024). Beware of metacognitive laziness: Effects of generative AI on learning motivation, processes, and performance. arXiv.

[23.] Fang, F., Zhang, Y., & Wang, L. (2022). Self-regulated learning, metacognitive strategies, and motivation as predictors of mathematics achievement.

[24.] Financial Times. (2024, June 10). Mathematics: The language of the universe. https://www.ft.com/content/4ed64525-95b4-41d6-a7eb-b3295ebf4a77

[25.] Foley, A., et al. (2021). Meta-analysis on math anxiety and achievement. RSIS International / PubMed.

[26.] Frontiers in Psychology. (2025). Analytical thinking in mathematics education: A systematic review. https://doi.org/10.3389/fpsyg.2025.1523836

[27.] Gabriel, M., et al. (2020). How does self-regulated learning affect students' mathematics anxiety? Pedagogical Research, 5(2), 1–15. https://doi.org/10.20935/eduped/2020.2.5

[28.] Gaumer Erickson, A. S., & Noonan, P. M. (2021). Self-regulation assessment suite: Technical report. College & Career Competency Framework. http://cccframework.org

[29.] Guntur, M., & Purnomo, Y. W. (2024). A meta-analysis of self-regulated learning intervention studies on learning outcomes in online and blended environments. Online Learning Journal, 28(3), 563–584. https://doi.org/10.24059/olj.v28i3.4025

[30.] Hayat, A. A., Shateri, K., Amini, M., & Shokrpour, N. (2020). Academic self-efficacy, learning-related emotions,

and metacognitive strategies with academic performance in medical students: A SEM approach. BMC Medical Education, 20, 1–11. https://doi.org/10.1186/s12909-020-02183-0

[31.] Hidayat, R., & Sariningsih, R. (2020). Problem-based learning for critical thinking skills in mathematics. Journal of Mathematics Education, 11(1), 1–10.

[32.] International Review of Research in Open and Distributed Learning. (2024). *Self-regulated learning in the digital age: A systematic review*.

[33.] Jia, Y., et al. (2023). *Effect of academic self-efficacy on test anxiety of higher vocational college students: The chain mediating effect*.

[34.] Latham, G. P. (2021). Goal setting: A possible framework for developing future leaders. *Organizational Dynamics, 50*(1), 100787. https://doi.org/10.1016/j.orgdyn.2020.100787

[35.] Lee, J., Lee, H., Makara, K. A., Fishman, B. J., & Wang, M. T. (2021). *English language learners' self-efficacy and self-regulated learning strategies in college settings: A social cognitive perspective*.

[36.] Li, J., & Ye, F. (2021). Emotional regulation and academic achievement: Evidence from mathematics learning. *Frontiers in Psychology, 12,* 640123. https://doi.org/10.3389/fpsyg.2021.640123

[37.] Liu, A., & McInnis, K. (2020). Language learning and cultural immersion in Southeast Asia. *Journal of Language and Intercultural Communication, 20*(5), 450–465. https://doi.org/10.1080/14708477.2020.1786912

[38.] Locke, E. A., & Latham, G. P. (2020). Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *American Psychologist, 75*(2), 161–174. https://doi.org/10.1037/amp0000415

[39.] Ma (2025) introduces innovative teaching strategies like the REACT model (Relating, Experiencing, Applying, Cooperating, Transferring), recommending experiential and application-oriented curricula to reduce anxiety. Frontiers

[40.] Malespina, A., Seifollahi, F., & Singh, C. (2025). *Bioscience students in physics courses with higher test anxiety have lower grades on high-stakes assessments, and women report more test anxiety than men*. *arXiv*.

[41.] Martín-Páez, T., & Rivera, D. (2025). Structured problem-solving in mathematics education: Insights from Pólya's framework. *Education Sciences, 15*(6), 667. https://doi.org/10.3390/educsci15060667

[42.] Martín-Páez, T., Aguilera, D., Perales-Palacios, F., & Vílchez-González, J. M. (2020). What are we talking about when we talk about STEM education? A review of literature. Science Education, 103(4), 799–822. https://doi.org/10.1002/sce.21522

[43.] Matovu, M. (2022). Self-efficacy as a predictor of student motivation and academic achievement. International Journal of Educational Research, 115, 102033.

[44.] Murayama, K., Pekrun, R., Lichtenfeld, S., & vom Hofe, R. (2022). *Motivation and self-beliefs as predictors of mathematics achievement: A cross-cultural meta-analysis*.

[45.] Nair, D. (2022). *ASEAN and the politics of regional cooperation in Southeast Asia*. Palgrave Macmillan.

[46.] Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology, 8,* 422. https://doi.org/10.3389/fpsyg.2017.00422

[47.] Panadero, E. (2022). A review of self-regulated learning: Six models and four directions for research. Frontiers in Psychology, 13, 865566. https://doi.org/10.3389/fpsyg.2022.865566

[48.] Panadero, E. (2022). A review of self-regulated learning: Six models and four directions for research. *Frontiers in Psychology, 13,* 840232. https://doi.org/10.3389/fpsyg.2022.840232

[49.] Panadero, E., & Broadbent, J. (2020). Developing teacher expertise in promoting self-regulated learning: A review. *Educational Psychology Review, 32,* 1–28. https://doi.org/10.1007/s10648-019-09491-0

[50.] Pekrun, R., & Perry, R. P. (2020). Control-value theory of achievement emotions. *International Handbook of Emotions in Education,* 2nd Edition, 45–70. https://doi.org/10.4324/9780429467171-4

[51.] Philippine Olympiad Foundation for Science and Arts. (2024, June 20). *Mathematics as the language of the universe*. https://pofsa.org/read/more/about/post/2

[52.] QuickSurveys.Blog. (2025). *A survey of mathematics: Applications in real world*. https://quicksurveys.blog/surveys/a-survey-of-mathematics-applications-in-real-world/

[53.] Robson, D. A., Allen, M. S., & Howard, S. J. (2020). Self-regulation in childhood as a predictor of academic achievement: A meta-analysis. Educational Psychology Review, 32(1), 1–20. https://doi.org/10.1007/s10648-019-09488-8

[54.] Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology, 61,* 101860. https://doi.org/10.1016/j.cedpsych.2020.101860

[55.] Schunk, D. H., & DiBenedetto, M. K. (2020). *Motivation and social-emotional learning: Theory, research, and practice*. *Contemporary Educational Psychology*, 60, 101827. https://doi.org/10.1016/j.cedpsych.2020.101827

[56.] Shimizu, Y. (2025). *Learning engagement as a moderator between self-efficacy, math anxiety, use of diagrams, and complex plane problem-solving*. *Eurasia Journal of Mathematics, Science and Technology Education*, 21(1), 1–15. https://www.ejmste.com

[57.] Steinert, S., Avila, K. E., Ruzika, S., Kuhn, J., & Küchemann, S. (2023). *Harnessing large language models to enhance self-regulated learning via formative feedback (LEAP)*. arXiv.

[58.] Tagliacozzo, E. (2020). *Southeast Asia and the history of the world*. Cambridge University Press.

[59.] Talsma, K., Schüz, B., Schwarzer, R., & Norris, K. (2021). I believe, therefore I achieve (and vice versa): A meta-analytic cross-lagged panel analysis of self-efficacy and academic performance. Learning and Individual Differences, 85, 101944. https://doi.org/10.1016/j.lindif.2020.101944

[60.] Tang, Y., Zhang, Y., & Liu, X. (2021). Neural mechanisms of cognitive control and self-regulation in academic learning. *Neuroscience & Biobehavioral Reviews, 126,* 150–165. https://doi.org/10.1016/j.neubiorev.2021.03.019

[61.] TechInDetail. (2025). *Real-life applications of mathematics*. https://techindetail.com/real-life-applications-of-mathematics/

[62.] Teng, L. S., & Zhang, L. J. (2020). *Self-regulation and metacognition in second language writing: A structural equation modeling approach*. Language Teaching Research, 24(3), 389–412. Zimmerman, B. J., & Moylan, A. R. (2022). *Self-regulation: An evolving theory and its applications*. In D. H. Schunk & J. A. Greene (Eds.), Handbook of Self-Regulation of Learning and Performance (2nd ed.). Routledge.

[63.] Tran, L. T., & Vu, T. T. (2021). Developing intercultural competence in Southeast Asian higher education. *Higher Education Research & Development, 40*(7), 1412–1426. https://doi.org/10.1080/07294360.2020.1835822

[64.] Vansteenkiste, M., Ryan, R. M., & Soenens, B. (2020). Basic psychological need theory: Advancements, critical themes, and future directions. *Motivation and Emotion, 44,* 1–31. https://doi.org/10.1007/s11031-019-09818-1

[65.] Veloo, A. (2022). Developing mathematical critical thinking skills through open-ended problems. *International Journal of Education and Practice*, 10(4), 112–121. https://www.proquest.com/docview/2625917666

[66.] Vendetti, M. S., & Bunge, S. A. (2020). Brain and cognitive development in adolescence: Implications for education. *Nature Reviews Neuroscience, 21,* 425–440. https://doi.org/10.1038/s41583-020-0311-9

[67.] Wigfield, A., Gladstone, J. R., & Turci, L. (2021). Expectancy-value theory in the classroom: Understanding motivation to learn. *Child Development Perspectives, 15*(3), 165–170. https://doi.org/10.1111/cdep.12371

[68.] Wikipedia contributors. (2025, [Month]). *Mathematics in social sciences*. In *Wikipedia*. Retrieved [Date], from https://en.wikipedia.org/wiki/Mathematics

[69.] Zheng, C., Li, X., & Zheng, Y. (2021). Self-regulated learning and mathematics achievement: The role of metacognition and motivation. *Educational Psychology, 41*(8), 1055–1072. https://doi.org/10.1080/01443410.2021.1962214

[70.] Zheng, C., Liang, J. C., & Tsai, C. C. (2023). The role of self-regulated learning in students' academic achievement: A systematic review. *Frontiers in Education, 8,* 1184591. https://doi.org/10.3389/feduc.2023.1184591

[71.] Zheng, L., & Li, X. (2020). The relationship between self-regulated learning and academic performance: A meta-analysis. Educational Research Review, 30, 100327. https://doi.org/10.1016/j.edurev.2020.100327