THE IMPACT OF PRECONCEIVED NOTIONS ON LEARNING AND UNDERSTANDING MATHEMATICS

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- The Researchers

ABSTRACT

Title : The Impact of Preconceived Notions on Learning and Understanding Mathematics

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This study is intended to determine the impact of preconceived notions on learning and understanding mathematics among grade 11 students at Cainta Catholic College. Preconceived notions are pre-existing ideas or beliefs that individuals form on a specific topic or group of people which can be barriers impacting students' confidence and ability to excel in Mathematics.

This research utilized a mixed methodology convergent parallel design to integrate the quantitative and qualitative data of the potential impacts of preconceived notions on learning and understanding mathematics. Using purposive sampling, an achievement test was administered to Grade 11 students across the strands to select the respondents based on their scores. The chosen thirty-six (36) respondents were surveyed and interviewed regarding their preconceived notions in mathematics and how these formed and affected their learning of mathematics. The findings revealed there is a significant relationship

between Grade 11 students' preconceived notions and their Level of Proficiency in Mathematics. This implies that preconceived notions, either positive or negative, affect the level of proficiency of the students. Furthermore, there is a complex interplay of personal experiences, social interactions, teaching styles, feelings, and academic factors in forming their preconceived notions on Mathematics.

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Chapter 1

THE PROBLEM AND ITS BACKGROUND

This chapter presents the problem that the researchers would like to tackle in the study, its background, hypothesis, scope and delimitations, and the significance of the study.

Introduction

Preconceived notions are pre-existing ideas or beliefs that individuals form on a specific topic or group of people. These notions are often shaped by personal experiences, cultural influences, or societal norms that can significantly impact how people perceive and interact with things. It occurs when an individual or a group of people assume based on limited or biased information that can be positive or negative. Preconceived notions can be based on reality and actual probability distributions or have no basis in real life (Mandalaywala, 2020). It can affect people's perceptions of objects, their interactions with those objects, and their treatment of them, leading to unfair biases, discriminatory behavior, prejudiced attitudes, and negative assumptions. Furthermore, when people internalize negative beliefs about their group or objects, they may start behaving in ways that confirm those assumptions.

Preconceived notions play a significant role in shaping students' academic performance and attitudes toward learning. In education, it refers to oversimplified and generalized views about individuals, subjects, groups, or things that could influence perceptions, attitudes, and interactions in educational

contexts. These notions may affect students' expectations depending on the students motivation, perceptions and learning ability. A possible reason for the persistent achievement gap is stereotype threat, a situational predicament that prompts individuals to perform in ways that mirror the notions associated with their social groups (Hilton, 2024). Self-affirmation interventions are frequently used to counteract the effects of negative preconceived notions by teaching students how to focus on their strengths and ideals to enhance their self-concept. However, spontaneous self-affirmation approaches may be more effective since kids may instantly self-affirm in any psychologically challenging scenario. In Mathematics, preconceived notions revolve around mindset and ability which can significantly affect the students' confidence and performance. These notions can lead to lower participation and confidence in math-related subjects and lose interest in math related activities. According to the results of some studies, the mathematics anxiety and motivation levels of middle school eighth-grade students were high and there was a positive and moderate relationship between mathematics anxiety and motivation towards mathematics. It was also determined that anxiety predicted achievement at a higher level, followed by motivation (Süren & Kandemir, 2020). Thus, preconceived notions can be barriers impacting students' confidence and ability to excel in Mathematics.

This research aims to determine the impact of preconceived notions on learning and understanding mathematics among grade 11 students at Cainta Catholic College. The study examines how preconceived notions can influence how students perceive and comprehend mathematics. The findings of this study

shed light on how preconceived notions about math affects learning outcomes and the connection between students' ability to learn and understand mathematics and the preconceived notions associated with the subject. By determining how notions can affect student perception in mathematics, the findings contributed to a deeper understanding of the factors influencing students' success in mathematics and suggest interventions to address the negative effects of preconceived notions.

Background of the Study

Mathematics is one of the core subjects that delves into the exploration of numbers, patterns, data, shapes, measurements, and more. It greatly influences people's lives, as mathematical concepts are encountered by people in different aspects of their day-to-day experiences. Mathematics provides individuals with strong skills in abstraction, problem analysis, and logical reasoning (Judijanto et al., 2024). Moreover, it serves as the foundation for developing critical thinking and plays a pivotal role in the educational development of students. However, the presence of preconceived notions to the subject itself can significantly influence students' learning and understanding of mathematics.

For many years, mathematics has been an area of concern, particularly in educational settings. Students' attitudes towards mathematics can be affected by internal and external factors, which include individual characteristics and the environment (Alibraheim, 2021). The factors include prior academic preparation,

teaching methodologies, and the perceived relevance of mathematics to their studies. When teachers provide engaging and encouraging instruction, students are more likely to develop an interest and enthusiasm for learning. In contrast, traditional or inflexible teaching methods can discourage students. Additionally, factors such as the attitudes of classmates, a student's confidence in their abilities, perceptions of math within society, and access to educational materials play a role in shaping a student's experience with mathematics.

Based on the study of Kunwar (2020), most of the students have math anxiety, which is a psychological condition that is characterized by fear in mathematics that leads to avoidance behaviour and underperformance to the subject. This is sometimes caused by negative past experiences, pressure to perform, harsh teaching methods, or societal stereotypes that perpetuate the belief that math is inherently difficult or exclusive to certain individuals. This belief is integrated with the preconceived notions that mathematics is primarily for certain racial groups, which prevents many students from achieving their potential in mathematics. This can lead to low self-efficacy, making students less likely to persist in mathematics (Jaffe, 2020). In the classroom, classmates have a significant role in shaping students' self-concept. When classmates share a belief that math is hard, it can create a classroom environment where students will believe that math is a difficult subject, further reinforcing their negative self-beliefs. It is suggested that the classroom environment, with its shared beliefs, can have a huge impact on students' perception of their mathematical ability (Dolinting & Pang, 2022). This belief can create a sense of inadequacy

and discouragement, particularly for students who perceive themselves as not "naturally" good at math. It can lead to a lack of confidence and a reluctance to participate in class or attempt challenging problems. This study aims to investigate the impact of preconceived notions on learning and understanding mathematics by examining the prevailing notions about mathematics and their influence on students' attitudes, beliefs, and performance. This research seeks to shed light on the factors that contribute to disparities in mathematics education. The findings of this study can be used to inform educational practices and interventions that can help to challenge negative preconceived notions and create a more inclusive and equitable learning environment for all students. Furthermore, the research can provide insights into the importance of fostering positive attitudes and beliefs about mathematics among students, which can lead to increased engagement, persistence, and academic success.

Statement of the Problem

This research aimed to determine the impact of preconceived notions on learning and understanding Mathematics among grade 11 students at Cainta Catholic College.

Specifically, the researchers intended to answer the following questions:

1. What is the level of proficiency of Grade 11 students regarding their achievement test results in general mathematics in terms of:
    1.1. Function;
    1.2. Business Mathematics; and

1.3. Logic?

2. What are the preconceived notions in Mathematics as perceived by the respondents in terms of:
   2.1. Motivation;
   2.2. Perceptions;
   2.3. Self-esteem;
   2.4. Peer-influence; and
   2.5. Teaching Strategies?
3. Is there a significant relationship between students' proficiency and their preconceived notions in Mathematics?
4. How do students form their preconceived notions about mathematics?
5. How do the preconceived notions in mathematics that affect the learning and understanding of the respondents?

Hypothesis

There is no significant relationship between students' level of proficiency and their preconceived notions in Mathematics.

Scope and Delimitations

The respondents of this study were the Grade 11 students enrolled during the school year 2024–2025. Using a purposive sampling approach, the researchers chose students per section across the strands. Thirty-six (36) respondents were selected, with six (6) students per section. The respondents were chosen based on their scores in achievement tests administered by the

researchers. Specifically, three (3) students from the higher group who got the highest scores and three (3) students from lower groups who got the lowest. Furthermore, the study focuses on identifying the impact of preconceived notions in grade 11 students' mathematical learning and understanding and possible interventions to motivate and mitigate these notions.

Significance of the Study

This study was conducted to provide valuable information on how preconceived notions about math can influence the learning and understanding of students in mathematics. By identifying its impact, the researchers suggest interventions that challenge negative beliefs and promote a growth mindset in mathematics. Ultimately, this study may contribute to more effective teaching practices that enhance students' confidence and engagement in the subject.

Students. The study provides students with a better understanding of how preconceived notions impact their learning and perception of mathematics, enabling them to recognize and overcome negative thoughts that could influence their academic performance. This knowledge helps them see math more positively and increases their confidence in the subject.

Teachers. The study gives teachers important information on how preconceived notions impact their students' performance. In order to provide equal chances for learners, it might inspire educators to use more inclusive

teaching techniques and create an engaging classroom environment that mitigates the negative notions on mathematics.

School Administrators. The study provides information that helps to inform policy decisions and curriculum development aimed at reducing stereotype-based barriers to learning. School leaders could integrate programs or workshops to mitigate false beliefs about mathematics and encourage diversity in mathematical success.

Future Researchers. The study contributes to the broader academic discourse on the intersection of social psychology and education. It may serve as a reference for future research on how preconceived notions affect learning in other subjects and across different age groups or educational institutions.

Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

In this chapter, the researchers discuss relevant literature and studies to the present study. The following literature and studies, both foreign and local, focused on the impact of stereotypes on learning and understanding mathematics.

Preconceived Notions

Preconceived notions are initial beliefs about mathematics that are formed without sufficient knowledge. The students' preconceived notions in mathematics were formed earlier without evidence. This could affect the learning and motivation of the students toward math subjects. According to Wakhata et al. (2023), students' existing knowledge and belief in mathematics influence their learning of new mathematical concepts. Positive preconceived notions can ignite motivation, active participation, and a belief in one's ability to improve in math. However, negative preconceived notions about math can trigger anxiety, reduce self-confidence, and discourage engagement with the subject.

Learning mathematics can be challenging for many students, with various factors contributing to these difficulties. Among these, learners' negative perceptions towards mathematics play a significant role. Kunwar (2021) highlights that fear and a sense of failure can significantly impact a student's ability to learn mathematics effectively. This negative perception often stems from the belief that mathematical abilities are innate and exclusive to a select group of

"gifted" individuals. According to Russo et al. (2023), students who struggle in math tend to have a fixed belief that their mathematical skills are unchangeable. Students see it as a talent that either born with or not, rather than something that can be improved with effort. This can cause students to lose motivation and give up easily when they encounter difficulties in math. The study indicated that students' experiences with tasks of appropriate difficulty were crucial for developing self-efficacy. Etang and Regidor (2022) highlighted that students with a positive outlook on mathematics, such as believing in their abilities and enjoying the subject, generally achieved higher scores on math tests. However, students with low self-efficacy, negative belief towards math, and those who didn't see the relevance of math in their lives generally scored lower on math tests. The study found that students who believed in their own abilities in mathematics had better chances of success. Students who thought they could understand and excel in math were more determined to overcome difficulties and perform well. Furthermore, the misconception that mathematics primarily involves rote memorization hinders the development of crucial critical thinking skills.

Motivation

Filgona et al. (2020) defined motivation as a driving force that makes a person pursue things, it can be knowledge, or skills, to understand or to achieve certain values. It is what drives a person to learn, understand, or believe in something which can lead the learners to concentrate, stimulate, and be eager to learn effectively and improve academic outcomes. Motivation can be influenced

by various things such as interest, goals, and learning environment that can either hinder or enhance learners' engagement.

According to Davidovitch and Dorot (2023), everyone's motivations are different, and when they choose to pursue something, their motivation is higher. For example, when a student shows interest in study materials and improves their achievements, they demonstrate motivation for learning, which can be intrinsic or extrinsic. It shows that both internal and extrinsic motivation will positively impact mathematics achievement (Tran & Nguyen, 2021). The difference between the two is the driving reason behind the student's engagement in the action. In addition, if the student chooses to study mathematics, their motivation will rise and their success will also rise. There is a significant association between a student's extrinsic motivation and their positive perception of their mathematics teacher. The study suggests that intrinsic and extrinsic motivation influence each other and substantially affect a student's academic performance (Hossein-Mohand & Hossein-Mohand, 2023). Additionally, if the students had a good instructor, their motivation toward mathematics and their academic success would rise. A study conducted by Yunos et al. (2022) discovered that motivation to learn mathematics has a positive effect on their academic performance. It also found that motivation will not only affect performance directly but also indirectly by its impact on student attitude and interest in Mathematics. However, motivating students to learn mathematics is a key challenge in educational institutions (Saadati & Celis, 2023). Because of the preconceived notions of the students, the motivation of the

students to learn mathematics decreases until they lose interest. Students' motivations and attitudes have a significant impact on their learning and performance in school subjects like mathematics (Michaelides et al., 2019). Theories like self-determination, expectancy-value, self-efficacy, self-concept, and achievement goal theory show important factors that affect learning and achievement. Generally, students who believe in themselves, are interested in, and value math tend to do better, although the connections might be small. Thus, motivation plays a big part in the learning of the students towards mathematics. With motivation, the students will make an effort to learn the subject and be interested in the subject.

Perceptions

According to the study of Putri (2022), Perception is a psychological process that allows the people to interpret experiences through the five senses. It involves the way one sees the world, enabling them to form responses that can be positive or negative. In the education setting, student's perception towards the subject or learning can affect their learning. The perceptions of students in their school environment could play a significant role in understanding the differences in academic achievement (Edgerton & McKechnie, 2023). In addition, either positive or negative perceptions contribute to their students' achievement. For instance, students' negative perceptions of mathematics, including beliefs, behaviors, and emotions, can significantly impact their achievement in the subject (Sakpla et al., 2023). In this study, the students showed a negative

attitude toward mathematics, wherein students developed fear, hatred, and lack of self-confidence in the subject. The students don't see any value in mathematics. They are only attending mathematics classes because they expect to be there. In addition, if students' confidence and self-perception in mathematics are not met, this will lead to a negative attitude toward the subject (Aguilar, 2021). The findings show the major reasons for having negative perceptions of students toward mathematics. They do not have confidence in their knowledge of mathematical concepts. Moreover, students' self-perception toward mathematical knowledge was the first reason for students to develop a negative attitude. Most students perceived math as a subject that requires too much work, needs to be clarified, and is difficult to understand, which led to not being the preferred subject for most students.

According to the Evolution Psychology Center (2016), the thinking of the students “I'm just not good in math” has harmful effects on their learning. This mindset could limit the ability of the students to learn. Believing in such a belief will cause decreased motivation and performance, ultimately conforming to the misconception is true. The students have fixed mindsets toward math that can discourage them from facing challenges and seeking help for themselves. To overcome math anxiety and achieve success, encouraging students and providing support can enhance students' motivation and build confidence in mathematics. If students have a positive mindset that they can improve their abilities, they will feel motivated and challenge themselves in math problems (Development and Research in Early Mathematics Education, 2022).

Mathematical skills can improve with practice. If students have a positive mindset toward mathematics they can develop their skills. When students make mistakes, they can learn from them and try again after failure. Furthermore, positive perception of students toward mathematics learning with the guidance of the teacher will improve their learning of mathematics (Hagan et al, 2020).

Self-Esteem

Ellis et al. (2018) defined self-esteem as the degree to which an individual tends to view themselves positively. It is a person's overall evaluation of and value placed on oneself. Some of the studies show that there is a positive correlation between self-esteem and learning. As the self-esteem of the students increases, the learning and academic engagement of the students also increases. Students with high self-esteem are more capable of achieving much more challenging tasks compared to those with low self-esteem, as they tend to set standards and goals. The results of the study by Zhao et al. (2021) indicate that self-esteem positively influences adolescent academic engagement, with academic self-efficacy serving as a mediating factor. In other words, high self-esteem can improve the academic engagement of adolescents making them more likely to actively participate in class, share their opinions, and take risks. Thus, self-esteem influences the motivation and determination of the students to learn, resulting in positive self-evaluation and increasing academic engagement.

According to Nabila and Widjajanti (2020), self-esteem plays a crucial role in learning mathematics. Many students struggle in mathematics because of low

self-esteem or lack of confidence which is mostly because of negative past experiences in math hindering their learning outcomes. In addition, self-esteem is one of the various factors that may influence math anxiety (Singh & Jethwani, 2023). Lower levels of self-esteem may result in higher levels of math anxiety and vice versa. If the self-esteem of the students is reduced or lower towards the subject, they can become more anxious and less confident. Likewise, self-esteem is identified as one of the psychological factors that influence students' academic achievement in mathematics (Ugwuanyi et al., 2020). This suggests that the student's success in school also depends on their level of self-esteem. Although self-esteem has a statistically significant positive relationship with math achievement, it cannot be concluded that it is a significant predictor of math achievement (Carabeo & Tado, 2024). Nonetheless, this still shows that students with higher levels of self-esteem tend to perform better in mathematics. The study suggests that there is a need for improvement, as many students' academic achievements in math have not met expectations. These interventions can be teamwork activities, peer tutoring, and body positivity programs. Furthermore, Self-esteem helps build self-confidence in mathematics. By developing self-confidence, students' difficulty in mathematics can be resolved with the help of close assistance (Moneva & Valle, 2020).

Peer-Influence

According to Field & Prinstein (2023), Peer influence is a dynamic process that may differ across behaviors, both within and between persons and thus

substantial research has been dedicated toward uncovering potential amplifying or mitigating factors. It was determined that peer influence is a system by which peers influence one another's behavior and attitudes over time. In the study conducted by Pendon (2024), there was a significant difference in the attitude of the students before and after the intervention, concluding that a peer collaboration approach would improve the student's attitude toward mathematics and can learn more about the subject if they collaborate than work alone with their peers. The findings of this study suggest that peer collaboration makes a student develop a positive attitude and enhance motivation in learning Mathematics. Additionally, the study of Shao et al. (2024) found a strong link between peer relationships and academic success in junior high school students. The increased interaction with peers has a positive impact on their learning attitude and personal values, leading to improved motivation and academic achievement. By collaborating with their peers, students can gain new perspectives and other insights. They can also attain skills including cooperation, listening, and leadership skills that can only be acquired through peer collaboration.

However, in other studies, peer pressure had a significant influence, indicating that less peer pressure is linked to better performance in mathematics (Pasco, 2021). For instance, students who feel less pressure from their peers to perform well in mathematics may reduce anxiety and stress related to the subject, leading to better focus and improved performance in math-related activities. The study by Bakar et al. (2021) shows that peers directly affect

mathematics achievement and indirectly affect mathematics achievement through student engagement. Moreover, peers' behavior and speech in the mathematics classroom directly influence mathematics anxiety (Garba et al., 2019). Positive peer behavior and supportive speech help reduce anxiety in mathematics, while negative behavior and discouraging speech intensify it. Peers' achievements, group discussions, and motivational support were also found to be particularly influential in reducing mathematics anxiety. In contrast, a study by So (2023), found that college students are highly influenced by their peers at school. Despite high peer pressures and influences, their academic achievement in mathematics is not affected. It concludes that a negative attitude toward Mathematics through peer pressure is developed at an early stage and does not affect college students. Hence, peers can play a significant role in either encouraging or discouraging learners. So sharing positive experiences about math among them can positively impact their success in math. It is also important for teachers to create a good classroom environment to discourage negative peer influence on Mathematics because creating a positive classroom where students are comfortable is essential for reducing math anxiety and promoting academic success.

Teaching Strategies

Teaching strategies refer to the specific methods and approaches that educators use to deliver instruction. These strategies reflect a teacher’s unique style for engaging students and helping them learn various skills (Cooper &

Ozansoy, 2022). They should align with the teacher's personality and interests, as well as the needs of the students and the requirements of the curriculum. There are several types of teaching strategies that teachers can implement in the classroom. These include cooperative learning, inquiry-based learning, project-based learning, the flipped classroom model, peer instruction, and more.

In mathematics, cooperative learning is the most commonly applied teaching strategy, followed by demonstration and repetitive exercises (Cardino & Cruz, 2020). This strategy helps the students to collaborate and learn from their peers, increasing engagement with the subject and facilitating a more student-centered classroom. According to Siller & Ahmad (2024), collaborative learning shows promise for improving mathematics achievement, as positive changes in attitudes toward mathematics were observed in the experimental group of elementary students. Moreover, the teacher should use a strategy that will be effective for their students. It is essential for teachers to select strategies that are effective for their students because teaching strategies can significantly influence classroom dynamics, both positively and negatively (Hargrove, 2023). Each has its potential benefits and disadvantages. Some strategies may enhance student engagement and active participation, while others may hinder it. Thus, teachers should use a variety of strategies that cater to the diverse educational needs of all students (Abulhul, 2021). What works well in one lesson may not be effective in another, and likewise, a strategy that is effective for one student might not be for another. Different students have varied learning styles and ways of absorbing knowledge and to keep them motivated and engaged,

teachers should implement various strategies that accommodate the needs of all learners in the classroom, leading to positive attitudes and outcomes. Furthemore, effective use and implementation of teaching strategies can result in improved motivation and performance among students, as these strategies address their individual needs.

Proficiency of Grade 11 Students in Mathematics

According to Berrame (2024), the primary aim of teaching Mathematics is to develop problem-solving skills among the students whereas one of the factors leading to this aim is mathematical proficiency. Poor ability to solve math problems was an indication that students lacked the critical and problem-solving skills necessary to solve real-life problems and that the proficiency level had a great impact on how students achieved in mathematics. Moreover, mathematics proficiency is a bigger priority in K–12 education. Although multiple kinds of factors might contribute to poor mathematical performance, the inability plays a big part in students' ability to solve basic computational problems smoothly. Students who struggle with these problems will also struggle with more complicated and advanced mathematical concepts without a solid conceptual understanding and foundational fluency. Thus, it is not easy to progress through higher levels of mathematics.

The study of Alova and Alova (2022) found a significant difference in the academic performance of grade 11 students in Mathematics based on their chosen strands, with ABM achieving the highest mean academic performance

and TVL achieving the lowest. Additionally, the study of Parcon and Bearneza (2024) found that the competency of the students in the three areas of General Mathematics in terms of Functions, Business Mathematics, and Logic was still a developing proficiency and only fair. It means that the knowledge of the students in these areas is still lacking and needs to improve. In another study by Marie and Angelo (2022), the grade 11 students at Sta. Cruz South High School did not meet expectations before the implementation of the modular learning approach, while fairly satisfactory after the modular learning approach on their understanding of key concepts of general mathematics, such as function, rational function, inverse function, exponential function, and logarithmic function. However, there are still students who struggle and find mathematics difficult. Grade 11 learners faced challenges in solving probability problems, with 98% scoring below 50% in areas such as Venn diagrams, mutually exclusive events, and dependent events (Makgakga & Dhlamini, 2019). These findings were affected by a lack of interest in learning the topic, along with an inconsistent understanding of probability reasoning and related vocabulary.

Based on PISA 2018, TIMSS 2019, and SEA-PLM 2019 results, students from the Philippines have continuously performed poorly in mathematics (Garcia et al., 2024). This may be caused by challenges in the current educational system or other factors affecting the mathematical proficiency of students in the Philippines. Saputri et al. (2024) stated that some children believe mathematics to be a challenging, unsettling, and frightening topic. Some students still struggle with mathematical difficulties, as learning mathematics is often abstract and

makes it difficult for them to understand. Students find it difficult to solve problems that are unfamiliar to them, they are more used to solving ordinary problems that are similar to those exemplified by the teachers. Moreover, mastering mathematics is still a challenge for most high school students, and their math performance directly impacts their overall academic achievement (Cabuquin & Abocejo, 2023). The findings indicate that there is no significant difference in mathematical achievement between male and female students. They can achieve success academically and equally practice mathematical concepts. Students who are more skilled in mathematics tend to excel in their academic courses, while those struggling with math often face difficulties in their overall academic performance. If students' challenges with studying mathematics are not instantly resolved, it will negatively affect them and make them less interested in the subject. Which causes the subject of mathematics to continue to be a subject ignored by students. Leal et al. (2022) stated that the better students' perception of beliefs about mathematics, the better their academic performance, and vice versa. For instance, students who have a positive belief in math and their math skills may be more likely to persist through challenging problems and seek out help when needed, leading to better academic performance. Conversely, students who lack confidence in their math skills may struggle to engage with the material and may experience lower academic performance as a result. The attitude and motivation also affect the student's academic performance. It was mentioned in the study of Libradilla et al., (2024) that those students who have a positive attitude towards Mathematics have

better performance in the subject. As they have positive attitudes like curiosity and interest in learning mathematics, it will improve their performance, while intense negative attitudes decrease and disrupt their learning process resulting in low academic performance. The willingness of the students to learn mathematics and their perception of math being a difficult subject are also some of the factors that affect their academic performance in the said subject (Iddrisu et al., 2023). This study shows that an organized and managed classroom environment influences students' ability to perform better and promote academic success. Furthermore, the students who are more willing to learn and have a positive perception of math may perform better academically in the subject rather than those who are not.

Synthesis

The literature and studies that were mentioned above are very helpful for this study to be a basis. The literature review shows a multi-affected interplay between preconceived notions, motivation, perception, self-esteem, peer influence, teaching strategies, and academic performance in mathematics. Preconceived notions and negative perceptions and attitudes contribute to students' anxiety and disengagement with mathematics, whereas motivation and positive perceptions and attitudes foster perseverance and success. Peer-influence and teaching strategies, while having the potential to either aid or hinder learning, play a key role in shaping students' perspectives. The cumulative effect of these factors significantly impacts students' mathematical proficiency

and academic achievement. Therefore, addressing these aspects in educational practices can create more supportive environments that promote better mathematical outcomes for students, especially those in Grade 11.

Theoretical Framework

This research was anchored by the Schema Theory that was developed by Frederic Bartlett (1932). Schema Theory posits that knowledge is organized into mental frameworks or structures called schema. These schemas represent our understanding of concepts, events, and situations. They are built through prior experiences and learning, and they guide our interpretation and processing of new information. Schema theory is a cognitive framework that explains how the brain organizes knowledge. It proposes that our minds don't store information as isolated facts, but rather as interconnected mental structures called schemas. These schemas are like mental blueprints or frameworks that represent our understanding of objects, events, concepts, and situations. They are built and refined through our experiences, acting as a dynamic and evolving knowledge base that guides our perception, interpretation, and processing of new information.

In mathematics, schema not only encompasses the mathematical concepts, but rather the subject itself, the student's ability, and the relevance of the subject in real life. Preconceived notions, which are essentially pre-existing schemas, play a pivotal role in shaping how students approach and process mathematical information. When a student encounters a new mathematical

concept or problem, their brain activates relevant schemas to make sense of the situation. If the new information aligns with existing schemas, assimilation occurs, and the student integrates the information seamlessly. However, if the new information contradicts or challenges existing schemas, accommodation is required, necessitating the modification or creation of new schemas. This process is crucial for deep learning and conceptual understanding, but it can be significantly hindered by inaccurate or inflexible preconceived notions. The impact of preconceived notions on mathematics learning is multifaceted. Students who hold negative schemas, such as "math is difficult" or "I'm not good at math," often experience anxiety and avoidance behaviors, which impede their engagement and learning. These schemas can lead to schema distortion, where students selectively interpret or ignore information to reinforce their existing beliefs, even if those beliefs are incorrect.

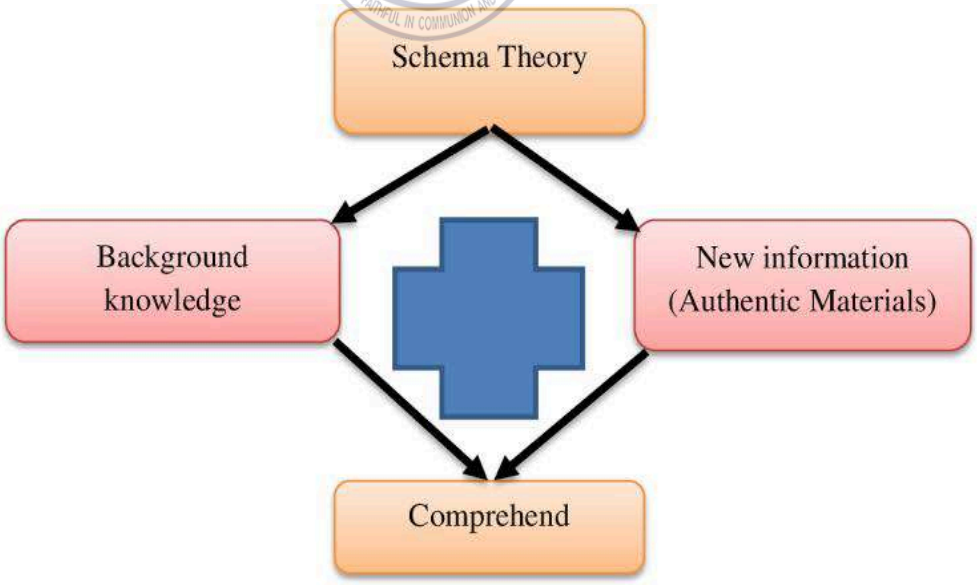

Figure 1

The Schema Theory (Piaget, 1952)

Schema Theory, as illustrated in the diagram on page 24, uses the interaction between background knowledge and new information (authentic materials) to explain how we comprehend. The "Schema Theory" box acts as the overarching framework, suggesting that comprehension is not a passive reception of information, but an active process mediated by our existing mental structures. The arrows highlight the dynamic interplay: background knowledge influences how we interpret new information, and conversely, new information can modify or expand our background knowledge. The central blue cross symbolizes the active cognitive processing where these two elements converge, leading to understanding or comprehension.

Conceptual Framework

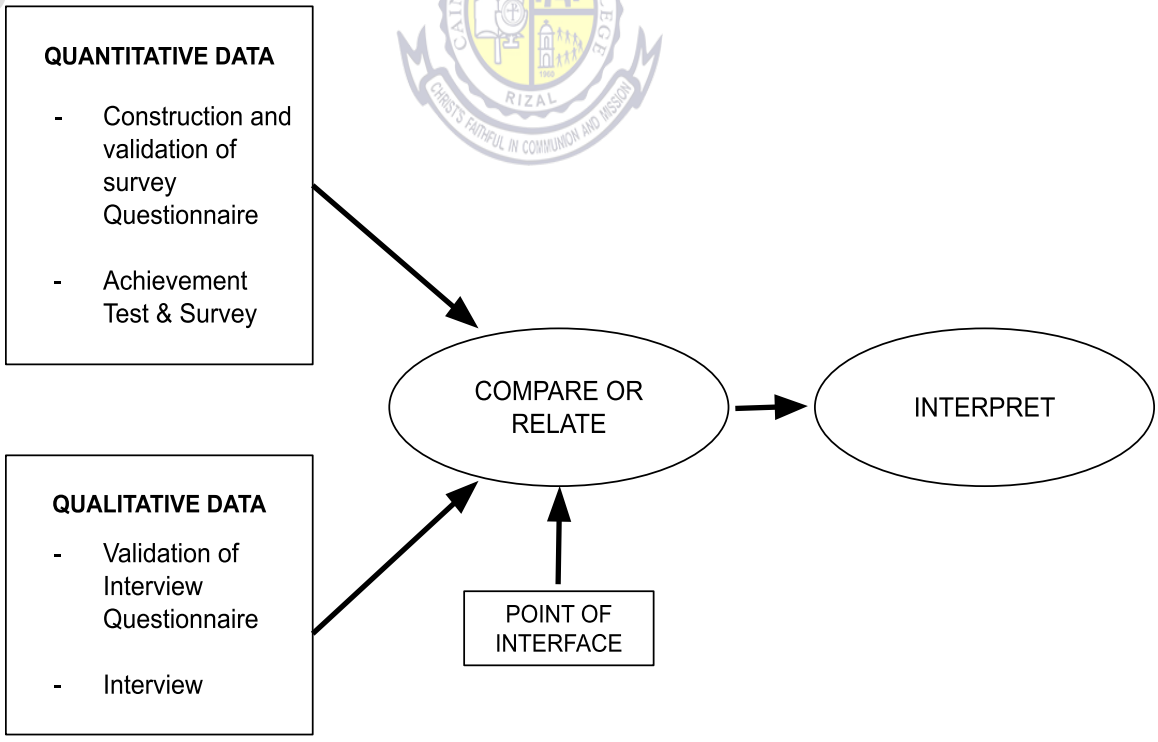

Figure 2

A Conceptual Framework Showing the Impact of Preconceived Notions on Learning and Understanding Mathematics

The study's conceptual framework, as shown in Figure 2 on page 25, used a mixed method and a convergent parallel design in examining the impact of preconceived notions in learning and understanding mathematics among grade 11 students at Cainta Catholic College. This framework was based on the study of Creswell & Plano-Clark (2011), as cited in the study of St. Mary (2020), and then modified by the researchers.

In the framework, the box represents the preparation and collection of data, while the oval signifies the process of comparing and relating the findings from both quantitative and qualitative data sets. The arrows indicate the flow from collecting the data to analyzing and interpreting it. The point of interface marks the step where quantitative and qualitative data are brought together for analysis.

The process began with planning to obtain data by creating and validating surveys and interview questionnaires. The researchers initially administered an achievement test to determine the respondents. After determining the six (6) respondents per section, the quantitative and qualitative data are simultaneously collected. The research initially collected quantitative data by surveying followed by interviewing to get the qualitative data of the six (6) chosen respondents per section regarding their preconceived notions towards mathematics. After getting both quantitative and qualitative data, the researchers separately analyzed and interpreted it. Then, after getting the results, the researchers integrated them to conclude. Thus, this provides valuable and detailed information on how preconceived notions affect the learning and understanding of mathematics among Grade 11 students.

Definition of Terms

Attitude. It refers to a person's mindset, influenced by their feelings or thoughts, can be positive, negative, or neutral, and can shape their responses to situations, people, or issues.

Mathematics. It is the abstract science of numbers, quantities, shapes, and patterns, essential for problem-solving, logical reasoning, and understanding patterns in various fields like science, engineering, and economics.

Motivation. This refers to internal or external factors, often driven by needs, desires, or goals, and can be intrinsic or extrinsic from within or external influences.

Perceptions. It is shaped by societal stereotypes, leading to biased beliefs about who is naturally good at math and who is not.

Peer-Influence. It is a significant influence on behavior, decisions, and attitudes, can be positive or negative, often strongest during adolescence but can affect individuals at any age.

Preconceived Notions. It indicates initial beliefs about mathematics formed without sufficient knowledge

Problem-Solving. It is the process of identifying and addressing challenges through critical thinking, analysis, creativity, and decision-making, essential in various fields like mathematics, science, and everyday life situations.

Proficiency. It refers to a high level of proficiency or skill in a specific task, often derived from training, practice, or experience.

Self-esteem. It refers to a student's confidence in their own mathematical abilities.

Teaching Strategies. It refers to the specific methods and approaches educators use to deliver instruction.

Chapter 3

RESEARCH METHODOLOGY

This chapter presents the research design method, locale, study subject, sampling technique, instrument and its validation, data collection procedures, and the data analysis procedure of the study.

Research Design

This study used mixed methodology research and employed a convergent parallel design as its research design. The mixed method is a type of research that combines quantitative and qualitative research to answer the research question (George, 2023). The study thoroughly investigated the impact of preconceived notions on learning and understanding mathematics through surveys and interviews among Grade 11 students. Moreover, this methodology allows the study to have more credible results since it integrates the gathered data and findings from both qualitative and quantitative data.

In addition, the study employed the convergent parallel design, a type of mixed-method research, as it further provides rich and detailed information on how preconceived notions affect the learning and understanding of mathematics among Grade 11 students. This design collects simultaneously the quantitative and qualitative data but analyzes them separately and the results are compared or integrated (Alele & Malau-Aduli, 2023). Moreover, this study gathered quantitative data using survey questionnaires and qualitative data using interviewing simultaneously. After analyzing separately, the results from both

data were compared or integrated to conclude the potential impacts of preconceived notions on learning and understanding mathematics.

Research Locale

The study was conducted at the Cainta Catholic College (CCC) at A. Bonifacio Ave., Poblacion, Cainta, Rizal, 1900. Cainta Catholic College was established in 1931 by Rev. Fr. Jose Tajon to fulfill Cainta's need for a primary educational institution. Fr. Tajon was a parish priest of Our Lady of Light and ran a school at the Manila Cathedral before. He thought that it would be wise to open a Catholic School at Cainta for students to avail themselves of primary education.

Cainta Catholic College received level I accreditation from the Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA), on November 29, 2006. By 2010, CCC was granted level I - Formal Accreditation Status. Cainta Catholic College's development was continuous and inspired by the hopes and dreams of its academic community. In November 2016, CCC achieved Level II Accreditation.

Furthermore, CCC offers primary to tertiary education. Cainta Catholic College continues to grow as it aims to reach its vision, mission, goals, and objectives. With the intercession of Mary, Our Lady of Light Parish, the college has truly become a community of Christ that is faithful in communion and mission proclaiming the gospel values of truth, justice, and love.

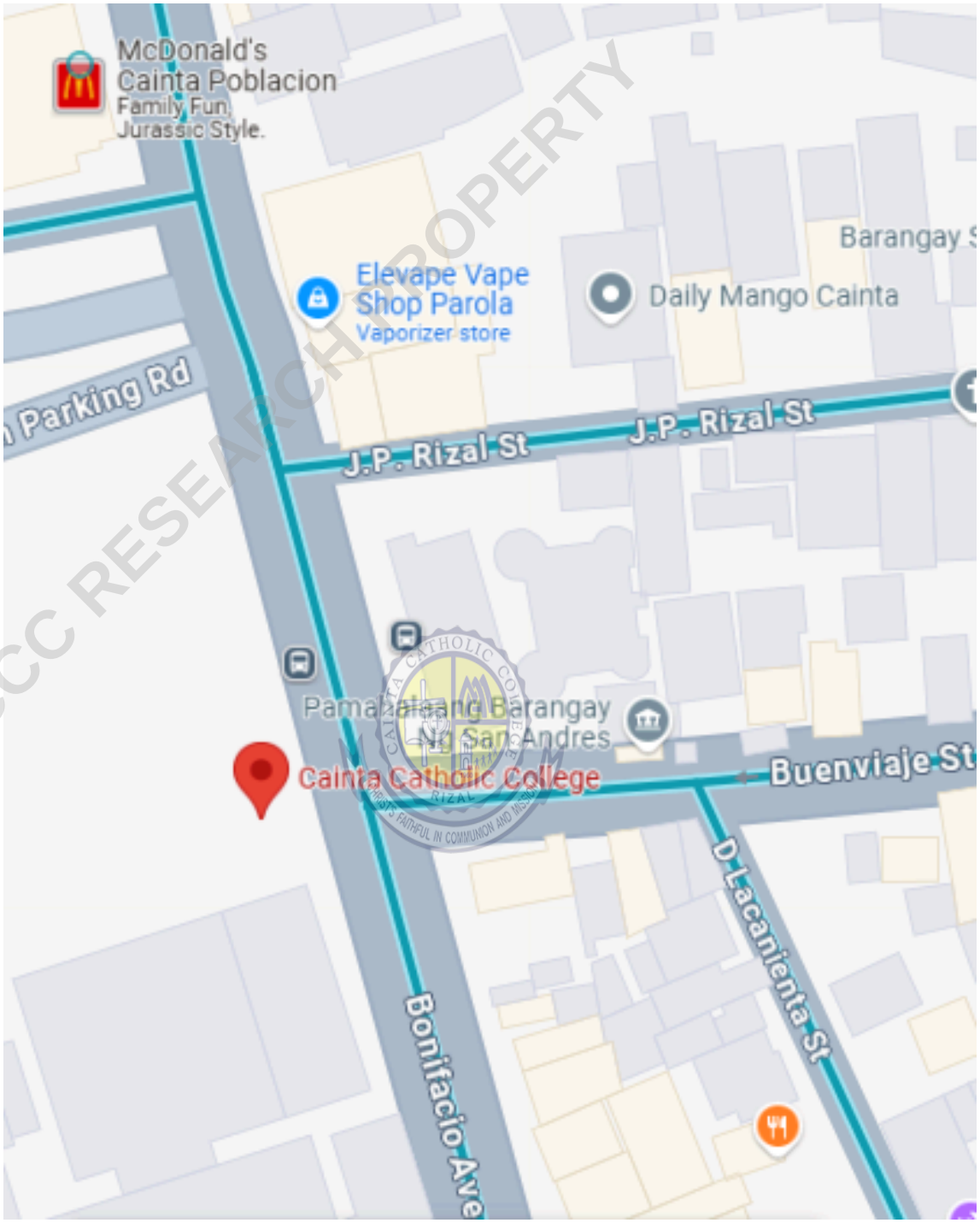

Figure 3

Location Map of Cainta Catholic College

The Subject of the Study

The main respondents of the study are the Grade 11 students enrolled during the school year 2024–2025 at Cainta Catholic College. The researchers include all Grade 11 strands. A total of thirty-six (36) respondents are selected, with six (6) students per section for the survey and interviews.

Sampling

This study utilized a purposive sampling method to choose the respondents from all the sections throughout grade 11 of Cainta Catholic College during the school year 2024-2025. Purposive sampling is a type of sampling technique where the participants were selected based on the same characteristics needed in the study (Nikolopoulou, 2023). In other words, samples are chosen on purpose in purposive sampling that focuses on the researcher's judgment to identify and pick the individuals, cases, or events that yield the most information to accomplish the study's objectives. The respondents of this study were chosen based on their scores on the achievement test in Mathematics that was administered by the researchers. Three (3) participants were chosen in the higher group and three (3) participants in the lower group, specifically, students with highest and lowest scores per section.

Research Instrument

The study used two primary instruments in collecting the data needed from the respondents. These are survey questionnaire checklists for quantitative data and semi-structured interviews for qualitative data. The survey

questionnaire checklist is about the factors that may impact the respondents' preconceived notions toward mathematics such as motivation, perceptions, self-esteem, peer-influence, and teaching strategies. The researchers also administered an achievement test to get the respondents of the study.

In Addition, the semi-structured interviews used by the researchers focused on how the respondents form their preconceived notions in mathematics, and how it affects their learning and understanding of mathematics.

Meanwhile, the Likert Scale was used to determine the respondents' level of proficiency and preconceived notions in mathematics in terms of motivation, perception, self-esteem, peer influence, and teaching strategies.

Range	Description
25 - 30	Highly Proficient (HP)
19 - 24	Proficient (P)
13 - 18	Nearly Proficient (NP)
1 - 12	Low Proficient (LP)

Scale	Range	Description
4	3.25 – 4.00	Strongly Agree
3	2.50 – 3.24	Agree
2	1.75 – 2.49	Disagree
1	1.00 – 1.74	Strongly Disagree

Validation of Instrument

The survey questionnaire checklist and interview questions underwent content validation. The instruments were presented to the research adviser and other experts for analysis and review. All of the comments and suggestions from the experts were considered and added to the questionnaires.

Data Collection Procedure

The researchers wrote a letter of permission to conduct the study upon the adviser's approval. The respondents in this study were chosen based on the achievement test in general mathematics administered by the researchers across the strands. In addition, those students who were in the higher group and the lower group per section. Afterward, the researchers gather the data using survey questionnaire checklists and semi-structured interviews simultaneously. The respondents were given first a survey questionnaire checklist, to determine the preconceived notions of the respondents in terms of motivation, perceptions, self-esteem, peer-influence, and teaching strategies toward mathematics. After conducting a survey questionnaire, the researchers interviewed the respondents. Using semi-structured interviews, the researchers determined how preconceived notions in mathematics were formed and how they affected their learning and understanding of that subject. The researchers also asked some follow-up questions.

Data Analysis

After collecting the data, it was analyzed and interpreted using descriptive and inferential statistical tools for quantitative data and thematic analysis for qualitative data. Appropriate tools were used for the specific problems.

To determine the level of proficiency of Grade 11 students regarding their achievement test results in general mathematics, a frequency distribution table was used.

To assess the respondents' preconceived notions in mathematics, including motivation, perception, self-esteem, peer-influence, and teaching strategies, the average weighted mean was applied.

To understand how respondents' preconceived notions in mathematics form and how these affect their learning and understanding of the subject, thematic analysis was utilized.

To determine the significant relationship between students' proficiency and their preconceived notions in Mathematics, Pearson R was employed.

Chapter 4

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter presents the comprehensive analysis and interpretation of results from the data gathered. Data was shown in a tabular form and interpreted and justified by the gathered literature and studies.

Table 1

Frequency Distribution Table on the Level of Proficiency of Grade 11 Students on the Achievement Test Results in General Mathematics

SCORES	FREQUENCY DISTRIBUTION OF SCORES		
	Function	Business Mathematics	Logic
0	0	1	1
1	1	6	1
2	1	9	4
3	9	4	5
4	2	4	3
5	2	5	2
6	6	3	4
7	2	3	0
8	9	1	1
9	2	0	1
10	2	0	14
Total number of students	36	36	36

Table 1 shows the frequency distribution table on the level of proficiency of the respondents on the achievement results in General Mathematics in terms of Function, Business Mathematics, and Logic. The table shows that most of the respondents are proficient in Logic with fourteen (14) students getting the highest

score of ten (10), while 1 respondent got a zero (0) score. Followed by a Function with two (2) respondents who got the highest score of ten (10), while one (1) respondent got one (1) score. Lastly, Business Mathematics with only one (1) respondent got an eight (8) score, while one (1) respondent got a zero (0) score.

Table 2

Computed Weighted Mean on the Achievement Test Result on General Mathematics in terms of Function, Business Math, and Logic

General Mathematics	Weighted Mean	Rank
1.1 Function	5.78	2
1.2 Business Mathematics	3.44	3
1.3 Logic	6.31	1

Table 2 shows the computed weighted mean on the achievement test results on general mathematics in terms of Function, Business Mathematics, and Logic. It can be seen from the table that the Logic topic has a weighted mean score of 6.31, followed by Function with a weighted mean score of 5.78, and Business Mathematics with a weighted mean score of 3.44. This implies that the respondents are more proficient in Logic which ranked first, followed by Function which ranked second, while the respondents are less proficient in Business Mathematics which ranked third. It is supported by the study of Mamolo and Sugano (2020) in which the results revealed that the students' actual competency in the three areas of General Mathematics (Function and their graphs, Business

Mathematics, and Logic) was fair. Likewise, the study by Kennan and Abutal (2019) highlighted that while Grade 11 students showed a satisfactory level of proficiency in General Mathematics, they struggled to master most of the learning competencies related to Functions and their Graphs and Business Mathematics.

Table 3

Computed Weighted Mean on the Preconceived Notions on Learning and Understanding General Mathematics in terms of Motivation

2.1 Motivation	WM	VI	RANK
1. I like mathematics because it challenges my potential.	2.97	A	4
2. I like to succeed in any mathematics subject.	3.69	SA	1
3. I feel a sense of accomplishment when I understand a new mathematics concept.	3.64	SA	2
4. I feel excited to learn new mathematics concepts.	2.78	A	5
5. I am willing to extend extra effort and time to learn and understand mathematics.	3.00	A	3
Average	**3.22**	**A**	

3.25-4.00 Strongly Agree (SA), 2.50-3.24 Agree (A), 1.75-2.49 Disagree (D), 1.00-1.74 Strongly Disagree (SD)

Table 3 shows the computed weighted mean on the preconceived notions on learning and understanding general mathematics in terms of Motivation. It can be seen from the table that statement number 2 “I like to succeed in any Mathematics subject” ranked first with a weighted mean of 3.69 and verbally interpreted as Strongly Agree, while statement number 4 “ I feel excited to learn new mathematics concepts” ranked fifth with the weighted mean of 2.78 and

verbally interpreted as Agree. The overall mean of the variable motivation is 3.22 and verbally interpreted as Agree. This suggests that the respondents have positive preconceived notions about mathematics with a strong motivation to succeed, accomplishment, and a willingness to spend effort and time in learning and understanding the subject. A study conducted by Yunos et al. (2022) discovered that motivation to learn mathematics has positive effects on their academic performance. Thus, motivation will not only affect performance directly but also indirectly by its impact on student attitude and interest in Mathematics. Likewise, it shows that both internal and extrinsic motivation will positively impact mathematics achievement (Tran & Nguyen, 2021).

Table 4

Computed Weighted Mean on the Preconceived Notions on Learning and Understanding General Mathematics in terms of Perception

2.2 Perception	WM	VI	RANK
1. I find mathematics interesting and engaging.	3.03	A	5
2. I find mathematical topics challenging.	3.61	SA	1
3. I believe that mathematics is useful in everyday life.	3.25	SA	4
4. I believe that mathematics is important to learn.	3.50	SA	3
5. I believe that mathematics helps me to think critically and solve problems analytically.	3.53	SA	2
Average	**3.38**	**SA**	

3.25-4.00 Strongly Agree (SA), 2.50-3.24 Agree (A), 1.75-2.49 Disagree (D), 1.00-1.74 Strongly Disagree (SD)

Table 4 on page 39 shows the computed weighted mean on the preconceived notions on learning and understanding general mathematics in terms of Perception. It can be seen from the table that statement number 2 “I find mathematical topics challenging” ranked first with a weighted mean of 3.61 and verbally interpreted as Strongly Agree, while statement number 1 “I find mathematics interesting and engaging” ranked fifth with the weighted mean of 3.03 and verbally interpreted as Agree. The overall mean of the variable perception is 3.38 and verbally interpreted as Strongly Agree. The table indicates that they have a positive perception on mathematics suggesting that while the respondents find mathematical topics challenging, they also recognize the subject's role in developing critical thinking and analytical problem-solving skills, as well as its importance and usefulness in daily life. According to Development and Research in Early Mathematics Education (2022), if students have positive preconceived notions on mathematics, they can improve their ability to learn. Thus, positive perceptions of the students will develop their skills and challenge them to solve math problems. However, the result found by Dr. Prasanna et al. (2023) is that a significant number of students experience boredom and disinterest during mathematics classes, highlighting the need for improvements to address these issues. This suggests that the approaches may not be enough for students to engage, leading to a lack of interest in the subject.

Table 5

Computed Weighted Mean on the Preconceived Notions on Learning and Understanding General Mathematics in terms of Self – Esteem

2.3 Self-Esteem	WM	VI	RANK
1. I am confident in my ability to learn and understand Mathematics concepts.	2.58	A	3
2. I can perform better in mathematics than in any other subject.	2.28	D	4
3. I feel that I am a good problem-solver in mathematics.	2.75	A	2
4. I feel positive in my potentials to improve my mathematics skills.	3.08	A	1
5. I can explain mathematics concepts clearly to others.	2.25	D	5
Average	**2.59**	**A**	

3.25-4.00 Strongly Agree (SA), 2.50-3.24 Agree (A), 1.75-2.49 Disagree (D), 1.00-1.74 Strongly Disagree (SD)

Table 5 shows the computed weighted mean on the preconceived notions on learning and understanding general mathematics in terms of Self-esteem. It can be seen from the table that statement number 4 “I feel positive in my potentials to improve my mathematics skills” ranked first with a weighted mean of 3.08 and was verbally interpreted as Agree, while statement number 5 “I can explain mathematics concepts clearly to others” ranked fifth with the weighted mean of 2.25 and verbally interpreted as Disagree. The overall mean of the variable self-esteem is 2.59 and verbally interpreted as Agree indicating that the respondents have positive preconceived notions on mathematics in terms of self-esteem. The table suggests that while the respondents have high self-esteem in certain areas, such as the potential for improving their math skills and problem-solving, they still need support to gain more confidence in their

ability to explain mathematical concepts to others and in their mathematical abilities relative to other subjects. In addition, the results of the study by Zhao et al. (2021) indicate that self-esteem positively influences adolescent academic engagement. As they have high self-esteem, they are more likely to actively participate in class, share their opinions, and take risks. Thus, self-esteem plays a crucial role in learning mathematics (Nabila & Widjajanti, 2020) as it increases the student's engagement in class.

Table 6

Computed Weighted Mean on the Preconceived Notions on Learning and Understanding General Mathematics in terms of Peer – Influence

2.4 Peer – Influence	WM	VI	RANK
1. My peers encouraged me to study Mathematics.	2.61	A	4
2. My peers influence my decision to take advanced mathematics courses.	2.14	D	5
3. My peers help me understand difficult mathematical problems.	3.22	A	1
4. I can do well in mathematics because of my peers.	2.83	A	3
5. I enjoy discussing mathematics with my peers/classmates.	2.86	A	2
Average	**2.73**	**A**	

3.25-4.00 Strongly Agree (SA), 2.50-3.24 Agree (A), 1.75-2.49 Disagree (D), 1.00-1.74 Strongly Disagree (SD)

Table 6 shows the computed weighted mean on the preconceived notions on learning and understanding general mathematics in terms of Peer-Influence. It can be seen from the table that statement number 3 "My peers help me understand difficult mathematical problems" ranked first with a weighted mean of

3.22 and was verbally interpreted as Agree, while statement number 2 “My peers influence my decision to take advanced mathematics courses” ranked fifth with the weighted mean of 2.14 and verbally interpreted as Disagree. The overall mean of the variable peer-influence is 2.73 and verbally interpreted as Agree. This means that most peers contribute positively to the learning experience of the respondents resulting in developing their positive preconceived notions on mathematics, while the decision to take advanced courses appears to be less influenced by peers. This is supported by the study of Shao et al. (2024) which found a strong link between peer relationships and academic success in junior high school students. This implies that the increased interaction with peers has a positive impact on their learning attitude and personal values, leading to improved motivation and academic achievement. As stated by Bakar et al. (2021) peer influence has a direct impact on mathematics achievement, and also indirectly affects achievement through increased student engagement.

Table 7 on page 44 shows the computed weighted mean on the preconceived notions on learning and understanding general mathematics in terms of Teaching Strategies. It can be seen from the table that statement number 1 “My mathematics teacher makes the subject interesting and engaging” ranked first with a weighted mean of 3.61 and verbally interpreted as Strongly Agree, while statement number 4 “My teachers use interactive and engaging activities in teaching mathematics” ranked fifth with the weighted mean of 3.11 and verbally interpreted as Agree.

Table 7

Computed Weighted Mean on the Preconceived Notions on Learning and Understanding General Mathematics in terms of Teaching Strategies

2.5 Teaching Strategies	WM	VI	RANK
1. My mathematics teacher makes the subject interesting and engaging.	3.64	SA	1
2. The PowerPoint presentation used in teaching mathematics helped me understand the lessons well.	3.39	SA	2
3. My teachers use real-life examples to illustrate mathematical concepts.	3.31	SA	3
4. My teachers use interactive and engaging activities in teaching mathematics.	3.11	A	5
5. My teacher uses various technologies to enhance teaching and learning of mathematics concepts.	3.19	A	4
Average	**3.33**	**SA**	

3.25-4.00 Strongly Agree (SA), 2.50-3.24 Agree (A), 1.75-2.49 Disagree (D), 1.00-1.74 Strongly Disagree (SD)

The overall mean of the variable teachings strategies is 3.33 and verbally interpreted as Strongly Agree. This suggests that the respondents have positive preconceived notions about the teaching strategies of their mathematics teacher such as effectively making the subject interesting and engaging and the use of PowerPoint presentations and real-life examples in teaching the lesson. According to Hargrove (2023), teachers' strategies are essential for the effective learning of the students, teaching strategies significantly influence students positively and negatively. Thus, the table implies that the teacher's teaching strategies affect their learning, making it interesting and engaging. Based on the

study of Cabrestante and Lopez (2023) integrating various intervention strategies effectively addressed negative learning experiences, keeping students engaged and motivated in the subject. This highlights the importance of intervention to students' needs and incorporating strategies that foster engagement, motivation, and a positive attitude toward mathematics.

Table 8

Composite Table on the Overall Average Weighted Mean on the Preconceived Notions on Learning and Understanding General Mathematics

Preconceived Notions on Learning and Understanding General Mathematics	Overall AWM	VI	Rank
2.1 Motivation	3.22	A	3
2.2 Perception	3.38	SA	1
2.3 Self-Esteem	2.59	A	5
2.4 Peer-Influence	2.73	A	4
2.5 Teaching Strategies	3.33	SA	2
Overall Average	**3.05**	**A**	

3.25-4.00 Strongly Agree (SA), 2.50-3.24 Agree (A), 1.75-2.49 Disagree (D), 1.00-1.74 Strongly Disagree (SD)

Table 8 shows the composite table on the overall average weighted mean on the preconceived notions on learning and understanding general mathematics. It can be seen from the data that the overall average weighted mean is 3.05 which is verbally interpreted as Agree. Perception obtained the highest average weighted mean of 3.38 which is ranked first and verbally interpreted as Strongly Agree. On the other hand, Teaching Strategies obtained 3.33, second in rank and verbally interpreted as Strongly Agree. Motivation obtained 3.22, third in rank, and verbally interpreted as Agree. Peer-Influence

has 2.73, fourth in rank and verbally interpreted as Agree. Lastly, Self-esteem is 2.59, fifth in rank and verbally interpreted as Agree. As stated by Hagan et al. (2020) positive perception of students toward mathematics learning with the guidance of the teacher will improve their learning of mathematics. Thus, this implies that the respondents have overall positive preconceived notions on mathematics. The preconceived notions of the students about mathematics are likely to be more open to learning and actively engage in the subject, driven by a belief in their ability to succeed and willingness to face challenges. Akpalu et al. (2025) highlight the complex interplay between students' perceptions of mathematics and their academic achievement, emphasizing the critical role of a belief in one's ability to succeed, teacher-student relationships, and wider societal influences. Positive perceptions, supported by engaging teaching methods and a relatable curriculum, enhance motivation and performance.

Table 9

Frequency Distribution on the Overall Scores of the Respondents' Achievement Test

Class Limits	Frequency (F)	Lower Boundary	Midpoint (X)	F X	Cumulative Frequency
25-30	3	24.5	27.5	82.5	3
19-24	14	18.5	21.5	301	17
13-18	3	12.5	15.5	46.5	20
7-12	13	6.5	9.5	123.5	33
1-6	3	0.5	3.5	10.5	36
	n = 36			Σ f(x)= 564	
			Weighted mean = 15.67		

25-30 Highly Proficient (HP), 19-24 Proficient (P), 13-18 Nearly Proficient (NP), 12 - 1 Low Proficient (LP)

Table 9 on page 46 shows the frequency distribution table of the respondents' overall achievement test scores. Most respondents scored 19-24 which means that they are proficient. On the other hand, three respondents had high scores of 25 - 30 and low scores of 1-6. The average weighted mean score is 15.67, which means that the majority of the respondents are Nearly Proficient (NP) in general mathematics. This is supported by the study of Parcon and Bearneza (2024) that the competency of the students in the three areas of General Mathematics in terms of Functions, Business Mathematics, and Logic was a developing proficiency and only fair. Moreover, Grade 11 students have a sufficient level of knowledge, skills, and core understanding of General Mathematics showing positive significant progress, but still have areas that need improvement. Conversely, the study of Olaco and Rebucas (2021) found that grade 11 students' proficiency was still at the beginning level and needs further improvements.

Table 10 on page 48 shows the composite table on the overall average weighted mean on the preconceived notions on learning and understanding general mathematics and the level of proficiency of grade 11 students' achievement test results. It can be seen that the overall average weighted mean on the preconceived notions of learning and understanding general mathematics is 3.05. The table also shows the weighted mean of the achievement test in terms of function with a weighted mean score of 5.78, Business Mathematics with 3.44, and Logic with a 6.31 mean score.

Based on the study of Wakhata et al. (2023), students' existing knowledge and belief in mathematics influence their learning of new mathematical concepts. Positive preconceived notions can ignite motivation, active participation, and a belief in one's ability to improve in math. This result differs from the study of Malgapo and Villaflor (2022) in which students demonstrated a high level of creative mathematical problem-solving ability, with an overall weighted mean of 2.47. While their performance was satisfactory, with a mean grade of 89.87, their perception of problem-solving highlighted the complexity and challenges involved.

Table 10

Composite Table on the Overall Average Weighted Mean on the Preconceived Notions on Learning and Understanding General Mathematics and Level of Proficiency of Grade 11 Students' Achievement Test Results

Preconceived Notions on Learning and Understanding General Mathematics	Overall AWM	General Mathematics	Achievement Test AWM
2.1 Motivation	3.22	1.1 Function	5.78
2.2 Perception	3.38	1.2 Business Mathematics	3.44
2.3 Self-Esteem	2.59	1.3 Logic	6.31
2.4 Peer-Influence	2.73		
2.5 Teaching Strategies	3.33		
Average	**3.05**		

3.25-4.00 Strongly Agree (SA), 2.50-3.24 Agree (A), 1.75-2.49 Disagree (D), 1.00-1.74 Strongly Disagree (SD)

Table 11

Analysis on the Correlation between the Preconceived Notions on Learning and Understanding General Mathematics and the Level of Proficiency of Grade 11 Students' Achievement Test Results

Computation Results using Statistical Analysis System (SAS) Software Factor Pearson Product –Moment Correlation Coefficients (r_{xy}) Statistical Results

Correlation Between Two Variables	Pearson Product – Moment Correlation Coefficients (r_{xy})	Interpretation	P - Value	H0	VI
Preconceived Notions on Learning and Understanding General Mathematics and Level of Proficiency	- 0.7821151701	High negative correlation	0.00001	Reject (R)	Significant (S)

Level of significance (α) at .05 Reject Ho if t computed is > 2.10 or if t computed is < -2.10 otherwise accept Ho

Another convention:

Less than or equal to 0.05 Probability Value that is Reject (R) and Significant (S): greater than 0.05 Probability Value that is Accept (A) and Not Significant (NS)

Table 11 shows the results of the Pearson Product – Moment Correlation Coefficients (r_{xy}) on the relationship between the Preconceived Notions on Learning and Understanding General Mathematics and the Level of Proficiency of Grade 11 Students' Achievement Test Results. The results show that the Preconceived Notions on Learning and Understanding General Mathematics including motivation, perceptions, self-esteem, peer- influence, and teaching

strategies and the Students' Level of Proficiency in General Mathematics have a 5 level of significance with the Pearson Product –Moment Correlation Coefficients (r_{xy}) of computation of **-0.7821151701**. The p-value obtained is 0.00001 lesser than the p-value at 0.05 level of significance. Therefore, the null hypothesis is **"Rejected" (R) and "Significant" (S)** based on the convention that if the p-value is less than or equal to 0.05 Probability Value the null hypothesis is "Rejected" (R) and "Significant" (S). Hence, there is a significant relationship between the Preconceived Notions on Learning and Understanding General Mathematics and the Level of Proficiency of Grade 11 Students based on Achievement Test Results.

The findings suggest that preconceived notions of the respondents in mathematics significantly influence their learning and understanding of the subject. According to Iddrisu et al. (2023), the willingness of the students to learn mathematics and their perception of math being a difficult subject are also some of the factors that affect their academic performance in the said subject. As negative preconceived notions of the students in mathematics increase, their level of proficiency in the subject decreases. In addition, as the level of proficiency in mathematics increases, the negative preconceived notions in mathematics decrease. Furthermore, the results are supported by the findings of Cerbito (2020) where students' attitude toward Mathematics influences their proficiency in the subject.

Table 12

Final Codes on the Preconceived Notions of Grade 11 Students When They Hear Mathematics as their Next Subject

Q1. What comes to your mind when you hear Mathematics? (as your next subject)	Thematic Analysis of the preconceived notions of Grade 11 students when they hear Mathematics as their next subject
It is a problem-solving, equations, numbers, formulas, and shapes (n= 12)	The Grade 11 students' preconceived notions when they hear mathematics as their next subject are about problem-solving, equations, numbers, formulas, and shapes, as well as it is hard, pressure, and nervousness. On the other hand, they also view mathematics as exciting, challenging, easy, a favorite subject, a puzzle that has patterns, and a subject they can learn a lot.
Math is hard (n= 10)	
Pressure and Nervousness (n= 4)	
It is exciting (n= 2)	
Challenging (n= 2)	
Easy (n= 2)	
Favorite subject (n= 2)	
A puzzle and has patterns (n= 1)	
Can learn a lot (n= 1)	

The common idea that comes to the respondents' minds when they hear mathematics as their next subject is “problem-solving, equations, numbers, formulas, and shapes” which are stated by twelve respondents (n=12). This means that many students think about mathematical concepts when Mathematics is their next subject. On the other hand, ten respondents (n=10) perceived math negatively as they stated that “math is hard”. Pressure and nervousness are also other respondents’ preconceived notions when they hear mathematics as their next subject, which was noted by four respondents (n=4).

One of the respondents stated, “It's hard and there's a lot of complex problems and numbers that need to be solved.” Hence, this respondent is having a hard time solving complex formulas and analyzing numbers which leads to developing a negative preconceived notion in mathematics. The study by Kunwar (2021) emphasizes that fear and a sense of failure can significantly hinder students' ability to learn mathematics effectively, highlighting the impact of negative perceptions of the subject. As highlighted by two respondents (n=2), mathematics subject is challenging for them.

On the other hand, two participants (n=2) view math as exciting, easy, and a favorite subject. While, one respondent (n=s) thinks it is a puzzle, has patterns and they can learn a lot from it. Obut et al. (2024) found that students often face challenges in learning mathematics due to a combination of factors, including difficulties understanding mathematical concepts, viewing math as a difficult subject, experiencing poor performance, lacking a strong foundation in basic mathematical skills, encountering ineffective teaching methods, holding negative attitudes towards math, and lacking interest in the subject.

Table 13 on page 54 shows the final codes on how Grade 11 students develop their preconceived notions about Mathematics. Preconceived notions of the respondents are the result of a complicated interaction between individual experiences along with additional influences. The majority of the respondents developed their preconceived notions in mathematics based on performance with thirteen (n=13) respondents who answered. Their perceived performance in the subject serves as a basis, with difficulties producing negative attitudes and

success producing positive views. This is followed by affected by peers with twelve (n=12) respondents. Social interactions have a major role since peers' shared experiences and viewpoints change their perceptions and emotions. In addition, four respondents (n=4) relate their notions about mathematics to their personal experiences, while three respondents (n=3) mention that the teaching methods used in their classes affect their ideas about mathematics. This indicated that prior experiences can create lasting impressions, either positive or negative, and highlighted the importance of teaching strategies and how these can influence students' engagement and understanding of the subject.

On the other hand, only one respondent (n=1) mentioned that they developed their preconceived notion in mathematics because of feeling overwhelmed, advanced learning, depending on the topic, and because it is a favorite subject. This suggests that while this may not be a common sentiment, it still affects their perception of mathematics potentially leading to negative or positive attitudes, interest, and engagement in the subject. Moreover, the individuality of their perceptions can be seen by the differences in understanding across different mathematical concepts. Furthermore, the significant impact of individual interest and enjoyment is shown by self-motivation, which results from mathematics being a favorite topic for some students. Leal et al. (2022) stated that students with positive beliefs about math are more likely to persist through challenging problems, seek help, and ultimately achieve better academic results. Essentially, a combination of academic success, interaction with others, workload, topic-specific understanding, and personal passion form these

students' mathematical perspectives. Stated on study of Flores (2023) found that student, teacher, and school factors significantly influence students' math performance. This means that a student's characteristics, their teacher's teaching practices, and the school's resources and policies all play a role in their academic success in math.

Table 13

Final Codes on how Grade 11 Students Develop Their Preconceived Notions about Mathematics

Q2. How did you develop your preconceived notions/ideas about Mathematics?	Thematic Analysis on how Grade 11 Students develop their preconceived notions/ideas about Mathematics
Based on performance (n=13)	Grade 11 developed their preconceived notions/ideas about Mathematics based on their performance, affected by peers, being overwhelmed, advanced learning, being able to understand the lesson depending on the topic, and because it is a favorite subject.
Affected by peers (n=12)	
Experience (n=4)	
Teaching styles (n=3)	
Overwhelmed (n=1)	
Advanced learning (n=1)	
Depends on the topic (n=1)	
Favorite subject (n=1)	

The experiences of the Grade 11 students show an obvious conflict in the ways that their preconceived ideas about mathematics have a direct impact on their academic achievement. Table 14 on page 55 show final codes on how Grade 11 Students' preconceived notions affect their learning and understanding about Mathematics.

Table 14

Final Codes on how Grade 11 Students' Preconceived Notions Affect their Learning and Understanding about Mathematics

Q3. How do you think these preconceived notions/ideas affect your learning and understanding of Mathematics?	Thematic Analysis of Grade 11 Students preconceived notions/ideas affect their learning and understanding of Mathematics
Motivated and encouraged to learn (n=12)	The Grade 11 students said their preconceived notions/ideas do affect their academic performance in mathematics. They become motivated and encouraged to learn the subject, boost their academic performance, they enjoy solving, and it challenges them in a good way. However, some of them said it was hard to understand, it discouraged them from learning, they couldn't keep up, they had low self-esteem, lost focus on other subjects, and were forced to do so.
Discouraged to learn (n=5)	
Hard to understand (n=4)	
Boost academic performance (n=4)	
Can't keep up (n=4)	
Enjoy solving (n=2)	
Low self-esteem (n=2)	
Challenging in a good way (n=1)	
Lose focus on other subjects (n=1)	
Forced (n=1)	

A majority of the respondents, specifically 12 students (n=12), mentioned that their preconceived notions in mathematics do affect their learning and understanding of the subject because they are motivated and encouraged to learn. Additionally, four respondents (n=4) highlighted that preconceived notions boosted their academic performance, while two respondents (n=2) expressed enjoyment in solving mathematical problems. This suggests that motivation, excitement, and engagement in learning mathematics can enhance overall academic performance. Moreover, students with positive ideas are more

motivated, succeed more academically, and genuinely enjoy solving problems because they see difficulties as chances to improve.

Conversely, five respondents (n=5) felt discouraged by their preconceived notions about mathematics, and four students (n=4) faced difficulty in understanding the subject and inability to keep up affecting their performance. Such negative feelings prevent them from fully engaging with the subject, resulting in further discouragement and loss of interest. These preconceived notions also contribute to low self-esteem, as noted by two respondents (n=2), and feeling forced and loss of focus on other subjects, as noted by one respondent (n=1). Thus, a negative view leads to serious challenges such as students having trouble understanding, losing interest in studying, and feeling that they can't keep up with the course material. This results in low self-esteem, a major concern that affects attention to other areas, and, in some cases, a feeling of being forced into studying without any genuine motivation.

In essence, students' perceptions of mathematics serve as an effective self-perception that can either help or hinder their growth, showing the importance of physical and mental aspects of mathematical learning. The researchers found that students' motivation to study mathematics was quite high, with a mean of 3.38 (Fuqoha et al., 2018). This states that students are generally interested in learning mathematics. Based on the study of Hossein-Mohand (2023) students who are intrinsically motivated, they likely to actively engage in learning, face challenges, and develop a deeper understanding. However, extrinsic motivation supports and strengthens intrinsic motivation. Students are

driven by the extrinsic motivation to pursue good grades, rewards, praise, and avoid punishment.

Table 15

Final Codes on the Strategies that Grade 11 Students Used to Learn and Understand Mathematics

Q4. What kind of strategies/ways did you use to learn and understand Mathematics?	Thematic Analysis on the kinds of strategies that Grade 11 students used to learn and understand Mathematics
Peer asking (n=12)	The grade 11 students used different kinds of strategies to cope with the math lesson. Most of them said that peer asking, teacher asking, watching videos and self-study were the most effective ways to understand mathematics. But, some of them have self-techniques like taking down notes and advanced reading.
Self Study (n=12)	
Teacher asking (n=5)	
Watching videos (n=4)	
Take down notes (n=1)	
Advance reading (n=1)	
Self technique (n=1)	

The grade 11 students used different kinds of strategies to cope with the math lesson. The learning strategies of the students depend on their preferred way of learning. The most common strategies, with twelve respondents (n=12) mentioning it are both peer-asking and self-study. The respondents stated that peer asking is their way to learn if they didn't understand the lesson, while self-study is their method of learning the hard topics. Additionally, five students (n=5) answered the teacher asking, four students (n=4) answered by watching videos, one student (n=1) answered taking down notes, another one (n=1) of

them answered advanced reading, and lastly, one student (n=1) answered self technique.

This suggests that self-study and peer interaction are significant, explaining the importance of both individual practice and group problem-solving. Students gain from independent study as well as additional online materials like videos, even though social learning through peer and teacher ‘interaction is highly utilized. The most effective strategy combines social learning with personal initiative and lots of resources. The study conducted by Pendon (2024), suggests that collaborative learning environments, where students work together with peers, foster a more positive attitude towards mathematics and enhance the motivation to learn the subject. On the other hand, the study of Lim and Park (2023) found that self-study, compared to lectures, led to more active and productive student engagement, resulting in better performance.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATION

This chapter summarizes the findings and conclusions of the conducted study. Recommendations were also mentioned for the solutions to problems that the study ought to address.

Summary of Findings

This study is intended to investigate the impact of preconceived notions on learning and understanding mathematics among Grade 11 students at Cainta Catholic College. The survey results showed that the Grade 11 students have positive preconceived notions in mathematics, indicating that they have a strong motivation and perception in learning and understanding the subject, as well as high self-esteem, positive peer-influence, and effective teaching strategies. The semi-structured interviews revealed that these preconceived notions about Mathematics are developed because of their performance in the subject, being affected by peers, being overwhelmed by the topic, because of advanced learning, being able to understand the lesson depending on the topic, and because it is a favorite subject. Overall, the convergence of quantitative and qualitative data revealed an integrated view of students' positive preconceived notions, as measured by the survey, supported by a complex interplay of personal experiences, social interactions, teaching styles, feelings, and academic factors, as stated in the interviews with the respondents.

1. Based on the findings, the average weighted mean on the level of proficiency based on achievement test results in general mathematics in terms of Function, Business Mathematics, and Logic is 15.67, indicating that the majority of the respondents are Nearly Proficient (NP) in general mathematics.

2. The Preconceived notions of Grade 11 students in Mathematics in terms of:

   2.1. **Motivation.** The Average Weighted Mean is 3.22, indicating that the respondents have positive preconceived notions about mathematics with a strong motivation to succeed, accomplishment, and a willingness to spend effort and time in learning and understanding the subject.

   2.2. **Perceptions.** The Average Weighted Mean is 3.38, indicating that the respondents have a positive perception on mathematics and suggesting that while the respondents find mathematical topics challenging, they also recognize the subject's role in developing critical thinking and analytical problem-solving skills, as well as its importance and usefulness in daily life.

   2.3. **Self-esteem.** The Average Weighted Mean is 2.59, indicating that while the respondents have high self-esteem in certain areas, such as the potential for improving their math skills and problem-solving, they still need support to gain more confidence in their ability to explain mathematical concepts to others.

2.4. **Peer-influence.** The Average Weighted Mean is 2.73, indicating that most peers contribute positively to the learning experience of the respondents resulting in developing their positive preconceived notions on mathematics.

2.5. **Teaching Strategies.** The Average Weighted Mean is 3.33, indicating that the respondents have positive preconceived notions about the teaching strategies of their mathematics teacher such as effectively making the subject interesting and engaging and the use of PowerPoint presentations and real-life examples in teaching the lesson.

3. The Pearson Product –Moment Correlation Coefficients (r_{xy}) computation on the relationship between the preconceived notions on learning and understanding General Mathematics and the level of proficiency of Grade 11 students' achievement test results shows that the p-value obtained is 0.00001 and it is significant and null hypothesis is rejected.

4. Majority of the respondents formed their preconceived notions about Mathematics based on their performance in the subject. Their performance in the subject serves as a basis for forming their preconceived notions in Mathematics with difficulties producing negative attitudes and success producing positive views. On the other hand, some of them were affected by peers, being overwhelmed by the topic, because of advanced learning, being able to understand the lesson depending on the topic, and because it is a favorite subject.

5. The Grade 11 students said their preconceived notions do affect their academic performance in mathematics. They become motivated and encouraged to learn the subject, boost their academic performance, they enjoy solving, and it challenges them in a good way. However, some of them said it was hard to understand, it discouraged them from learning, they couldn't keep up, they had low self-esteem, lost focus on other subjects, and were forced to do so.

Conclusion

Based on the summary of findings, this study shows a strong correlation between Grade 11 students' preconceived notions and their overall mathematics proficiency. Students' achievement test scores showed a "Nearly Proficient" level with having good preconceived notions about motivation, perception, peer influence, and teaching strategies. This matter shows that when positive preconceived notions of the students increase, the level of proficiency in the subject increases and vice versa. The qualitative information elaborated on the deep roots of these ideas, showing that students' attitudes toward mathematics are influenced by their performance, relationships with peers, perceived difficulty of the subject, and personal interests.

In addition, the importance of these beliefs on academic performance can be seen by the statistical significance of the connection between achievement test results and preconceived notions, indicating a high negative correlation and rejecting the null hypothesis. This implies that as the students' negative

preconceived notions of the students in mathematics increase, their level of proficiency in the subject decreases. According to respondents, positive ideas encouraged enjoyment, and a sense of challenge, all of these resulted in better performance. On the other hand, negative ideas that resulted from challenges and perceived problems caused discouragement, a decline in self-esteem, and even a distraction from other topics. In order for students to achieve learning outcomes, it is crucial to address both positive and negative misconceptions within learning contexts.

Therefore, this study emphasizes that while addressing negative misconceptions, teachers should encourage and promote positive ones. Teachers can help students create a more positive and effective relationship with mathematics by providing an encouraging learning context, using effective teaching strategies, and giving them opportunities to thrive. Improving student engagement and achievement in mathematics requires an understanding of and attention to the relationship between prior conceptions and academic performance.

Recommendations

Based on the summary of findings and conclusions drawn, the following are hereby suggested.

1. The **students** should actively reflect on their own preconceived notions about mathematics. As the findings revealed that the students preferred to be taught by

their peers, the researchers suggest a peer tutoring program that will be aligned with their interest and preference to learn with classmates. The students may keep a journal to reflect on their learning and their experiences with their peers. In addition, this may help them increase their proficiency in Mathematics because they are more at ease in learning with their peers.

2. The **Math teachers** can implement differentiated instruction strategies to cater the diverse learning styles and individual needs of the students, as well as boosting their self-esteem towards Mathematics.

3. The **School Administrators** can support teachers in implementing innovative teaching methods and utilizing technology in the classroom. In addition, they can implement a policy that requires mandatory counseling for students. This will help monitor their learning experiences across all subjects, assess their well-being and discuss their concerns and motivation in studying.

4. For **future researchers,** they can investigate the effectiveness of various interventions designed to increase the proficiency of the grade 11 students. The researchers also recommend to conduct a study with teachers as respondents to investigate their perspectives on mathematics and their students' preconceived notions about the subject.

Chapter 6

PROPOSED CLASSROOM-BASED PEER TUTORING PROGRAM

Based on the results of the study, peers significantly influence the motivation and learning experience of the respondents, helping them develop positive preconceived notions on mathematics. Therefore, a Classroom-Based peer tutoring program is recommended to further improve the student's motivation and proficiency in mathematics.

I. Rationale

Mathematics is one of the core subjects that delves into the exploration of numbers, patterns, data, shapes, measurements, and more. It serves as the foundation for developing critical thinking and plays a pivotal role in the educational development of students. However, mathematics has been an area of concern for many years, particularly in educational settings. The presence of preconceived notions about the subject itself significantly influences students' learning and understanding of mathematics. With this, the peer tutoring program can be seen as one of the interventions to enhance the interest and skills of the students. The peer tutoring program will help both the tutor and tutee to increase their critical thinking skills and motivate them to learn math in a more interactive and engaging way.

II. Objectives

A. Increase the proficiency of the students in General Mathematics;

B. Demonstrate a positive view in Mathematics;

C. Motivate students to learn Mathematics; and

D. Engage and enjoy learning Mathematics with their peers.

III. Target Participants

The target participants of this Classroom-Based Peer Tutoring Program are Grade 11 students and the Senior High School Math Teachers at Cainta Catholic College.

IV. Program Focus

Social skills: Improving the social skills and relationships of the students that will be valuable for the students learning and social life.

Academic proficiency: Improving the proficiency of the students in Mathematics.

Subject engagement: Increasing the motivation and active participation of the students in Math class.

V. Program Beneficiaries

Students: They will improve or develop social skills, academic proficiency, and subject engagement that will be helpful for their future career.

Teachers: They will gain deeper insights into common student learning challenges and they can observe firsthand how students process information and develop problem-solving skills.

VI. Program Duration

The duration of the program is for one semester. Specifically, it will be implemented during the first semester's second quarter since the first quarter (Prelim) will be the basis for the teacher to select who will be the tutor and tutee.

Note: If the teacher observes that there is slow progress in the academic performance of the students, he/she may continue the classroom-based peer tutorial program for the next semester or until it improves the competencies and proficiency of the students in General Mathematics

VII. Program Process

The first phase of this tutorial program is the selection, the second phase is the implementation, and the final phase is the final evaluation.

1. The classroom-based peer tutorial program will be conducted during their independent learning for the first semester's second quarter.
2. The teacher will administer and facilitate the sessions.
3. Students will be paired by the teacher based on their levels of proficiency (one proficient and one struggling). The more proficient student will act as

the tutor, while the less proficient student will be the tutee. The teacher will identify participants based on their grades and evaluations in the subject.

4. The tutor will assist the tutee during the session to answer the activity tasks that were given by the teacher.
5. At the end of every session, the students will write his/her reflections on learning and experience in a journal which then will be submitted at the end of the program.

VIII. Program Activities

Objectives	Activity	Person/s Involved	Timeline	Success indicators
To identify the participants of the program	Selection and classification of tutor and tutee by teacher's evaluation and students' academic performance during the 1st semester- 1st quarter.	Math Teachers and Students	June - July	The students are paired appropriately and satisfied with their pairs
Motivate students to learn math Engage and enjoy learning math with their peers Increase the proficiency of the students in General Mathematics	The tutor is going to assist the tutee every independent learning session to answer the activity tasks that were given by the teacher.	Teacher, Tutor, and Tutees	August - December	The journal is filled with entries Show a visual improvement in their academic performance
Demonstrate a positive view in Mathematics	The students will write their reflections on learning and experiences in the journal and submit them at the end of the peer tutoring program. Meanwhile, the teacher will make a progress report regarding the program.	Tutees and Teachers	January	All the students submitted their portfolios and had them checked by their teacher.

REFERENCES

Abulhul, Z. (2021). Teaching strategies for enhancing Student's learning. Journal of Practical Studies in Education, 2(3), 1–4. https://doi.org/10.46809/jpse.v2i3.22

Aguilar, J. J. (2021). High School Students' Reasons for disliking Mathematics: The Intersection Between Teacher's Role and Student's Emotions, Belief and Self-efficacy. International Electronic Journal of Mathematics Education, 16(3), em0658. https://doi.org/10.29333/iejme/11294

Akpalu, R., Boateng, P. A., Ayisi, E., & Owusu, J. (2025). Students' Perceptions of Mathematics and the Impact on their Achievement among Senior High School Students in Ghana. International Journal of Research and Innovation in Social Science, IX(I), 3829–3840. https://doi.org/10.47772/ijriss.2025.9010299

Alele, F., & Malau-Aduli, B. (2023, February 22). 5.5 Mixed Methods study designs. Pressbooks. https://jcu.pressbooks.pub/intro-res-methods-health/chapter/5-5-mixed-methods-study-designs/

Alibraheim, E. A. (2021). Factors Affecting Freshman Engineering Students' Attitudes Toward Mathematics. Eurasia Journal of Mathematics, Science and Technology Education, 17(6), em1973. https://doi.org/10.29333/ejmste/10899

Alova, C. a. R., & Alova, I. M. C. (2022). Academic Performance in General Mathematics of Grade 11 Students: A Brief report. ResearchGate. https://doi.org/10.13140/RG.2.2.31975.11685

Bakar, N. a. A., Ayub, A. F. M., Ahmad, N., & Abdullah, S. I. S. S. (2021). Mathematics Achievement: The Relationship between Student Engagement, Parental Involvement, and Peer Influence. https://www.semanticscholar.org/paper/Mathematics-Achievement%3A-The-Relationship-between-Bakar-Ayub/c35c3dc9452d323b15ab23e78ccd433716a6d446

Barrera, J., & Cerna, J. D. (2022). Perceived effectiveness of mathematics teaching strategies and students' academic performance in blended learning modality. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.4168090

Berrame, R. (2024). Proficiency and academic achievement of Grade 7 students in mathematics. scimatic.org. https://doi.org/10.5281/zenodo.11099553

Cabrestante, J. & Lopez, E. (2023). Extent and Effectiveness of Mathematics Intervention Strategies: Their Relationship to the Academic Performance of Students. Psychology and Education: A Multidisciplinary Journal, 8(10), 1176-1200. https://10.5281/zenodo.7949332

Cabuquin, J. C., & Abocejo, F. T. (2023). Mathematics Learners' performance and academic achievement at a public high school institution in Leyte, Philippines. Formatif Jurnal Ilmiah Pendidikan MIPA, 13(2). https://doi.org/10.30998/formatif.v13i2.17235

Carabeo, J. N., LPT, & Tado, P. P., PhD. (2024, July 23). Student's Self-Esteem and Self-Control as Predictors of Academic Achievement of Students in Mathematics. EPRA Journals. https://eprajournals.com/IJSR/article/13637

Cardino, J. M., & Cruz, R. a. O. (2020). Understanding of learning styles and teaching strategies towards improving the teaching and learning of mathematics. LUMAT International Journal on Math Science and Technology Education, 8(1). https://doi.org/10.31129/lumat.8.1.1348

Cerbito, A. F. (2020). Comparative analysis of Mathematics proficiency and attitudes toward Mathematics of senior high school student. Online Submission, 10(5), 211-222.https://eric.ed.gov/?id=ED605013

Cooper, J. J., & Ozansoy, K. (2022). The impacts of strategies in teaching on students' performance in school. dergi.neu.edu.tr. https://dergi.neu.edu.tr/index.php/neuje/article/view/631

Davidovitch, N., & Dorot, R. (2023). The Effect of Motivation For Learning Among High School Students and Undergraduate Students—A Comparative Study. International Education Studies, 16(2), 117. https://doi.org/10.5539/ies.v16n2p117

Diaz, L. B. (2023). Current Approaches for Engaging Parents in Students' Academic Performance: Basis for Parental Engagement Policy. American Journal of Multidisciplinary Research and Innovation, 2(4), 32–41. https://doi.org/10.54536/ajmri.v2i4.1817

Dolinting, P. P., & Pang, V. (2022). The Classroom Climate, Students' Mathematics Achievement, Students' Knowledge of Cognition and Regulation Cognition: A Mediation Analysis. Malaysian Journal of Social Sciences and Humanities (MJSSH), 7(6), e001533. https://doi.org/10.47405/mjssh.v7i6.1533

Development and Research in Early Mathematics Education (2022). All about positive math attitudes ⋆ DREME family math. DREME Family Math.

https://familymath.stanford.edu/for-educators/positive-math-attitudes-definitions-and-tips/

Ellis, L., Hoskin, A. W., & Ratnasingam, M. (2018). Attitudes, preferences, and beliefs. In Elsevier eBooks (pp. 119–145). https://doi.org/10.1016/b978-0-12-805371-3.00005-4

Edgerton, E., & McKechnie, J. (2023). The relationship between student's perceptions of their school environment and academic achievement. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.959259

Etang, M. a. G., & Regidor, R. M. (2022). STUDENTS' MATHEMATICAL BELIEFS AND ATTITUDES AS PREDICTORS TO STUDENTS' MATHEMATICAL ABILITY. International Journal of Education and Social Science Research, 05(03), 23–60. https://doi.org/10.37500/ijessr.2022.5303

Evolution Psychology Center (2016). "I'm Just Not Good at Math;" How False Beliefs Could Shape Your Child's Future – Evolution Psychology Center. https://www.evolutionpsychologycenter.ca/im-just-not-good-at-math-how-false-beliefs-could-shape-your-childs-future/

Field, N. H., & Prinstein, M. J. (2023). Peer influence. In Elsevier eBooks. https://doi.org/10.1016/b978-0-323-96023-6.00016-6

Filgona, J., Sakiyo, J., Gwany, D. M., & Okoronka, A. U. (2020). Motivation in learning. Asian Journal of Education and Social Studies, 16–37. https://doi.org/10.9734/ajess/2020/v10i430273

Flores, M. (2023, November 18). Factors Affecting the Performance of the Grade 9 students in Learning Mathematics - International Journal of Advanced Multidisciplinary Studies. https://www.ijams-bbp.net/archive/vol-3-issue-11november/factors-affecting-the-performance-of-the-grade-9-students-in-learning-mathematics/

Fuqoha, A. a. N., Budiyono, B., & Indriati, D. (2018). Motivation in mathematics learning. Pancaran Pendidikan, 7(1). https://doi.org/10.25037/pancaran.v7i1.151

Garba, A., Ismail, N., Osman, S., & Rameli, M. R. M. (2019). Exploring Peer Effect on Mathematics Anxiety among Secondary School Students of Sokoto State, Nigeria through Photovoice Approach. Eurasia Journal of Mathematics Science and Technology Education, 16(2). https://doi.org/10.29333/ejmste/112622

Garcia, M. L. B., Gaylo, D. N., & Vistro-Yu, C. P. (2024, May 25). Writing PISA-Like Mathematics Items: The Case of Tertiary Mathematics Instructors from a State University in the Philippines. https://www.eu-jer.com/writing-pisa-like-mathematics-items-the-case-of-tertiary-mathematics-instructors-from-a-state-university-in-the-philippines

George, T. (2023, June 22). Mixed Methods Research | Definition, Guide & Examples. Scribbr. https://www.scribbr.com/methodology/mixed-methods-research/

Hagan, J. E., Amoaddai, S., Lawer, V. T., & Atteh, E. (2020). Students' Perception towards Mathematics and Its Effects on Academic Performance. Asian Journal of Education and Social Studies, 8–14. https://doi.org/10.9734/ajess/2020/v8i130210

Hargrove, P. (2023). THE USE OF TEACHING METHODS AND STRATEGIES AND HOW THEY AFFECT THE STUDENT AND TEACHER CLASSROOM DYNAMICS. Murray State's Digital Commons. https://digitalcommons.murraystate.edu/bis437/544/

Hayikaleng, N. (2019). The Effects of Using Authentic Materials on Students ' Achievement towards English Reading Comprehension among Narathiwat Technical College Students. https://www.semanticscholar.org/paper/The-Effects-of-Using-Authentic-Materials-on-%E2%80%99-among-/dd5bbda7fab054cebf040b1ebc3a1457e6e428e9

Hilton, K. (2024). Spontaneous Self-Affirmation and Social Context as Moderators between Stereotype Threat and Online Academic Performance. https://eric.ed.gov/?q=education+stereotypes+about+learning&ff1=dtySince_2020&ff2=subStudent+Attitudes&id=ED646053

Hossein-Mohand, H., & Hossein-Mohand, H. (2023). Influence of motivation on the perception of mathematics by secondary school students. Frontiers in Psychology, 13. https://doi.org/10.3389/fpsyg.2022.1111600

Iddrisu, A. B., Bornaa, C. S., Alagbela, A. A., Kwakye, D. O., Gariba, A., Ahusah, E. T., & Badger, T. N. A. (2023). Students' Characteristics and academic performance in Mathematics. Journal of Education Society and Behavioural Science, 36(3), 54–67. https://doi.org/10.9734/jesbs/2023/v36i31214

Jaffe, E. (2020). Mindset in the Classroom: Changing the Way Students See Themselves in Mathematics and Beyond. The Clearing House: A Journal

of Educational Strategies, Issues and Ideas, 93(5), 255–263. https://doi.org/10.1080/00098655.2020.1802215

Judijanto, L., Manu, C. M. A., Sitopu, J. W., Mangelep, N. O., & Hardiansyah, A. (2024, January 27). THE IMPACT OF MATHEMATICS IN SCIENCE AND TECHNOLOGY DEVELOPMENT. https://injotel.org/index.php/12/article/view/80

Kennan, C. C., & Abutal, M. B. (2019, January 18). Proficiency level in General Mathematics of Grade 11 Science, Technology, Engineering and Mathematics students in Dagatan National High School. https://ojs.aaresearchindex.com/index.php/AAJMRA/article/view/6362

Knaggs, C. M., Sondergeld, T. A., & Schardt, B. (2013). Overcoming barriers to college enrollment, persistence, and perceptions for urban high school students in a college preparatory program. Journal of Mixed Methods Research, 9(1), 7–30. https://doi.org/10.1177/1558689813497260

Kunwar, R. (2020). MATHEMATICS PHOBIA: CAUSES, SYMPTOMS AND WAYS TO OVERCOME. International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.8, Issue 8, pp.818-822. http://www.ijcrt.org/papers/IJCRT2008103

Leal, P. R., Fernández-Cézar, R., Núñez, R. P., & Suárez, C. a. H. (2022). Academic performance and beliefs about mathematics in college students. ResearchGate. https://www.researchgate.net/publication/364120442_Academic_Performance_And_Beliefs_About_Mathematics_In_College_Students

Libradilla, A. A., Bacatan, R. J., Misoles, P. A., & Morales, D. R. (2023). Examining the Association between Attitude towards Mathematics and Student Achievement. ResearchGate. https://www.researchgate.net/publication/372625115_Examining_the_Association_between_Attitude_towards_Mathematics_and_Student_Achievement

Macmull, M. S., & Ashkenazi, S. (2019). Math Anxiety: The Relationship between Parenting style and Math Self-Efficacy. Frontiers in Psychology, 10. https://doi.org/10.3389/fpsyg.2019.01721

Makgakga, T. P., & Dhlamini, J. J. (2019, November 1). Exploring the grade 11 mathematics learners' experiences and challenges in solving probability problems in selected Soshanguve schools. https://uir.unisa.ac.za/handle/10500/27917

Malgapo, C. and Villaflor, D. (2022), Students Mathematical Creative Problem-Solving Ability, Perception and Performance in General Mathematics. Multidisciplinary International Journal of Research and Development (MIJRD), Volume: 01 Issue: 06, Pages: 35-40. https://www.mijrd.com/papers/v1/i6/MIJRDV1I60004.pdf

Mamolo, L. A., & Sugano, S. G. C. (2020). Self-perceived and actual competencies of senior high school students in General Mathematics. Cogent Education, 7(1). https://doi.org/10.1080/2331186x.2020.1779505

Mandalaywala, T. M. (2020). Does essentialism lead to racial prejudice? It is not so Black and White. Advances in Child Development and Behavior, 195–245. https://doi.org/10.1016/bs.acdb.2020.05.007

Marie, A. A., & Angelo, B. E. (2022). Performance in General Mathematics of Grade 11 students of Sta. Cruz South High School using modular learning approach. Zenodo (CERN European Organization for Nuclear Research). https://doi.org/10.5281/zenodo.6849810

Michaelides, M. P., Brown, G. T. L., Eklöf, H., & Papanastasiou, E. C. (2019). The Relationship of Motivation with Achievement in Mathematics. In IEA research for education (pp. 9–23). https://doi.org/10.1007/978-3-030-26183-2_2

Moneva, J. C., & Valle, A. F. S. (2020). Difficulty in mathematics: close assistance and Self-Confidence. Journal of Studies in Education, 10(1), 117. https://doi.org/10.5296/jse.v10i1.16460

Nabila, L. A., & Widjajanti, D. B. (2020). Self-esteem in mathematics learning: How to develop it through contextual teaching and learning approach? Journal of Physics Conference Series, 1581(1), 012049. https://doi.org/10.1088/1742-6596/1581/1/012049

Nikolopoulou, K. (2023, June 22). What Is Purposive Sampling? | Definition & Examples. Scribbr. Retrieved October 15, 2024, from https://www.scribbr.com/methodology/purposive-sampling/

Obut, V., Jumawan, M, Baluyos, G., and Bacus, J. (2024). Exploring the Students' Struggles in Learning Mathematics: Basis for Enhancement. United International Journal for Research & Technology (UIJRT). 5(3), pp133-147. https://uijrt.com/paper/exploring-students-struggles-learning-mathematics-basis-enhancement

Olaco, M. G. R., & Rebucas, J. N. T. (2021). Students' Performance in General Mathematics under Modular Class, Candijay National High School,

Candijay, Bohol. ACADEME University of Bohol Graduate School and Professional Studies, 18(1), 22–41. https://doi.org/10.15631/aubgsps.v18i1.158

Parcon, C. a. S., & Bearneza, F. J. D. (2024). Mathematical Skills and General Mathematics Performance of Grade 11 Students in a Public National High School in Southern Negros Occidental, Philippines. Philippine Social Science Journal, 7(2), 31–40. https://doi.org/10.52006/main.v7i2.995

Pasco, J. C. (2021). Self-Concept, peer pressure, and teaching Strategies, and their Influence on Students' performance in Mathematics: A Cross-Sectional Study. Journal of Education in Black Sea Region, 7(1), 85–104. https://doi.org/10.31578/jebs.v7i1.252

Pendon, R. P. (2024). Effects of peer collaboration on attitude towards mathematics in the new normal. kuey.net. https://doi.org/10.53555/kuey.v30i4.2627

Putri, D. C. (2022). Students' Perception On The Use Of Online Learning Platform At The Second Year Students' Of English Language Education At Universitas Islam Riau. Other thesis, Universitas Islam Riau. http://repository.uir.ac.id/id/eprint/14750

Quaye, J., & Pomeroy, D. (2021). Social class inequalities in attitudes towards mathematics and achievement in mathematics cross generations: a quantitative Bourdieusian analysis. Educational Studies in Mathematics, 109(1), 155–175. https://doi.org/10.1007/s10649-021-10078-5

Russo, J., Kalogeropoulos, P., & Roche, A. (2023). Exploring underachieving students' views of, and attitudes towards, mathematics across stage of schooling. Asian Journal for Mathematics Education, 2(2), 240-257. https://doi.org/10.1177/27527263231177435

Saadati, F., & Celis, S. (2022). Student Motivation in Learning Mathematics in Technical and Vocational Higher Education: Development of an instrument. International Journal of Education in Mathematics Science and Technology, 11(1), 156–178. https://doi.org/10.46328/ijemst.2194

Sakpla, G. K., Owusu-Darko, I. & Iddrisu, A. (2023). Factors that Contribute to Junior High School Female Students' Negative Attitudes toward the Study of Mathematics in the Fanteakwa District, Ghana. Futurity Education. 3(4). 6-30. https://doi.org/10.57125/FED.2023.12.25.01

Saputri, S., Ruqoyyah, S., & Rohaeti, E. E. (2024, July 31). Analysis of student difficulties in learning mathematics in elementary school lower grades. Saputri | Journal of Educational Experts (JEE).

https://journal.kopertis-4.org/index.php/jee/article/view/229/159?fbclid=IwY2xjawFzV8ZleHRuA2FlbQIxMAABHbOfCL00eaMIWh57d_YR5wTdk0TfEOv1EW-0R9Y9mT9cXXCR8AagcsSGTA_aem_EUjRDlF60NLqrwJiavB1mw

Shah, N. H., Nazir, N., Arshad, M., Akhter, K., Shaheen, A. K., Younas, S., & Ghazanfar, F. (2023). Effect of Students Attitude Towards Mathematics on their Mathematical Achievement at Secondary School Level. International Journal of Emerging Technologies in Learning (iJET), 18(12), 178–192. https://doi.org/10.3991/ijet.v18i12.38765

Shao, Y., Kang, S., Lu, Q., Zhang, C., & Li, R. (2024). How peer relationships affect academic achievement among junior high school students: The chain mediating roles of learning motivation and learning engagement. BMC Psychology, 12(1). https://doi.org/10.1186/s40359-024-01780-z

Siller, H., & Ahmad, S. (2024b). Analyzing the impact of collaborative learning approach on grade six students' mathematics achievement and attitude towards mathematics. Eurasia Journal of Mathematics Science and Technology Education, 20(2), em2395. https://doi.org/10.29333/ejmste/14153

Singh, R., & Jethwani, L. M. (2023). Mathematics Anxiety and Self-Esteem among Young Adults Aged 18-30 Years » The International Journal of Indian Psychology. International Journal of Indian Psychology. https://doi.org/10.25215/1103.429

So, A. M. P. (2023). Extent of peer influence: its relation to the social well-being and mathematics academic achievement of the students. International Journal for Multidisciplinary Research, 5(3). https://doi.org/10.36948/ijfmr.2023.v05i03.4041

St. Mary, J. (2020). "The Gates are Closed Here": A Mixed Methods Study Examining the Lived Experiences of Black South African Township Youth. 10.13140/RG.2.2.12117.04325.

Süren, N., & Kandemir, M. A. (2020). The effects of mathematics anxiety and motivation on students' mathematics achievement. International Journal of Education in Mathematics Science and Technology, 8(3), 190. https://doi.org/10.46328/ijemst.v8i3.926

Tran, L. T., & Nguyen, T. S. (2021, September). Motivation and Mathematics Achievement: a Vietnamese case study. https://eric.ed.gov/?id=EJ1340080

Ugwuanyi, C. S., Okeke, C. I. O., & Asomugha, C. G. (2020). Prediction of learners' mathematics performance by their emotional intelligence, Self-Esteem and Self-Efficacy. https://eric.ed.gov/?id=EJ1262264

Wakhata, R., Balimuttajjo, S., & Mutarutinya, V. (2022). Building on Students' Prior Mathematical Thinking: Exploring Students' Reasoning Interpretation of Preconceptions in Learning Mathematics. MATHEMATICS TEACHING RESEARCH JOURNAL, 127–151. https://files.eric.ed.gov/fulltext/EJ1391459.pdf

Weerasinghe, D. (2016). A mixed methods design to investigate student outcomes based on parental attitudes, beliefs, and expectations in mathematics education. ResearchGate. https://www.researchgate.net/publication/306424427_A_mixed_methods_design_to_investigate_student_outcomes_based_on_parental_attitudes_beliefs_and_expectations_in_mathematics_education

Wen, R., & Dubé, A. K. (2022). A systematic review of secondary students' attitudes towards mathematics and its relations with mathematics achievement. Journal of Numerical Cognition, 8(2), 295–325. https://doi.org/10.5964/jn

Yunos, N. M., Thangal, T. B. T., Rahmat, N. H., Sharif, N. F. M., Ahmad, S. N., & Latif, N. A. (2022, September 17). Motivation for Learning Mathematics: A study across Disciplines. https://hrmars.com/index.php/IJARBSS/article/view/14526/Motivation-for-Learning-Mathematics-A-Study-Across-Disciplines

Zhao, Y., Zheng, Z., Pan, C., & Zhou, L. (2021). Self-Esteem and academic engagement among Adolescents: a Moderated mediation model. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.690828