East Asian Journal of Multidisciplinary Research (EAJMR)
Vol. 3, No. 7, 2024 : 2721 - 2738

Students' Perception in Learning the Course Mathematics in the Modern World: A Qualitative Study

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A R T I C L E I N F O

Keywords: Mathematics In The Modern World, Mathematics Education, Student Perception, Learning Mathematics

Received : 10, June
Revised : 24, June
Accepted: 25, Juli

A B S T R A C T

Mathematics fosters analytical thinking, problem-solving, and logical reasoning, essential for academic success and daily decisions. The course "*Mathematics in the Modern World*" aims to make mathematics more relatable by using real-life scenarios, countering its abstract and difficult perception. This study used a hermeneutic phenomenological narrative inquiry to explore the experiences and perceptions of six college students. This study used a hermeneutic phenomenological narrative inquiry to explore the experiences and perceptions of six college students. The inquiry focuses on individuals' accounts to comprehensively explore their lived experiences and the meanings they construct around learning mathematics. Data, gathered through in-depth interviews and a validated questionnaire, revealed that students view mathematics as practical and essential. Real-world applications and positive learning experiences enhance engagement, confidence, and motivation. Supportive teaching practices and practical examples foster a deeper understanding, leading to a more effective and satisfying educational experience.

DOI prefix: https://doi.org/10.55927/eajmr.v3i7.10071
ISSN-E: 2828-1519
https://journal.yp3a.org/index.php/eajmr

INTRODUCTION

Background of the Study

Mathematics is a fundamental discipline that fosters analytical thinking, problem-solving skills, and logical reasoning. Its vast applications encompass science, engineering, technology, finance, and social sciences. Understanding mathematical concepts is essential for academic success and informed decision-making in everyday situations (Lave, 2019). By equipping students with the ability to approach complex problems methodically, mathematics empowers them to navigate a world increasingly driven by data and quantitative analysis (Rizki & Priatna, 2019). The significance of learning "*Mathematics in the Modern World*" is its ability to contextualize mathematical principles within real-life scenarios, making the subject more relatable and engaging for students. This course aims to demystify mathematics, presenting it not as an abstract set of rules but as a practical tool with tangible benefits (Umpay, 2022).

Many learners perceive mathematics as an inherently difficult and abstract subject, often leading to a lack of engagement and poor performance. Traditional teaching methods further compound this perception by emphasizing rote learning and memorization over conceptual understanding and practical application (Langoban, 2020). Consequently, students need help to see the relevance of mathematical concepts in their daily lives and future careers, which diminishes their motivation to learn and hinders their overall academic development (Luzano, 2024). Mathematics instruction must sufficiently cater to students' varying levels of prior knowledge and individual learning preferences in many educational settings (Roman, 2019).

Research consistently shows that students' perceptions of mathematics significantly influence their engagement, performance, and long-term interest in the subject (Boaler, 2022). Studies by Laranang and Bundoc (2020) and Paguican and Torreon (2020) demonstrate that positive perceptions and self-efficacy in mathematics lead to higher achievement levels and greater persistence in pursuing STEM careers. Despite the extensive research on mathematics education, a notable gap exists in understanding how contemporary, real-world applications of mathematics influence students' perceptions and learning experiences (Skovsmose, 2020).

Furthermore, much of the existing literature has concentrated on traditional classroom settings and did not sufficiently address the integration of real-world contexts in mathematics instruction (English & Kirshner, 2015). The study addresses the population gap in mathematics education by exploring the diverse experiences and challenges students from different backgrounds face. This gap often manifests in varying access to quality education, resources, and support systems, leading to mathematical proficiency and confidence disparities (Grootenboer et al., 2015). The study explores the perceptions that students experience while learning mathematics within the context of contemporary, real-world applications. By capturing students' perspectives, the study seeks to identify the factors that influence their engagement and performance in the course, with the ultimate goal of informing the development of more effective and relatable teaching methods

Statement of the Problem

The study explored students' perceptions of the "*Mathematics in the Modern World*" course, underscoring the importance of mathematics education in shaping competent, confident individuals capable of contributing meaningfully to society. Specifically, the study sought to answer the question:

1. What are college students' perceptions when learning the Mathematics in the Modern World course?

THEORETICAL REVIEW

Theoretical Background of the Study

The theoretical anchorage of the study is rooted in Ethnomathematics (Ascher & Ascher, 1986) and Self-Efficacy Theory (Bandura, 1977). These frameworks provide a comprehensive lens through which the study examines students' diverse and multifaceted experiences in mathematics. Ethnomathematics, a theory that explores the relationship between mathematics and culture, is highly relevant for this study as it acknowledges students' diverse cultural backgrounds and how they influence their understanding and engagement with mathematical concepts. This theory posits that mathematics is not a universal language but is shaped by cultural practices and social contexts (Villarin et al., 2024). Moreover, self-efficacy theory is also crucial for guiding this study. This theory focuses on an individual's belief in their abilities to succeed in specific tasks, directly influencing their motivation, learning, and performance. In mathematics education, self-efficacy significantly shapes students' attitudes and perseverance in facing challenges (Schunk & DiBenedetto, 2016). The study seeks to identify how students from different cultural backgrounds perceive and approach mathematics by applying ethnomathematics and by exploring students' self-efficacy beliefs, the study aims to understand how confidence levels affect their engagement with the course and identify strategies to bolster their self-efficacy.

METHODOLOGY

Research Design

The study used hermeneutic phenomenological narrative inquiry method (Fuster Guillen, 2019) to explore students' experiences and perceptions. The method is particularly suited for this research as it focuses on individuals' stories, allowing for a deep understanding of their lived experiences and how they construct meaning around learning mathematics. Through the method, the researchers gathered varied insights into the students' perceptions, uncovering themes and patterns that reveal the intricacies of their learning experiences. The method's focus on storytelling helped highlight individual differences and commonalities, providing a holistic view of how students engage with and perceive mathematics in a modern educational context (Clandinin, 2022).

Sample and Sampling Technique

The study employed criterion sampling (Coyne, 1997) to ensure a purposeful selection of participants who meet specific criteria relevant to the research objectives. The participant selection is based on predefined criteria, and the researchers can ensure that the sample is both homogenous in some respects and diverse in others, facilitating a deeper exploration of the research questions.

The criteria for selecting participants were as follows: they must be bona fide college students at the institution conducting the study, must not have taken the subject before or in another school, must be enrolled in the course "Mathematics in the Modern World," and must be a first-year college student. These criteria ensure that participants are experiencing the course for the first time within a consistent educational context, which helps isolate and understand their perceptions and experiences specific to the course and setting (Robinson, 2015).

Table 1. Demographic profile of the participants of the study

Name	Sex	Age	Secondary School	Strand	Course
MS-1	Female	20	Urban	TVL	Education
MS-2	Male	23	Rural	STEM	Engineering
MS-3	Male	18	Urban	ABM	Accountancy
MS-4	Male	19	Urban	HUMSS	Philosophy
MS-5	Female	18	Rural	HUMSS	Education
MS-6	Male	21	Urban	ABM	Business Administration

The study participants comprised six (6) college students aged 18-23 enrolled in various courses at San Isidro College. The gender distribution includes four (4) females and two (2) males, providing a balanced perspective across genders. The sample includes students from diverse educational backgrounds and strands: four (4) from urban secondary schools and two (2) from rural secondary schools. This diverse sample ensures that the study captures a wide range of perspectives and experiences, enriching the analysis of students' perceptions of learning "*Mathematics in the Modern World*."

Data Gathering Procedure

The data-gathering procedure for the study began with administering a researcher-made questionnaire, validated by three (3) experts, to ensure its appropriateness and effectiveness. The initial step was designed to gather preliminary information on students' perceptions and to inform the subsequent interview process. Following the questionnaire, in-depth semi-structured interviews were conducted with each participant (Milena et al., 2008). The interviews lasted between 26 and 32 minutes, allowing for a comprehensive exploration of the students' experiences and perceptions.

The interviews were recorded with the participant's consent and continued until data saturation was achieved with the sixth participant,

ensuring the collected data was rich and detailed (Fuscg & Ness, 2015). Informed consent was obtained from all participants, ensuring they were fully aware of the study's purpose and rights. Data privacy was rigorously maintained, with all personal information kept confidential and secure. Anonymity and confidentiality were prioritized to protect the identities of the participants. Additionally, the researchers approached the study respectfully and sensitively, mindful of the participant's comfort and well-being throughout the interviews (Xu et al., 2020).

Data Analysis

The data analysis followed the narrative analysis (Sparkes, 2005), a method well-suited for identifying and interpreting patterns within qualitative data. After the interviews were transcribed verbatim, the researchers immersed themselves in the data, lasting one (1) month. The immersion period allowed the researchers to become thoroughly familiar with the content, facilitating a deep understanding of the nuances within the data. During this time, the researchers engaged in multiple readings of the transcripts, annotating and coding significant statements and themes that emerged from the participants' narratives (Green et al., 2007).

Following the initial coding phase, the researchers organized the codes into broader themes, continuously refining and collapsing them to accurately capture the essence of the participants' experiences. To ensure the validity and credibility of the findings, the initial transcripts and identified themes were subjected to member checking (Clarke et al., 2019). Participants were allowed to review and confirm the accuracy of the transcripts and the researchers' interpretations, ensuring that the findings accurately reflected their perspectives (Motulsky, 2021).

RESULTS AND DISCUSSION

The study explored the perceptions of the college students, through the lenses of ethnomathematics and self-efficacy theory, in learning the course Mathematics in the Modern World.

Perception of the Students in Learning the Course Mathematics in the Modern World

Figure 1 presents the overview of the thematic chart on the perception of learning Mathematics in the Modern World course. Two (2) overarching themes emerged: Fundamental of Mathematics with three (3) major themes and five (5) sub-themes that complement the major themes and Learning and Personal Development in Mathematics with four (4) major themes and six (6) sub-themes that complements the major themes.

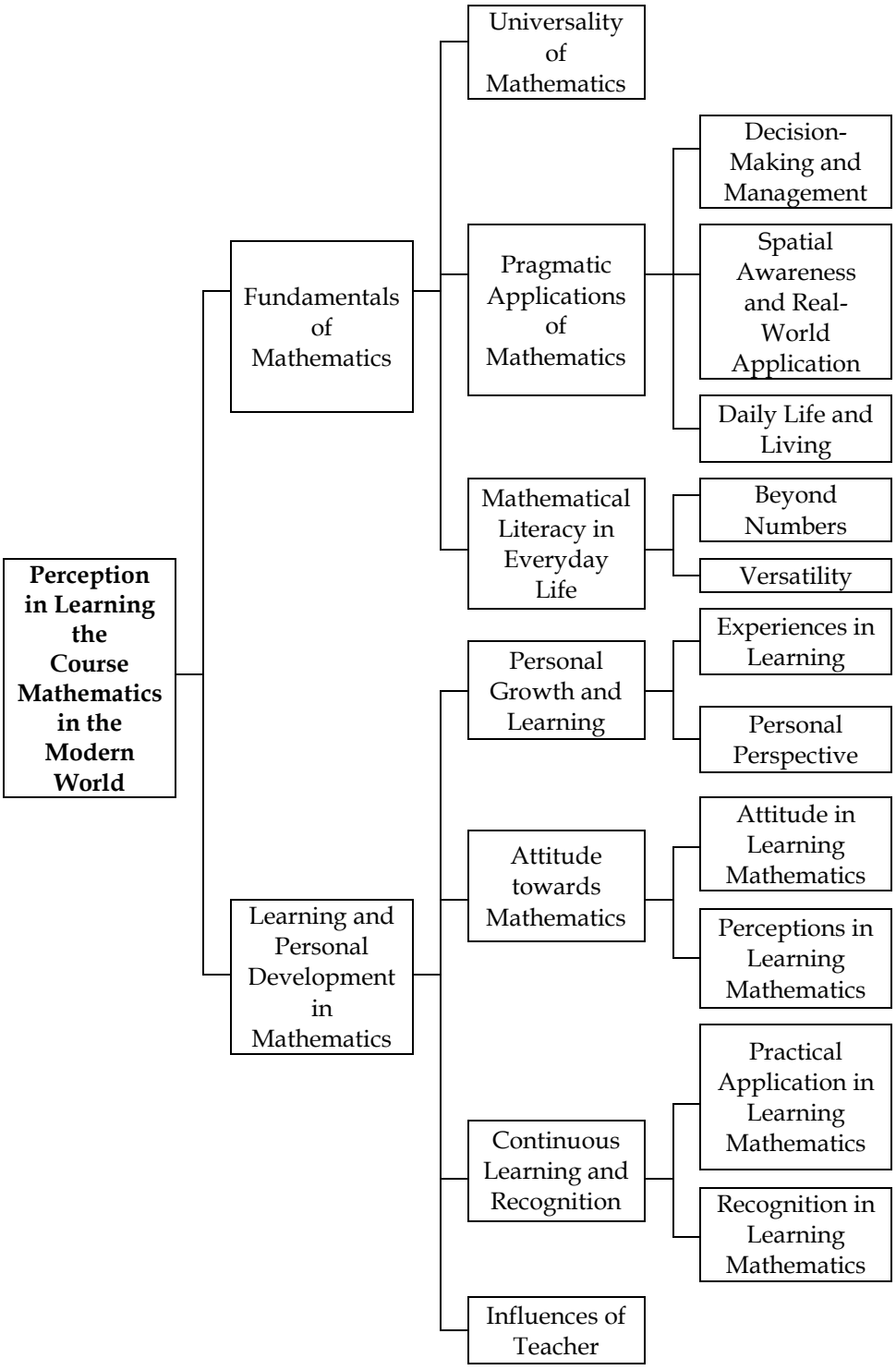

Figure 1. Overview of the thematic chart on the perception in learning the course Mathematics in the Modern World.

Fundamentals of Mathematics

Matrix 1 displays the summary of the qualitative themes on fundamentals of mathematics regarding the students' perception in learning the course Mathematics in the Modern World. Moreover, Matrix 1 presents sample

verbatim responses of the participants to support the generated themes and sub-themes

Matrix 1. Summary of qualitative themes on fundamentals of mathematics regarding the students' perception in learning the course Mathematics in the Modern World.

Theme	Sub-Theme	Examples
Universality of Mathematics		*"…Mathematics is offered at school to improve our creativity, critical thinking, reasoning, and problem-solving abilities…"*
Pragmatic Applications of Mathematics	Decision-Making and Management	*"…I use mathematics countless times every day. Budgeting my allowance,…answering my schoolwork's,… scheduling, and mostly everything I do involves mathematics..."*
	Spatial Awareness and Real-World Application	*"…I use mathematics in everything I do, whether it is simple or challenging. Mathematics is an integral component of both our everyday lives and the wider world..."*
	Daily Life and Living	*"…I cannot complete my day fully without it, especially without MMW [sic], because my life in a day revolves around an everyday routine and calculations, it is indispensable for living..."*
Mathematical Literacy in Everyday Life	Beyond Numbers	*"…I realize mathematics is seen everywhere. The simple patterns of the leaves I saw outside…and my daily routine are examples of applying mathematics in my life…"*
	Versatility	*"…I also view mathematics like water. Without water, man cannot live since water can be used in many ways..."*

Universality of Mathematics

The major theme of the *Universality of Mathematics* emerged prominently from the interviews, highlighting students' perceptions of mathematics as a universal language that transcends cultural and geographical boundaries (Bayug, 2022). Students recognized that mathematical principles are deeply embedded in diverse cultural practices and fundamental to human experience worldwide (Villarin et al., 2024). This universality fosters a sense of interconnectedness and shared understanding among students from varied backgrounds, reinforcing the notion that mathematical concepts are not confined to the classroom but are relevant and applicable in a global context (Paraide et al., 2023). The realization enhances students' confidence in their mathematical abilities, as they perceive themselves as participants in a universal dialogue, thus promoting a positive attitude toward learning mathematics (Pagtulunan, 2018).

Pragmatic Applications of Mathematics

The sub-theme of *Decision-Making and Management* reflects students' recognition of mathematics's role in everyday decision-making and organizational tasks. Students perceive mathematical skills as essential for managing daily activities and making informed decisions, whether in personal finance, time management, or resource allocation (D'Ambrosio & Rosa, 2017). The practical application underscores mathematical education's cultural and contextual relevance, making it more relatable and meaningful (Verdeflor & Pacadaljen, 2021). For students who successfully apply mathematical reasoning to real-life situations, their belief in their capability to use these skills effectively is strengthened, enhancing their overall mathematical self-efficacy (Albay, 2020).

The sub-theme of *Spatial Awareness and Real-World Application* highlights how students perceive mathematics as crucial for understanding and navigating physical spaces and environments. Students recognize that spatial reasoning is a mathematical and cultural skill rooted in activities like architecture, navigation, and art (Prahmana, 2022). This awareness connects mathematical learning to tangible real-world contexts, making abstract concepts more accessible and engaging (D'Ambrosio & Rosa, 2017). From the perspective of self-efficacy theory, students' ability to relate mathematical concepts to their physical world boosts their confidence in using mathematics to solve everyday problems, thereby increasing their overall competence in the subject (Pascual & San Pedro, 2018).

The sub-theme, *Daily Life and Living*, captures students' perceptions of mathematics as being integral to their everyday activities and routines. Students see mathematical principles in various cultural practices and daily tasks, from cooking and shopping to planning and budgeting (Reyes et al., 2019). Integrating mathematics into daily life demystifies the subject, showing its practical and essential nature. Students recognize their successful use of mathematics in daily activities, and their self-confidence in handling mathematical challenges is enhanced, leading to a more positive and proactive approach to learning the subject (Pascual & San Pedro, 2018; Guinocor et al., 2020).

The sub-themes collectively emphasize the practical and everyday relevance of mathematics. These sub-themes illustrate that students perceive mathematics as an academic subject and a vital tool for navigating various aspects of life (Albay, 2020; Guinocor et al., 2020; Prahmana, 2022). The major theme, *Pragmatic Applications of Mathematics*, encapsulates this understanding, highlighting how students' recognition of mathematics in practical contexts enhances their engagement and self-efficacy (Tatto, 2020). The theme underscores the importance of making mathematical education relevant to students' lives, fostering a deeper and more meaningful learning experience (Ruiz et al., 2023).

Mathematical Literacy in Everyday Life

The sub-theme *Beyond Numbers* emerged from students' reflections on how mathematics encompasses more than just numerical calculations, extending to logical reasoning, problem-solving, and analytical thinking (Reyes et al., 2019). Students appreciate how mathematical thinking is embedded in various cultural artifacts and intellectual traditions, indicating its broad scope and interdisciplinary nature (Roman, 2019). Recognizing these broader applications of mathematics enhances students' confidence in their ability to think critically and solve complex problems, thus broadening their perception of what it means to be proficient in mathematics (Subia et al., 2020).

The sub-theme of *Versatility* captures students' perceptions of mathematics as a versatile tool that can be applied across various domains and disciplines (Pascual & San Pedro, 2018). Students see mathematical skills as adaptable and valuable in different cultural and professional contexts, from scientific research to creative arts (Langoban, 2020). When students recognize the versatility of mathematics, their belief in their ability to transfer these skills to new and diverse situations is strengthened, enhancing their overall mathematical self-efficacy and adaptability (Albay, 2020).

The sub-themes together highlight the multifaceted nature of mathematical literacy. These sub-themes show that students perceive mathematics as a comprehensive and adaptable skill set beyond traditional numerical applications (Subia et al., 2020; Langoban, 2020). The major theme, *Mathematical Literacy in Everyday Life*, synthesizes these insights, emphasizing that students value mathematics for its broad applicability and essential role in everyday intellectual and practical activities (Golla & Reyes, 2020). The theme underscores the importance of teaching mathematics in a way that highlights its diverse applications and relevance to various aspects of life (Reyes et al., 2019).

Fundamentals of Mathematics

The overarching theme, *Fundamentals of Mathematics*, synthesizes the main themes. These themes collectively highlight that students perceive mathematics as a universal, practical, and versatile discipline integral to everyday life and various cultural contexts (Pagtulunan, 2018; Reyes et al., 2019; Ruiz et al., 2023). The study reveals that understanding mathematics' cultural relevance and practical applications enhances students' confidence and engagement in learning (Guinocor et al., 2020). The overarching theme emphasizes that a holistic approach to teaching mathematics integrates cultural and practical perspectives and fosters a deeper and more effective learning experience (Luzano, 2024).

Learning and Personal Development in Mathematics

Matrix 2 displays the summary of the qualitative themes on learning and personal development in mathematics regarding the students' perception in

learning the course Mathematics in the Modern World. Moreover, Matrix 2 presents sample verbatim responses of the participants to support the generated themes and sub-themes.

Matrix 2. Summary of qualitative themes on learning and personal development in mathematics regarding the students' perception in learning the course Mathematics in the Modern World.

Theme	Sub-Theme	Examples
Personal Growth and Learning	Experiences in Learning	*"…I instilled [sic] in my mind that I could improve…in some instances dealing with it, I cannot put myself at ease because I am trying to push myself to become good at that subject…"*
	Personal Perspective	*"…I cannot say that Mathematics makes my life easier all the time. However, I cannot say that it also complicates my living…my views are divided into two perspectives, the positive and the negative…"*
Attitude towards Mathematics	Attitude in Learning Mathematics	*"…I desire to learn but needed more courage to start because I always complain first…"*
	Perceptions in Learning Mathematics	*"…I thought that math made things complicated…it made my life more complicated to understand…however, that misunderstanding helped me realize I was wrong because mathematics is part of my existence…"*
Continuous Learning and Recognition	Practical Application in Learning Mathematics	*"…because of mathematics, I can divide my time into different aspects: from work, studies, as a son, etc., through time-management…"*
	Recognition in Learning Mathematics	*"…that Mathematics is everything is to learn the subject itself [sic]. Learning is a daily process, not a one-shot deal…"*
Influences of Teacher		*"…I was very grateful to my teacher who is the foundation of my mathematics knowledge. She taught me art that no one can steal from me…"*

Personal Growth and Learning

The sub-theme, *Experiences in Learning*, highlights students' diverse experiences in Mathematics, emphasizing how these experiences shape their perceptions and attitudes toward the subject (Langoban, 2020). Students' learning experiences are seen as influenced by their cultural backgrounds and prior knowledge, which contribute to their understanding and engagement with mathematical concepts (Villarin et al., 2024). Positive learning experiences enhance students' confidence in their mathematical abilities, leading to increased motivation and a more proactive approach to tackling mathematical challenges (Reyes et al., 2019; Guinocor et al., 2020).

The sub-theme, *Personal Perspective*, reflects how students' viewpoints and attitudes toward mathematics impact their learning experiences (Roman, 2019). Students' perspectives are shaped by their cultural contexts and the relevance they perceive in the mathematical content (Bravo et al., 2023). When students view mathematics as relevant and applicable to their lives, their belief in their ability to succeed in the subject increases, fostering a more positive attitude and a greater willingness to engage with mathematical tasks (Subia et al., 2020).

The major theme, *Personal Growth and Learning*, encapsulates the sub-themes, highlighting how students' experiences and viewpoints contribute to their development in mathematics (Guinocor et al., 2020; Subia et al., 2020). The major theme underscores the importance of recognizing and valuing students' unique cultural backgrounds and personal attitudes as central to their learning process (Villa& Sebastian, 2021; Bravo et al., 2023). Positive learning experiences and relevant personal perspectives can significantly enhance students' confidence and motivation in mathematics, leading to meaningful personal growth and a deeper understanding of the subject (Capuno et al., 2019).

Attitude towards Mathematics

The sub-theme, *Attitude in Learning Mathematics*, reveals how students' attitudes toward mathematics influence their engagement and success in the course (Capuno et al., 2019). Cultural factors and prior experiences with the subject often shape these attitudes (Agup & Agup, 2020). Students with a positive attitude towards mathematics are likelier to believe in their ability to succeed, motivating them to persist in their studies and overcome challenges, resulting in better learning outcomes (Laranang & Bundoc, 2020).

The sub-theme, *Perceptions in Learning Mathematics*, examines students' overall perceptions of mathematics. These perceptions are influenced by cultural contexts and the practical relevance of mathematical concepts in their daily lives (Mamolo & Sugano, 2020). When students perceive mathematics as valuable and relevant, their confidence in their mathematical abilities increases, leading to a more engaged and proactive approach to learning the subject (Reyes et al., 2019).

The major theme, *Attitude towards Mathematics*, synthesizes the sub-themes, highlighting the critical role of students' attitudes and perceptions in their mathematical learning journey (Capuno et al., 2019; Mamolo & Sugano, 2020). The theme demonstrates that fostering positive attitudes and relevant perceptions can significantly enhance students' engagement and success in mathematics (Guinocor et al., 2020). Creating a supportive and culturally relevant learning environment can boost students' confidence and motivation, leading to better learning outcomes (Luzano, 2024).

Continuous Learning and Recognition

The sub-theme, *Practical Application in Learning Mathematics*, highlights students' recognition of the importance of applying mathematical concepts to real-world situations (Roman, 2019). Students see practical applications as

essential for making mathematics relevant and meaningful (Villarin et al., 2024). Students successfully apply mathematical concepts in practical contexts, strengthening their confidence in their mathematical abilities and enhancing their overall engagement and interest in the subject (Subia et al., 2020).

The sub-theme, *Recognition in Learning Mathematics*, focuses on students' awareness and acknowledgment of their progress and achievements in mathematics (Villarin et al., 2024). Recognition can be influenced by cultural factors and societal values placed on mathematical achievement. Recognizing and celebrating students' successes boosts their confidence and motivation, encouraging them to continue striving for excellence in mathematics (Tan & Limjap, 2018; Guinocor et al., 2020).

The major theme, *Continuous Learning and Recognition*, encapsulates the sub-themes that emphasize the importance of ongoing learning and acknowledgment of achievements in mathematics (Villarin et al., 2024). The major theme highlights that practical application and recognition are key to maintaining students' engagement and motivation (Reyes et al., 2019). Providing opportunities for practical application and recognizing students' progress can enhance their confidence and encourage a continuous and enthusiastic approach to learning mathematics (Tan & Limjap, 2018).

Influences of Teacher

The major theme, *Influences of Teacher*, examines teachers' significant impact on students' perceptions and learning experiences in mathematics. Teachers are seen as cultural mediators who can contextualize mathematical concepts in ways that resonate with students' backgrounds (Langoban, 2020). Supportive and effective teaching practices can enhance students' belief in their mathematical abilities, fostering a positive learning environment that encourages persistence and success in the subject (Guinocor et al., 2020).

Learning and Personal Development in Mathematics

The overarching theme of *Learning and Personal Development in Mathematics* synthesizes the main themes, which highlights that a complex interplay of personal attitudes, cultural contexts, practical applications, recognition of achievements, and teacher influences shapes students' perceptions and experiences in learning mathematics (Tan & Limjap, 2018; Guinocor et al., 2020; Bravo et al., 2023; Luzano, 2024). A holistic approach integrating cultural relevance, personal growth, positive attitudes, practical applications, recognition, and effective teaching practices is essential for fostering meaningful learning and personal development in mathematics (Reyes et al., 2019; Guinocor et al., 2020).

CONCLUSIONS AND RECOMMENDATIONS

The study reveals that college students perceive mathematics as universal and an essential tool for everyday life, transcending cultural and geographical boundaries. Students recognize the cultural relevance of mathematical principles, viewing them as integral to diverse cultural practices. The perspective highlights

how students understand the interconnectedness of mathematics with various contexts, enhancing their appreciation for the subject.

Moreover, the study underscores how practical applications in decision-making, spatial awareness, and daily activities reinforce students' belief in their mathematical abilities. Students reported that seeing the real-world relevance of mathematics in their lives boosted their confidence and motivation to engage with the subject. These practical applications make abstract concepts more tangible and relatable, fostering a positive learning experience.

Furthermore, the findings suggest that positive learning experiences, relevant content, and supportive teaching practices significantly enhance students' confidence, motivation, and engagement in mathematics. An integrated approach emphasizing relevance, practical application, and personal growth fosters a deeper and more meaningful learning experience in mathematics. The study concludes that mathematics education can be significantly improved by making it more relevant and practically applicable to students' lives.

FURTHER STUDY

Further research could investigate the effectiveness of professional development programs for mathematics teachers, focusing on culturally responsive teaching and methods to connect mathematical concepts with students' daily experiences and cultural backgrounds. Additionally, research could explore strategies to promote self-efficacy among students by encouraging belief in their mathematical abilities and providing opportunities for success, enhancing their problem-solving skills and logical reasoning.

ACKNOWLEDGMENT

The authors would like to thank the students who participated in the study and Dr. Sol G. Simbulan for reviewing the article and her valuable insights and advice for the improvement of the paper. Additionally, the authors would like to thank San Isidro College for the support in the conduct and publication of this paper.

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