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Untangling the “Why” of Math: Examining Student Perceptions on the Value of Mathematics in the Modern World

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ABSTRACT

Mathematics in the Modern World is a college course that aims to develop critical thinking and problem-solving skills through fundamental mathematical concepts, emphasizing their real-world applications. However, students often find the course daunting due to negative experiences and a lack of interest, undermining its value and engagement. The study utilized purposive sampling to identify participants with diverse experiences in mathematics and employed narrative inquiry to delve into the perspectives of four college students on the value perceived towards mathematics. The study found that first-year college students value mathematics for developing cognitive skills, its applications in daily life, and technological advancements. Their perceptions highlight the influence of internal and external experiences on their appreciation for mathematics. Addressing external and internal factors is crucial for enhancing students' engagement and appreciation of Mathematics in the Modern World course.

INTRODUCTION

“Mathematics in the Modern World” (MMW) is a course designed to introduce students to the fundamental concepts and applications of mathematics in contemporary society. Commonly taken during the first year of tertiary education, this course was introduced by the Commission of Higher Education (CMO 20, s.2013) as part of the general education requirement. The course covers a wide range of topics, including logic, sets, probability, statistics, and financial mathematics, highlighting their relevance in real-world situations. The course aims to develop critical thinking and problem-solving skills, providing students with the mathematical literacy necessary to navigate and make informed decisions in an increasingly complex world (Umpay, 2022). Its inclusion in the curriculum underscores the importance of mathematical knowledge in a well-rounded education, equipping students with tools to understand and address various practical and theoretical issues.

Despite its significance, many students find mathematics-related courses less enticing due to mathematics anxiety (García & Banayo, 2022), an initial stigma around mathematics being inherently difficult (Nabayra, 2022), and a general disinterest in the subject (Janiola & Galimpin, 2023). Mathematics anxiety can lead to feelings of tension and fear that interfere with math performance, while the stigma can create a mental block that discourages engagement with the subject (Gamit, 2022). This aversion is often compounded by past negative experiences with mathematics, resulting in a lack of confidence and motivation to pursue further mathematical learning (Tobe, 2023). Consequently, students may approach MMW with

apprehension, affecting their overall performance and perception of the course (Carandang *et al.*, 2024).

The challenges in learning mathematics can significantly undermine the value of the MMW course. When students need help with foundational mathematical concepts, it can lead to a broader disengagement from the subject, diminishing their appreciation of its relevance and applicability (Balmaceda, 2021). This challenge affects not only their performance in the course but also their ability to see the importance of mathematics in everyday life and various professional fields (Oracion & Abina, 2021).

Existing studies provide a mixed picture regarding the significance of mathematics-related courses. Existing research suggests that courses like MMW may be associated with improvements in students' quantitative reasoning skills and their ability to apply mathematical concepts to real-world problems (Taban *et al.*, 2023; Luzano, 2024). However, other studies point to persistent issues, such as mathematics anxiety and negative attitudes toward the subject, which can hinder the effectiveness of these courses (García & Banayo, 2022; Nabayra, 2022; Janiola & Galimpin, 2023). Literature also suggests that innovative teaching methods and supportive learning environments can mitigate some of these challenges, emphasizing the need for ongoing research and adaptation in teaching practices to support student learning better (Cayubitt, 2022; Tobe, 2023).

This study aims to explore college students' perceptions of the MMW course, addressing an empirical gap in understanding how students view its relevance and impact. By examining students' attitudes, experiences, and challenges, the study seeks to provide insights into the

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factors that influence their engagement and success in the course. Investigating these perceptions may contribute to the development of strategies for potentially improving course effectiveness and student learning outcomes in mathematical literacy and confidence.

This study aims to explore students' perceptions of learning the course MMW. By delving into their attitudes, experiences, and challenges, the study seeks to uncover the underlying factors that shape their engagement with the subject.

Theoretical Framework

The study is anchored on Weiner's Attribution Theory (1979), which explores how individuals interpret and attribute causes to their successes and failures. This theory is essential for the study as it provides a framework to understand the factors influencing students' attitudes and perceptions toward mathematics. Attribution Theory suggests that students' beliefs about the causes of their performance—whether they attribute success or failure to internal factors like ability and effort or external factors like task difficulty and luck—can significantly impact their motivation and engagement. By applying this theory, the study aims to investigate how students' attributions affect their perception of the value of mathematics.

Statement of the Problem

The study aims to highlight the value of mathematics from the students' perspective and ensure that the course fulfills its purpose of enhancing their mathematical literacy and critical thinking skills. Specifically, the study sought to answer:

1. What are the college student's perception in the value of learning the course "Mathematics in the Modern World"?

LITERATURE REVIEW

Mathematics plays a critical role in various fields and everyday activities in the modern world. It is perceived as a valuable tool facilitating essential daily activities across various roles, underscoring its practical applications and continuous use. Students recognize the importance of mathematics in contributing to meaningful outcomes in both personal and professional settings (Nabayra, 2022; Tobe, 2023; Luzano, 2024). This perception aligns with the notion that mathematics is integral to daily life, reinforcing its value based on its consistent, practical utility (Gamit, 2022; Villa & Sebastian, 2021; Bayug, 2022).

Despite its significance, many students experience mathematics anxiety, which can lead to tension and fear that interfere with their math performance (Garcia & Banayo, 2022). This anxiety is often compounded by a stigma around mathematics being inherently difficult and a general disinterest in the subject (Nabayra, 2022; Janiola & Galimpin, 2023). These negative attitudes and past adverse experiences can result in a lack of confidence

and motivation to pursue further mathematical learning, affecting students' overall performance and perception of mathematics in the modern world (Gamit, 2022; Carandang *et al.*, 2024).

Research shows a mixed picture regarding the significance of mathematics-related courses. Some studies suggest that courses like Mathematics in the Modern World (MMW) can enhance students' quantitative reasoning skills and ability to apply mathematical concepts to real-world problems (Taban *et al.*, 2023; Luzano, 2024). However, persistent issues such as mathematics anxiety and negative attitudes toward the subject can hinder the effectiveness of these courses (Garcia & Banayo, 2022; Nabayra, 2022; Janiola & Galimpin, 2023). Innovative teaching methods and supportive learning environments are essential to mitigate these challenges, emphasizing the need for ongoing adaptation in teaching practices to support student learning better (Cayubit, 2022; Tobe, 2023).

The integration of mathematics in various technological tools and systems highlights its modern relevance. Students attribute the prevalence and utility of mathematics to advancements in technology, recognizing it as a foundational element in developing and functioning modern technological innovations (Sasota *et al.*, 2021; Gurrea *et al.*, 2022). Additionally, mathematics is crucial for effective financial management, with students acknowledging the direct impact of their mathematical abilities on handling financial and management tasks (Tilan *et al.*, 2021; Balaza *et al.*, 2021; Gamit, 2022). These perspectives illustrate the comprehensive relevance of mathematics in both technological advancements and practical everyday skills.

Literature suggests that mathematics is widely recognized for its utility in contemporary society. While challenges such as mathematics anxiety persist, research consistently affirms its role in cognitive development, interdisciplinary studies, and practical problem-solving. The evolving landscape of education and technology further emphasizes the relevance of mathematical proficiency. Consequently, mathematics is established as both an academic subject and a foundational skill for personal and professional advancement.

MATERIALS AND METHODS

Research Design and Locale of the Study

The study utilized a narrative inquiry research design (Wells, 2011). This method allows for an in-depth exploration of individual student's experiences and perceptions, delving into the subtleties of their perceptions of mathematics. Conducted in a college institution in Malaybalay City, Bukidnon, the narrative inquiry design facilitates a comprehensive understanding of the personal and contextual factors that shape students' views on the value of mathematics, providing rich, detailed narratives that offer insights into their educational experiences.

Sampling and Sampling Technique

The study utilizes purposive sampling (Tongco, 2007) to select participants who can provide the most relevant and rich data regarding their perceptions of mathematics. This technique is most appropriate for the study as it allows the researchers to intentionally choose first-year

college students who have recent and relevant experiences with the Mathematics in the Modern World course. By focusing on specific individuals who are likely to have diverse perspectives, the study aims to capture a broad range of insights and experiences, enhancing the depth and validity of the findings.

Table 1: Demographic profile of the participants of the study

Name	Age	Sex	Department
L-1	20	Male	Nursing
L-2	19	Male	Engineering
L-3	19	Male	Arts and Sciences
L-4	18	Female	Education

The sample for the study consists of four (4) first-year college students from various courses at a college institution in Malaybalay City, Bukidnon. Among the respondents, three (3) are male and one (1) is female, aged 18-20. The small sample size was chosen to facilitate detailed narrative inquiry, and data saturation was achieved by the fourth respondent (Saunders *et al.*, 2018), ensuring that the gathered data was rich and comprehensive to address the research questions effectively.

Research Instrument and Data Gathering

The research instrument used in the study is a researcher-made questionnaire designed specifically to explore students' perceptions of mathematics. This questionnaire underwent a rigorous validation process by three (3) experts in mathematics education to ensure its content validity and relevance. The validated instrument allowed the researchers to gather focused and meaningful data on the participants' experiences and attitudes toward the subject.

Data gathering for the study was conducted through in-depth semi-structured interviews (Adams, 2015), following strict ethical guidelines, including informed consent, data privacy, and the right to withdraw (Arifin, 2018). Each interview lasted approximately 20-25 minutes and was recorded with the participant's consent to ensure accuracy in capturing their responses. The semi-structured format allowed for flexibility, enabling the researchers to probe into specific areas of interest while maintaining a consistent framework across interviews.

Moreover, the interviews were designed to elicit detailed narratives from the participants, providing rich qualitative data. The researchers ensured that the interview environment was comfortable and conducive to open, honest communication, which was crucial for obtaining

genuine insights into the students' perceptions and experiences with mathematics. This approach facilitated the collection of comprehensive data that reflected the complex and multifaceted nature of the student's attitudes toward the subject.

Data Analysis

The study employed narrative analysis (Smith, 2016) to interpret the data collected from the interviews. This method is most appropriate for the study as it focuses on understanding the stories and experiences shared by the participants, allowing the researchers to identify common themes and patterns. Narrative analysis helps in uncovering the underlying factors that influence students' perceptions of mathematics, providing a deep and rich understanding of their attitudes and experiences.

Additionally, the study followed the process of member checking (McKim, 2023), where the researchers shared the generated themes and interpretations with the participants to verify accuracy and authenticity. This step ensured that the findings were a true reflection of the participants' perspectives, enhancing the credibility and trustworthiness of the study.

RESULTS AND DISCUSSION

Students Perception on the Value of Mathematics in the Modern World

Figure 1 presents the overview of the thematic chart on the perceptions of the general public regarding the use of mathematics. Five (5) significant themes were generated: importance of mathematics in daily life, perspectives on mathematics, educational value of mathematics, challenges and misconceptions, and modern relevance of mathematics. Per themes, sub-themes were also generated and recorded.

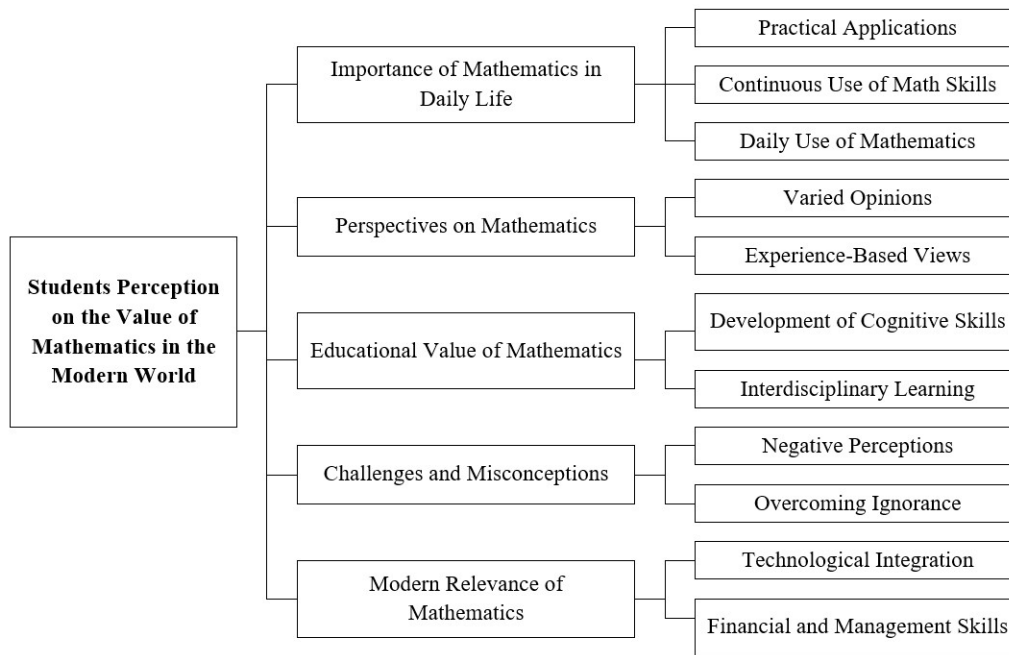


Figure 1: Overview of the thematic chart on the participants perception towards the value of mathematics in the modern world

Importance of Mathematics in Daily Life

The sub-theme on Practical Applications of Mathematics focuses on students' perceptions of how mathematics is used in practical, everyday situations. It captures the idea that mathematical skills are essential for performing various daily tasks and fulfilling different roles. The participants stated:

"...mathematics helps us to do important things in our daily lives..." (L-1)

"...people can use it in their occupation as a parent, a child, or as a student..." (L-2)

The statements highlight the perceived practical applications of mathematics in everyday life. Students attribute the usefulness of mathematics to its ability to facilitate essential daily activities across various roles (Nabayra, 2022). The result reflects an external attribution where the value of mathematics is linked to its applicability in real-world contexts, thereby recognizing its importance in contributing to practical and meaningful outcomes in personal and professional settings (Tobe, 2023; Luzano, 2024).

The sub-theme on Continuous Use of Math Skills explores the idea that mathematical skills are not only learned but continuously applied and developed through daily activities. It emphasizes the ongoing engagement with mathematics as part of everyday life. A participant claimed:

"...every day we apply mathematical ideas and the skill we develop from solving problems..." (L-4)

The statement underscores the continuous use of mathematical skills in daily activities. This perspective suggests that students attribute their ongoing engagement with mathematics to the necessity of problem-solving skills that are developed and honed over time (Gamit,

2022). This consistent application reinforces their understanding of mathematics as an integral part of their daily lives, further solidifying the perception of its value based on its continuous practical utility (Villa & Sebastian, 2021; Bayug, 2022).

The sub-theme on Daily Use of Mathematics captures the notion that mathematics is an essential part of daily existence, influencing both human and natural activities. It reflects the fundamental role of mathematics in everyday survival and functioning. The participants detailed:

"...mathematics provides enough knowledge for us to survive in these trying times as it becomes part of our existence..." (L-1)

"...even insects use mathematics in their everyday life for existence..." (L-4)

The statements illustrate the fundamental role of mathematics in daily survival and existence. Students perceive the necessity of mathematics as an external factor essential for navigating everyday challenges (Nabayra, 2022). This perception highlights an intrinsic value attributed to mathematics, grounded in its ubiquitous presence and utility in both human and natural contexts, emphasizing its critical role in daily life (Rodrigo & Prudente, 2024).

The central theme, Importance of Mathematics in Daily Life, encompasses how students perceive mathematics as valuable and essential in their daily lives. The result reveals that students generally value mathematics significantly based on its practical applications, continuous use, and essential role in survival (Villa & Sebastian, 2021; Tobe, 2023; Rodrigo & Prudente, 2024). These attributions suggest that students recognize mathematics as an indispensable tool that enhances their ability to perform daily tasks, solve problems, and adapt to various life roles

and challenges (Balmaceda, 2021). The perception of mathematics as an integral part of life indicates a firm external attribution, where its importance is derived from its pervasive and practical applications in the world around them (Bayug, 2022; Luzano, 2024).

Perspectives on Mathematics

The sub-theme on Varied Opinions explores the diverse perspectives that individuals hold about mathematics. It acknowledges that students have different views and attitudes towards the subject, which can influence their perception of its value in the modern world. The participants claimed:

“...people really do have different perspectives about mathematics...” (L-2)

“...views about mathematics in the Modern World vary from person to another person...” (L-3)

These statements indicate a recognition of the diversity in opinions about mathematics. Students attribute these varied perspectives to individual differences in experiences, backgrounds, and personal beliefs. This external attribution highlights the idea that perceptions of mathematics are shaped by various factors, leading to a spectrum of attitudes and beliefs about the subject (Etang & Regidor, 2022; Luzano, 2024).

The sub-theme on Experience-Based Views focuses on how personal experiences influence individuals' perspectives on mathematics. It emphasizes the role of past experiences in shaping how students view and engage with mathematics in the modern world. A Participant stated:

“...our experiences matter in learning mathematics. Our experiences are the foundation in order to derive such perspectives about Mathematics in the Modern World...” (L-3)

The response underscores the impact of personal experiences on students' views of mathematics. The result suggests that students attribute their perceptions of mathematics to their prior experiences, whether positive or negative (Villa & Sebastian, 2021). This internal attribution implies that individual experiences are critical in forming attitudes toward mathematics, influencing how students perceive its relevance and value in their lives (Tobe, 2023).

The central theme, Perspectives on Mathematics, encompasses how students perceive mathematics, considering the diversity of opinions and the influence of personal experiences. It reflects the complex and multifaceted nature of students' attitudes towards mathematics. The result reveals that both external and internal attributions influence students' perceptions. Varied opinions about mathematics are attributed to external factors such as individual differences and diverse backgrounds (Etang & Regidor, 2022). In contrast, experience-based views are attributed to internal factors, with personal experiences significantly shaping students' attitudes toward mathematics (Villa & Sebastian, 2021). This dual attribution highlights the complex interplay between individual experiences and broader social

influences in forming students' perspectives on the value of mathematics in the modern world (Tobe, 2023).

Educational Value of Mathematics

The sub-theme on Development of Cognitive Skills focuses on the role of mathematics in enhancing cognitive abilities. It highlights how engaging with mathematical activities can foster clarity of thought and an open-minded attitude. The participants stated:

“...mathematics promotes logical thinking and useful methods for developing mental discipline...” (L-3)

“...math puzzles and riddles encourage and attract an alert and open-minded attitude among young people and help them develop clarity in their thinking...” (L-4)

The statements illustrate the perceived cognitive benefits of studying mathematics. Students attribute the development of these cognitive skills to their engagement with mathematical concepts and problem-solving activities (Doño & Mangila, 2021; Gahi *et al.*, 2023). This internal attribution suggests that students recognize the inherent value of mathematics in fostering critical thinking and mental discipline, which are essential skills applicable across various contexts (Gamit, 2022).

The sub-theme on Interdisciplinary Learning explores the importance of mathematics in understanding and excelling in other academic disciplines. It underscores mathematics' interconnectedness with fields such as physics, social studies, music, and art. A participant mentioned:

“...comprehending mathematics is essential for learning other academic disciplines like physics, social studies, and even music and art...” (L-4)

The statement highlights mathematics' interdisciplinary nature. Students attribute their ability to grasp and excel in other subjects to their understanding of mathematics (Tobe, 2023). This external attribution indicates that students perceive mathematics as a foundational skill that enhances their overall academic performance and broadens their educational experience, reinforcing that mathematics is integral to a well-rounded education (Villa & Sebastian, 2021).

The central theme, Educational Value of Mathematics, encompasses the various educational benefits students perceive mathematics to offer. It includes sub-themes that highlight the development of cognitive skills and the interdisciplinary learning facilitated by mathematical knowledge. The result reveals that internal and external attributions shape students' perceptions. The development of cognitive skills is attributed to internal factors, where engagement with mathematical activities is seen as enhancing logical thinking and mental discipline (Gahi *et al.*, 2023). In contrast, interdisciplinary learning is attributed to external factors, where understanding mathematics is viewed as crucial for success in other academic disciplines (Villa & Sebastian, 2021). This dual attribution underscores the multifaceted educational value of mathematics, highlighting its role in fostering essential cognitive abilities and supporting interdisciplinary academic growth (Tobe, 2023).

Challenges and Misconceptions

The sub-theme on Negative Perceptions examines how negative opinions about mathematics influence students' attitudes. It highlights the impact of external opinions on students' perceptions and their overall appreciation of mathematics. The participants noted:

"...there are times mathematics is unappreciable because of the negative opinions of other people which was planted in our mind..." (L-2)

"...I hope that people may focus not only on the dim side of it but also the brighter side..." (L-3)

The statements reflect the influence of negative perceptions on students' attitudes toward mathematics. Students attribute their negative perceptions to external factors, such as the opinions of others (Nabayra, 2022). This external attribution highlights the impact of social influences on students' views, indicating that negative comments and attitudes from others can diminish their appreciation and engagement with mathematics (Villa & Sebastian, 2021).

The sub-theme on Overcoming Ignorance focuses on overcoming misconceptions and gaining a positive understanding of mathematics. It emphasizes the transformative effect of acquiring knowledge and dispelling ignorance about the subject. A participant stated:

"...having a knowledge of it in a brighter way brings the person outside the darkness of ignorance and leads him into the light of progression..." (L-3)

The statement illustrates the importance of overcoming ignorance to appreciate the value of mathematics. This perspective suggests that students attribute their improved understanding and positive perception of mathematics to their active efforts to learn and comprehend the subject (Gamit, 2022). This internal attribution indicates that gaining knowledge and overcoming misconceptions are seen as personal achievements that enhance their appreciation and recognition of mathematics as a valuable discipline (Villa & Sebastian, 2021; Tobe, 2023).

The central theme, Challenges and Misconceptions, explores students' various challenges and misconceptions regarding mathematics. It includes sub-themes that address negative perceptions and overcoming ignorance to achieve a more positive understanding of the subject. The result reveals that external and internal attributions influence students' perceptions. Negative perceptions are attributed to external factors, such as the opinions and attitudes of others, which can undermine students' appreciation of mathematics (Nabayra, 2022). In contrast, overcoming ignorance is attributed to internal factors, where personal efforts to learn and understand mathematics lead to a more positive perception of the subject (Gamit, 2022). This dual attribution highlights the complex interplay between social influences and personal agency in shaping students' views on the value of mathematics (Tobe, 2023).

Modern Relevance of Mathematics

The sub-theme on Technological Integration explores how mathematics is integrated into modern technology, emphasizing its presence and importance in contemporary technological advancements and applications. A respondent stated:

"...mathematics in the Modern World is present in the modern technology that we are using nowadays..." (L-2)

The statement highlights the integration of mathematics in various technological tools and systems. Students attribute the prevalence and utility of mathematics to the advancements in technology that they interact with daily (Sasota *et al.*, 2021). This external attribution recognizes the role of mathematics as a foundational element in the development and functioning of modern technological innovations, suggesting that students perceive mathematics as crucial for technological progress and everyday technological applications (Gurrea *et al.*, 2022; Nabayra, 2022).

The sub-theme on Financial and Management Skills focuses on the role of mathematics in developing skills related to financial management, emphasizing its practical applications in these areas. A participant claimed:

"...it is also helpful by managing financial and marketing issues..." (L-2)

The statement underscores the importance of mathematics in the context of financial management. Students attribute their ability to manage financial tasks to their mathematical knowledge and skills (Tilan *et al.*, 2021). This internal attribution suggests that students recognize the direct impact of their mathematical abilities on their competence in handling financial and management challenges, highlighting the practical relevance of mathematics in everyday and professional life (Balaza *et al.*, 2021; Gamit, 2022).

The central theme, Modern Relevance of Mathematics, examines the contemporary significance of mathematics, particularly concerning technology and practical skills like financial management. It includes sub-themes that illustrate mathematics' diverse applications and importance in the modern world. The result reveals that external and internal attributions shape students' perceptions. Technological integration is attributed to external factors, where the presence and role of mathematics in modern technology are recognized as essential (Sasota *et al.*, 2021; Gurrea *et al.*, 2022). In contrast, financial and management skills are attributed to internal factors, with students acknowledging the importance of their mathematical knowledge in effectively managing financial and marketing tasks (Balaza *et al.*, 2021; Tilan *et al.*, 2021). This dual attribution underscores mathematics' comprehensive relevance in technological advancements and practical everyday skills (Gamit, 2022).

CONCLUSION

Students attribute significant value to mathematics based on its ability to facilitate everyday tasks, problem-solving,

and survival, recognizing its integral role in modern life and technological advancements. Furthermore, the students acknowledge that individual differences, experiences, and external influences shape their views, underscoring the importance of supportive and personalized approaches to teaching mathematics. These insights highlight the dual importance of mathematics in developing critical cognitive skills, enhancing academic performance, and addressing challenges and misconceptions.

The result also shows that while negative opinions can diminish students' appreciation of mathematics, personal efforts to overcome ignorance and gain knowledge can lead to a more positive perception. This understanding emphasizes the need to address external social influences and foster internal motivation and understanding to improve students' engagement with mathematics. Students recognize mathematics' educational and modern relevance, particularly in its role in technological innovations and practical applications in financial and management contexts, highlighting its pervasive significance in various personal and professional roles.

The study concludes that students perceive mathematics as a crucial tool for navigating modern life, contributing significantly to cognitive development, academic success, and practical problem-solving. External social influences and internal motivations shape students' attitudes toward mathematics. By addressing the challenges and misconceptions surrounding mathematics, educators can foster a more supportive and personalized learning environment, enhancing students' engagement and appreciation of the subject. The dual recognition of mathematics' educational and practical value underscores its integral role in a well-rounded education and its pervasive relevance in various personal and professional contexts.

RECOMMENDATION

Based on the results, the study recommends that educators can adopt a more personalized and supportive teaching approach to address the diverse opinions and experiences that shape students' perceptions of mathematics. Efforts could be made to counteract negative opinions and misconceptions by highlighting mathematics' practical applications and benefits in everyday life and various professional fields. Integrating technology and real-world problem-solving activities into the curriculum can help demonstrate the relevance of mathematics and enhance students' engagement. Additionally, fostering a positive classroom environment that encourages personal efforts to overcome challenges and misconceptions will be crucial in improving students' appreciation and understanding of mathematics. Finally, ongoing professional development for teachers could focus on strategies to address both external social influences and internal motivations to support students' learning effectively.

LIMITATION OF THE STUDY

The study's limitations include its small sample size of only four student respondents and its focus on a

single institution within Malaybalay City, Bukidnon. Additionally, the study's scope was confined to examining the value of mathematics, which may not capture the full range of factors influencing students' perceptions. These limitations suggest that the findings may need to be more generalizable to a broader population, and further research with a more extensive and diverse sample across multiple institutions and regions is necessary to gain a more comprehensive understanding of students' perceptions of Mathematics in the Modern World course.

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