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Perceptions of Non-Math Students in Learning Mathematics: Understanding the Challenges and Opportunities

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Abstract

This study research on mathematics education, specifically focusing on college students who have a strong dislike for the subject. Employing a qualitative research design and an exploratory strategy, this paper analyzed narratives from 50 college students enrolled in non-mathematics courses using theme analysis. The study, conducted in a private higher education institution offering a Bachelor of Science program in Customs Administration, delved into the practical significance of mathematics in students' daily lives. The discussion section explored the paradox wherein students acknowledged mathematics' value but opted to avoid related courses. It advocated for a curriculum prioritizing practical applications of mathematical principles, emphasizing real-life scenarios to enhance student interest. The findings supported a practical approach to mathematics education to change attitudes and emphasized the significance of matching instructional tactics with students' perceived worth. The journal contributed valuable insights to mathematics education, serving as a resource for educators, researchers, and policymakers to enhance teaching methods and foster a positive learning environment for students of varying mathematical abilities.

Keywords: instructional approach, learning mathematics, non-mathematics-oriented course, realistic mathematics education, perceived value

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INTRODUCTION

Mathematics is a fundamental subject that plays a crucial role in various aspects of life, from everyday tasks to scientific advancements. However, for many non-math students, the perception of mathematics is often negative, characterized by feelings of anxiety, difficulty, and irrelevance. These negative perceptions can significantly impact their motivation, and overall performance in mathematics courses.

The present study aims to explore the extent to which students perceive mathematics as relevant and applicable in their everyday lives, and subsequently utilize this perspective to propose potential modifications to the pedagogical strategies employed by educators. The narratives provided by students who are not oriented towards mathematics offer valuable insights into the development of a curriculum that emphasizes the practical applications of mathematics in students' lives. This approach has the potential to positively impact students' perception of and interest in the subject.

Although several students possess natural aptitude in mathematics, a significant proportion of the student body consists of individuals who are not inclined towards the subject. These children frequently experience apprehension when it comes to math and struggle to establish a connection with the content. Consequently, individuals may have feelings of discouragement or lack of motivation, which can result in an unfavorable overall view of mathematics.

Student learning outcomes are directly influenced by the intricate nature of student engagement in mathematics, which encompasses a range of cognitive, emotional, and behavioral concepts (Kong et al., 2003; Al-Mutawah & Fateel, 2018; Lawson & Lawson, 2013; Harun et al., 2021). Students would engage in and derive pleasure from mathematics instruction when they hold a constructive perception of their own capability to succeed (Putwain et al., 2018; Hannula, 2012; Middleton & Spaniard, 1999; Ryan et al., 2022).

In a study conducted by Siregar (2017), it was found that 45% of the student population expressed the perception that mathematics is a challenging subject. Additionally, a significant majority of 80% of the students acknowledged the importance of mathematics as an academic discipline. Moreover, a significant majority of 85% of the students held the belief that the introduction of novel and interactive teaching techniques may improve their level of involvement in the learning process. The mathematics classroom is intentionally structured to foster a communal atmosphere among students. This is accomplished by promoting open dialogues, nurturing the development of ideas, permitting deliberations, and eventually empowering students to get a thorough comprehension of mathematical ideas (Sinay & Nahornick, 2016; Bruce, 2007).

This study aims to evaluate how students with negative perceptions of mathematics view the subject's relevance and significance. It further explores how these perceptions can inform the development of a more engaging and effective curriculum. Emphasis is placed on integrating practical applications to foster student interest and participation in meaningful mathematical activities.

The current study is based on the premise that by fostering students' appreciation for the pragmatic implications of mathematics, their enthusiasm for the subject can be heightened. Recent empirical research conducted by Oppermann et al. (2021) and Gaspard et al. (2019) has found a positive correlation between students' views of the importance of mathematics as opposed to verbal skills and their likelihood of pursuing a profession in the area of mathematics. Therefore, gaining insight into the reasons why students who are not inclined towards mathematics perceive its value in their everyday lives could offer valuable information for the school administration to effectively implement realistic mathematics education.

An example that demonstrates Realistic Mathematics Education (RME) involves studying and analyzing the variations in the number of people getting on busses at a specific bus stop (Wahyudi et al., 2017; and Gravemeijer, 1994). When studying passenger behavior in a bus system, the observed condition includes a procedure that includes subtracting and adding operations, as stated by Wahyudi et al. (2017). This study employed the concept of perceived value towards mathematics to gain insights into the specific domains of students' lives where they utilize mathematical skills.

Undoubtedly, the aforementioned statement can be classified as a manifestation of mathematical conviction. The fundamental focus of implementing mathematical teaching methodologies (Chavez & Lamorinas, 2023) is centered on the formulation of mathematical beliefs (Goldin, 2002). The formation of a student's mathematical belief is influenced by their mindset towards their own understanding of mathematics, leading to an improvement in their mathematical value (Yanita et al., 2018). Effective teaching strategies employed by educators can facilitate the development of students' mathematical beliefs (Greer et al., 2002).

An individual's perspective on mathematics is influenced by their comprehension of mathematical procedures, capacity to generate mathematical concepts, and

proficiency in utilizing diverse problem-solving techniques (Tariq et al., 2013). The term "realistic" is used to highlight the wide range of concepts and ideas that children can develop using their cognitive abilities. The term "real-life problem" denotes a situation or circumstance that arises from actual experiences, while being grounded in formal mathematical principles. Additionally, it refers to a hypothetical scenario that exists outside the boundaries of actuality, but may nevertheless be mentally understood (Fauzana et al., 2020; Panhuizen et al., 2014).

Students who lack a strong interest in mathematics may still recognize its practical relevance, and this recognition can promote greater engagement in learning. Realistic Mathematics Education (RME) supports this by connecting mathematical concepts to real-life contexts, making learning more meaningful and accessible. By situating math within familiar, everyday scenarios, RME fosters student understanding and involvement, particularly for those who struggle to connect with abstract concepts. This approach offers valuable insights for educators aiming to implement strategies that enhance student motivation and participation through practical and relatable learning experiences.

RESEARCH METHOD

The present investigation utilized a qualitative research methodology in order to thoroughly investigate and scrutinize the narratives provided by the participants, who were students. Qualitative analysis, as a research method, involves the systematic examination of patterns found in written or spoken language. This approach aims to delve into the intricate interconnections that underlie how individuals respond to and comprehend a particular phenomenon. Qualitative research is a methodical and thorough methodology that aims to achieve a profound comprehension and examination of complex phenomena by thoroughly investigating individuals' events, views, and storiesThe current study employed an exploratory design, utilizing a qualitative methodology, to examine the experiences and viewpoints of students on the enhancement of the teaching approach in the domain of mathematics. The study additionally sought to ascertain the participants' perspectives regarding the overarching importance of mathematics.

The utilization of an exploratory design proves to be a highly efficacious methodology as it enables researchers to delve into the intricate nuances of participants' experiences, thereby facilitating a comprehensive comprehension of the intricate dynamics inherent in real-world scenarios (Chavez, 2022). By conducting an analysis of narratives, one can shed light on the tangible significance of mathematics beyond the confines of educational environments. This process serves to elucidate the perspectives of students regarding the applicability and utilitarian value of mathematics in their day-to-day lives.

This study was conducted in a private tertiary level. This institution offers a Bachelor of Science in Customs Administration (BSCA) degree program under the College of Customs Administration department.

The study participants consisted of 50 students from the College of Customs Administration who were enrolled in courses that were not focused on mathematics. The participants were selected using a purposive sampling technique, specifically targeting individuals who were enrolled in non-math courses and attending college. The study was restricted to persons belonging to a specified socioeconomic, as defined by these exact characteristics.

The researchers obtained formal consent from the school administrators to carry out the investigation within the confines of the educational institution. The objectives, scope, and aims of the research were elucidated through the issuance of a formal correspondence. The aforementioned letter served to emphasize the utmost importance of the research within the realm of education, highlighting its inherent capacity to augment pedagogical methodologies. The school administrators were apprised of the implementation of an interview-based methodology for data acquisition and were furnished with assurances pertaining to the strict adherence to all requisite ethical considerations.

Students participated in individual face-to-face semi-structured interviews focused on their classroom experiences. While a core set of open-ended questions guided each interview, follow-up questions were used to explore relevant topics in greater depth. Interviews began with the prompt: "What is your experience in learning mathematics as part of completing a degree?" All interviews were transcribed and analyzed using the Colaizzi method a widely recognized qualitative approach used to extract significant themes from participant narratives. This method supported thematic analysis by identifying recurring patterns and relationships, offering deeper insight into students' perceptions and experiences. The rigorous protocols implemented throughout the research project ensure its adherence to ethical standards, fostering transparency and exhibiting proper consideration for the educational institution and the participants engaged. This approach leads to an increase in the reliability and trustworthiness of the study's conclusions.

The present study utilized thematic analysis as a methodological approach to deconstruct and identify the prevailing themes that emerged from the narratives provided by the student participants. The process of conducting a thematic analysis commences with familiarizing oneself with the pertinent facts and information. As part of the research process, the interview transcripts are subjected to meticulous analysis by researchers. This analytical approach is undertaken with the aim of gaining a comprehensive understanding of the information that is conveyed within the transcripts. The stage described herein served as a means by which the researchers were able to gain a comprehensive understanding of the narratives, experiences, and viewpoints expressed by the participants with regards to the importance of mathematics and the instructional approaches employed in its teaching.

Themes, according to Chavez (2022), are repeating sequences of meaning that incorporate ideas, concepts, and attitudes conveyed by individuals. These themes function as a means to identify and examine the fundamental ideas and views inside a specific setting. The identification and exploration of these recurring themes facilitated a comprehensive understanding of the participants' experiences and conceptualizations, enabling the researchers to gain a holistic perspective.

The researchers presented an analysis of the participants' attitudes towards mathematics and their perspectives on various pedagogical approaches employed in its instruction. Through meticulous examination and juxtaposition of these thematic elements, the scholarly investigators achieved a comprehensive comprehension of the diverse cognitive processes employed by individuals who do not specialize in mathematics when contemplating mathematical concepts.

RESULTS AND DISCUSSION

Table 1 displays the main themes and their corresponding sub-themes.

Table 1. Main theme corresponds to sub-theme

Theme	Sub-theme	Examples of transcriptions from the interviews
Overall Utilitarian Concept	Everyday Math Essentials	"I really dislike mathematics, to be honest. That's why I selected a course with a lighter math component. While I recognize the importance of fundamental skills such as addition and subtraction, I find it challenging in most other areas."– (Student 5)
		"I believe that math can be used in everyday life. It helps with running a business, and professionals can do better with a strong grasp of mathematical ideas. This is true for everyone, whether they are a student or have a degree in an area other than math. Math is used in their daily lives."- (Student 11)
		"The math is useful to me even though I'm not good at it. I feel like I need math in my life because it can help me get to specific places and use them whenever I need to."– (Student 20)
	Practical Measurement Applications	"We truly require a method similar to pure math, such as measuring things...when a formula is available. In ratio, for instance. The topic of unit conversion and metric system conversion is also covered in mathematics. Unit conversion and metric system conversion are topics covered in mathematics as well."– (Student 11)
		"We still need math, just like we need it for trains. We have to make sure we pay the right amount of money every time we take the jeepney or any other type of public transportation. I'll still need numbers to buy food at school after that. The money needs to be added up." (Student 15)
The Utilization of Self-Control and Self-Regulation	Cognitive Math Enhancement	"I really struggle with math because it takes a lot of mental skills. For example, simple math tasks like adding and subtracting help me get smarter quickly, which boosts my intellectual identity." (Student 8)
		"Learning math, especially on its real-life applications, makes you more positive on how we could use simple additions to make something useful in humans." (Student 33)
Life-essentials with Math	Everyday Problem-solving	"Learning math, especially on its real-life applications, makes you more positive on how we could use simple additions to make something useful in humans." – (Student 30)
		"Math is anywhere around us. When you learn math, you also appreciate that even your life-essentials like electricity and housing rely on math." (Student 25)

Overall Utilitarian Concept

The prevailing consensus among students who exhibit a limited inclination towards mathematics is that they acknowledge the importance of acquiring mathematical knowledge owing to its tangible relevance in various real-world contexts. Approximately 8 students especially emphasized fundamental computational abilities, such as addition, subtraction, and number conversion, as the most pertinent and

advantageous mathematics skills. Several individuals also provided instances of how they utilize mathematical concepts in everyday situations such as shopping, purchasing goods, and utilizing transportation.

> "I really dislike mathematics, to be honest. That's why I selected a course with a lighter math component. While I recognize the importance of fundamental skills such as addition and subtraction, I find it challenging in most other areas."

> "I believe that math can be used in everyday life. It helps with running a business, and professionals can do better with a strong grasp of mathematical ideas. This is true for everyone, whether they are a student or have a degree in an area other than math. Math is used in their daily lives."

> "The math is useful to me even though I'm not good at it. I feel like I need math in my life because it can help me get to specific places and use them whenever I need to."

Utilization of Self-Control and Self-Regulation

Additionally, certain students hold the belief that mathematics is not merely an academic topic, but rather a transformative experience that has a lasting impact on one's life. They recognize its practical application and its pervasive presence, even when we are unaware of its influence.

Students who are not inclined towards maths appreciated the practical application of mathematical concepts in their everyday lives. The utilization of mathematics was observed in the context of fundamental transactions within a store, encompassing the process of adding numerical values. Additionally, mathematics was also employed for the purpose of facilitating transportation activities. Multiple respondents expressed their positive reception towards the utilization of mathematical principles in the context of self-regulation and management. They reported that this approach facilitated their understanding and improvement of various skills. It has been observed that certain individuals acquire a profound appreciation for the field of mathematics as a result of its widespread application in various essential domains of human existence.

> "We truly require a method similar to pure math, such as measuring things...when a formula is available. In ratio, for instance, the topic of unit conversion and metric system conversion is also covered in mathematics. Unit conversion and metric system conversion are topics covered in mathematics as well."

> "We still need math, just like we need it for trains. We have to make sure we pay the right amount of money every time we take the jeepney or any other type of public transportation. I'll still need numbers to buy food at school after that. The money needs to be added up."

Life-Essentials with Math

The emergence of the concept of appreciation for the subject was also evident. Several students held the belief that acquiring knowledge in mathematics enhances their ability to recognize and value mathematical concepts in their surroundings. The principles of mathematics are inextricably entwined with various vital components of human existence, such as energy and housing.

> "Learning math, especially on its real-life applications, makes you more positive on how we could use simple additions to make something useful in humans."

> "Math is anywhere around us. When you learn math, you also appreciate that even your life-essentials like electricity and housing rely on math."

It was observed that students who lacked interest in mathematics demonstrated an appreciation for the practical application of mathematical concepts in their daily lives. The utilization of mathematical principles was employed in order to conduct observations, specifically through the process of summing integers in a basic commercial transaction, as well as for the purpose of transportation. Several individuals expressed their appreciation for the utilization of mathematics in the context of self-control and management, as it facilitates the recognition and refinement of individuals' skills. Gratitude towards mathematics often emerges as a result of its widespread application in complex everyday necessities.

Prior studies have examined students' viewpoints on the practical use of mathematics in their everyday life (Daud et al., 2020; Olasehinde & Olatoye, 2014). According to Hagan et al. (2020), there is a perception among students that mathematics holds significant importance as a core subject and that possessing mathematical knowledge is essential for everyone. The perception that mathematics serves as the foundation for scientific knowledge is apparent even in ancient times, as individual's inherently associate mathematics with scientific understanding (Anthony & Walshaw, 2009). The issue at hand pertains to the fact that despite students acknowledging the perceived value of mathematics in their daily lives, they consistently exhibit a preference for opting out of mathematics-related courses whenever feasible, instead opting for alternative courses with a lower number of mathematical units (Brown et al., 2008). According to Participant 5, students often develop a negative attitude towards mathematics and tend to opt for courses that involve less mathematical content. Attitudes and beliefs about the challenging nature of mathematics can impact a student's choice to pursue a profession in the subject of mathematics. Khan (2012) noted that mathematics is generally not a topic that is widely favored by children. According to a study conducted by Göller (2020), there exists a perception among certain students with a focus on mathematics that concepts such as proof are not applicable to their future careers. The field of study under consideration poses a multitude of obstacles, which often result in a loss of interest and subsequent decision by a significant number of students to withdraw from this particular academic domain (Akhter & Akhter, 2018).

Initially, the present study aimed to investigate the discrepancy between the perceived value of mathematics and the actual inclination to pursue it. Although students perceive the subject to possess inherent value in their daily lives, a subset of individuals consciously elect to abstain from engaging in the learning process associated with it. Perceived value refers to the evaluation made by consumers on the value of a specific product or service. This assessment is grounded on their personal interpretation of the result arising from the interaction between their contribution and the benefits they receive (Amado-Mateus et al., 2023; Zeithaml, 1988). The present study builds upon the concept of perceived value as introduced in the field of marketing (Alves, 2011), and extends its application to the domain of skill acquisition and learning. Upon further investigation, it has been discovered that students attribute significance to the field of mathematics due to its practical applications in real-world scenarios. The concept described here shares similarities with the idea of perceived worth in the field of advertising (Lai et al., 2012; Sheth et al., 1991). It is observed that students attribute significance to the acquisition of mathematical proficiency, despite acknowledging certain challenges associated with the perceived complexity of the subject matter.

Perceived value plays a crucial role in shaping students' perceptions, attitudes, and acceptance of mathematics and their engagement in mathematics learning. According to Büdenbender-Kuklinski et al. (2022), students' perception of significance is not exclusively dependent on utilitarian considerations. Instead, it encompasses a wider array of factors, such as personal interest and curiosity. According to one participant, who identified as a student, it was expressed that despite not being inclined towards mathematics, there is still perceived value in the subject matter [Participant 8]. Further investigation of this phenomena has the capacity to offer valuable understanding of the complex interplay between internal motivation, cognitive involvement, and how one thinks of significance within educational settings.

The acknowledgment of the importance of mathematics by students may act as an indication of their ability to make a connection among their enthusiasm in the topic and their future career aspirations. Consequently, this indicates a positive assessment and recognition of the practical usability of mathematics in real-world scenarios. Within the scope of this investigation, the focus lies on examining the relationship between the perceived value of mathematics and the level of interest displayed by students towards the subject. According to one participant (Participant 20), there is a belief that learning mathematics, particularly when it is applied to real-life situations, can foster a positive mindset regarding the potential utility of basic addition operations in human contexts.

A low perception of value can act as a barrier to student engagement in learning mathematics. According to expectancy-value theory, students are more likely to invest effort when they view a task as meaningful or useful. Previous studies (Gaspard et al., 2019; Lauermann, 2015) emphasize the importance of how students evaluate the relevance of learning activities. While recognizing the value of mathematics is important, this perception alone does not automatically lead to active engagement. Other factors such as interest, confidence, and perceived difficulty also play critical roles in shaping students' willingness to participate in learning tasks.

Although some students lack strong interest in mathematics, they still acknowledge its practical value in daily life, such as managing finances, performing calculations, and navigating transportation. Interestingly, despite recognizing its importance, many students choose not to pursue math-related courses. This highlights a disconnect between perceived relevance and actual engagement, suggesting that factors like personal attitudes, perceived difficulty, and individual interests significantly influence their academic choices.

CONCLUSION

While acknowledging the pragmatic value of mathematics in their daily lives, a significant portion of these students continue to exhibit hesitancy in fully embracing the subject. There is a suggestion that educators should take use of students' understanding of how mathematical concepts may be used in real-life situations. This can be done by creating a curriculum that focuses on the practical relevance of mathematical principles. By integrating tangible elements and incorporating real-world scenarios into "mathematics" lessons, educators have the potential to bridge the existing gap between active student engagement and perceived value. This, in turn, can enhance student motivation and involvement.

The present study has successfully showcased the potential of realistic mathematics education in offering students the opportunity to engage with mathematical concepts within the context of their daily lives. Upon adoption, these strategies have the ability to create a classroom atmosphere that is marked by

heightened positivism and energy. This setting has the ability to cater to various learning preferences, thereby helping to decrease the negative connotations sometimes associated with the subject matter. The research study placed significant emphasis on the cruciality of aligning instructional tactics with students' perceived value. Through the utilization of practical applications and the cultivation of intrinsic motivation, there exists the potential to fundamentally transform the methodology employed in the realm of mathematics education for college students who exhibit a dearth of enthusiasm towards the subject matter.

DECLARATION

Author Contribution

All authors contribute in the research process, such as collecting the data, analyzing the data, and writing the manuscript. All authors approved the final manuscript.

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Conflict of Interest

All authors declare that they have no competing interests.

Ethics Declaration

We as authors acknowledge that this work has been written based on ethical research that conforms with the regulations of our institutions and that we have obtained the permission from the relevant institutes when collecting data. We support the International Journal on Emerging Mathematics Education (IJEME) in maintaining high standards of personal conduct, practicing honesty in all our professional practices and endeavors.

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