



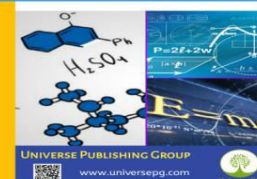
Publisher homepage: www.universepg.com, ISSN: 2707-4625 (Online) & 2707-4617 (Print)

<https://doi.org/10.34104/ijmms.024.085099>

International Journal of Material and Mathematical Sciences

Journal homepage: www.universepg.com/journal/ijmms

International Journal of
**Material and
Mathematical Sciences**



Attitude and Challenges in Learning Mathematics in the Modern World (MMW): Basis for Intervention Program

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ABSTRACT

Difficulty in learning mathematics is a common and significant problem throughout the school years. It was identified that only 19% of Filipino students met the Low benchmark, meaning they had “some basic mathematical knowledge,” while 81% did not reach this level. Filipino students also lagged behind other countries in the international assessment for mathematics as mentioned in the Trends in International Mathematics and Science Study 2019 (TIMSS). To address this; a researcher conducted a study to explore students’ attitudes and challenges in learning Mathematics in the Modern World (MMW). The data gathered were used in formulating intervention programs. The study utilized the descriptive method of research and employed a survey questionnaire as the main data-gathering instrument. It involved the participation of all college students from the University of Batangas who were taking Mathematics in the Modern World (MMW) during the school year 2022-2023 using a purposive sampling technique. Furthermore, the responses of the respondents were computed using frequency count, percentage, weighted mean, ranking, and chi-square as the main statistical treatments of data. Ethical guidelines were highly considered to maintain the confidentiality of the study. Key findings include that the majority of the students are 19-21 years old, male, and enrolled in Criminology courses. Students strongly agreed and exhibited a positive attitude toward wanting to develop their mathematical skills. It was observed that there is a positive and moderate correlation between the attitude and the challenges encountered by the students in learning Mathematics in the Modern World (MMW). The main challenge identified is the difficulty in remembering math facts, concepts, rules, formulas, sequences, and procedures. The researcher proposed different intervention programs to address the challenges encountered by students in learning MMW.

Keywords: Attitude, Challenge, Descriptive method, Intervention programs, and Mathematics learning.

INTRODUCTION:

Amidst the development of civilization, mathematics has emerged as a cornerstone of scholarly inquiry. The study of mathematics is not merely a pursuit of academic interest but an essential requirement for navigating the complexities of the contemporary

world. Both the structure of school curricula and the emphasis placed on mathematical education bear testament to this vital relevance. Mathematics, often revered as the universal language, assumes a pivotal role in shaping the intellectual fabric of individuals and societies alike. In the contemporary era dominated

by technology and scientific advancements, the significance of mathematics in education cannot be overstated. However, the acquisition of mathematical knowledge is not without its challenges, with students' attitudes towards the subject often serving as a determining factor in their academic achievement.

Within the Philippine educational framework, the Commission on Higher Education undertook an evaluation of the general education curriculum, resulting in a significant reduction from the previous 63 course units to a streamlined 36 units. The revamped general education curriculum is structured around eight core courses, one of which is Mathematics in the Modern World (Valencia, 2015). This course delves into pertinent issues such as algebra and its practical applications in addressing everyday problems encountered by students. This course aims to provide students with opportunities to tackle problems that illustrate how mathematics can be applied across various occupations and human endeavors (DLSU, 2015). Analyzing the course's impact on both students and teachers, while aligning with the desired outcomes, is crucial for enhancing the teaching and learning process. Outcomes-based education (OBE), which prioritizes excellent instruction and innovative instructional methods, ensures that students achieve course objectives. Given mathematics' inherent connections to numerous other fields and disciplines, it has long garnered significant attention in schools. Furthermore, students' success in mathematics is a matter of global concern in many nations. Issues in math learning have been associated with students' limited control over their learning processes and the perception of the subject as difficult. According to Wolters, (2010) self-regulation in learning is linked to 21st-century learning competencies, making it challenging for unregulated students to overcome obstacles in their learning. Students are significantly affected by the rapid changes in educational systems and delivery styles, requiring them to learn efficiently and independently. To achieve this, students need to be taught how to enhance their ability to choose the most effective learning technique. Failure to do so can impact students' motivation and attitude towards learning, leading to a decline in interest. Motivation, as a catalyst for successful task completion, is a crucial

aspect of the learning process. Therefore, motivation is essential for the successfully overcoming academic obstacles.

Moreover, students use motivation as a basis for their attitude towards learning and performance. Attitudes related to academic motivation, such as the desire to tackle challenging tasks and persevere in difficult situations, determine students' ability to navigate daily school challenges. The learning of mathematics is significantly influenced by an individual's attitude, characterized as a tendency to react either favorably or unfavorably to a particular thing, person, or circumstance. Many students harbor negative perceptions of the subject, often stemming from misconceptions about its difficulty or relevance to everyday life. Overcoming such negative mindsets is essential for creating a positive learning environment. Traditional teaching approaches may not align with the diverse learning styles of today's students, contributing to negative sentiments towards mathematics. Adopting an interactive, application-based approach can make mathematics more engaging and relevant. By bridging the gap between theory and practicality through real-world applications, teachers can reshape students' perceptions of mathematics. Learning mathematics remains a persistent and significant challenge throughout the school years, with only 19% of Filipino students attaining the Low benchmark indicating "some basic mathematical knowledge," while a staggering 81% did not reach this level. Additionally, in international assessments such as the Trends in International Mathematics and Science Study 2019 (TIMSS), the Philippines scored the lowest among all 58 participating countries for both tests. Various factors contribute to the complexity of learning mathematics, including conceptual difficulties and external influences such as educational resources and socioeconomic backgrounds. Mathematical concepts are often abstract, posing challenges for students to grasp them conceptually. To address these obstacles, a comprehensive understanding of the underlying reasons and a tailored intervention strategy are necessary.

Another significant issue that frequently leads to math anxiety in students is the fear of failure. Intervention

programs should prioritize establishing a safe and supportive learning environment that encourages students to take calculated risks, values effort over innate talent, and fosters a growth mindset. To alleviate anxiety and promote a positive learning environment, educators can redefine the narrative surrounding success and failure. A comprehensive understanding of the factors influencing attitudes and challenges in learning mathematics is crucial for designing effective intervention programs. Teacher professional development plays a pivotal role in this endeavor, as educators can revolutionize the learning process by incorporating cutting-edge teaching techniques, leveraging technological resources, and adapting to the diverse needs of their students. Intervention programs should also encompass peer support networks and mentorship initiatives. Collaborative learning environments have been shown to positively impact mathematical performance and attitudes, allowing students to work together to solve problems and exchange insights. Cultivating a sense of belonging and shared accountability helps alleviate the feelings of isolation that often accompany difficulties in mathematics. In summary, addressing the complexities of attitudes toward and obstacles in studying mathematics requires deliberate action. By tackling the various challenges students face and understanding the underlying reasons for negative attitudes, teachers can create a more engaging and productive learning environment. Implementing focused intervention programs that emphasize creative teaching methods, mentorship, and collaborative learning can empower a generation to embrace mathematics as a necessary and empowering skill in contemporary society. Based on this information, the researchers aim to conduct a study exploring students' attitudes and daily challenges encountered in learning Mathematics in the Modern World (MMW). These challenges may serve as obstacles hindering students' progress in mathematics education, given the evolving nature of mathematics education, delivery systems, and potential factors that impede students' learning. The primary objective of the current study is to assess the attitudes and challenges faced by students in learning Mathematics in the Modern World (MMW). The collected data will serve as a foundation for crafting intervention programs aimed at addressing these issues.

This specifically seeks to achieve the following objectives:

1. Identify the demographic profile of the respondents in terms of:
 - Age
 - Gender and
 - Program of study.
2. Determine the student's attitude toward learning Mathematics in the Modern World (MMW).
3. Determine the obstacles faced by students when learning Mathematics in the Modern World (MMW).
4. Assess the significant relationship between the students' attitudes and the challenges they encountered in learning Mathematics in the Modern World (MMW).
5. Based on the findings, suggest intervention initiatives aimed at mitigating the difficulties experienced by the students.

Review of Literature

Proficiency in mathematics is crucial for the economic success of cultures and is integral to the scientific and technical advancement of countries (Enu *et al.*, 2015). This importance stems from the fact that mathematics is indispensable for understanding various academic disciplines, including engineering, physics, social sciences, and even the arts (Phonapichat *et al.*, 2014). Abe and Gbenro, (2014) highlight the multifaceted role of mathematics in science and technology, with applications spanning across all fields of study, industry, and technology. Given the significance of mathematics, it has been incorporated as a core subject in school curricula. The primary objective of the mathematics curriculum, as noted by Ngussa and Mbuti, (2017) is to equip students with the knowledge and skills necessary to thrive in today's rapidly evolving technological landscape. In Tanzanian primary and ordinary-level secondary schools, mathematics is considered an essential course that all students must take. Alongside mathematics, the curricula of ordinary-level secondary schools typically include subjects such as geography, Kiswahili, English, civics, history, and biology. However, Tanzania is not unique in perceiving mathematics as one of the most challenging subjects. Data over the past fifteen years have indicated a declining trend in

Tanzanian students' overall performance on the Certificate of Secondary Education Examination (Mabula, 2015). Ngussa and Mbuti, (2017) highlight several factors contributing to the high failure rates in mathematics and the resulting disorientation in students' learning. For instance, data from the National Examinations Council of Tanzania (NECTA) revealed alarming statistics, with 70.1% of ordinary-level secondary school students and 66.6% of standard 7 students failing their final year mathematics exams. Additionally, in 2016, failure rates stood at 53.4% for primary school students and 81.9% for secondary school students (NECTA, 2016). These persistent trends of low performance in mathematics raise concerns among the public regarding the educational system's ability to produce graduates equipped with the necessary skills to thrive in today's rapidly changing society. Such findings underscore the importance of further investigation into the various factors influencing students' mathematical proficiency, facilitating the development of effective strategies to improve math pass rates in the future.

According to (Tshabalala and Ncube, 2016; Ramos *et al.*, 2024) the performance of students in mathematics can be significantly influenced by various factors exhibited by teachers and schools, suggesting that low performance in mathematics is often the result of multifaceted issues related to students. Many experts contend that a student's mindset plays a crucial role in determining their performance in mathematics (Ngussa & Mbuti, 2017). As defined by Sarmah and Puri, (2014) attitude refers to the ability to react favorably or unfavorably to various stimuli such as circumstances, items, concepts, or individuals. Attitudes are not static; they can evolve and change over time (Syeda, 2016). Establishing a positive attitude toward mathematics can enhance students' academic performance, while a negative mindset can hinder learning outcomes. Therefore, attitude is a critical factor that cannot be overlooked. Depending on the learner, attitude can have either a positive or negative impact on their mathematical performance. This study seeks to investigate Tanzanian students' perspectives on learning mathematics as a means to address this issue. The primary objective of this study was to explore Tanzanian students' attitudes toward mathe-

matics and the factors influencing these attitudes, as well as their impact on academic performance. Drawing on Walberg's Theory of Productivity and the ABC Model, the research sought to understand the reasons behind students' preferences or aversions to mathematics. A mixed-methods approach was employed, involving quantitative surveys and qualitative analysis, to gather data from a diverse sample comprising 419 primary school students, 318 secondary school students, and 132 college students across 17 schools and 6 colleges in mainland Tanzania. Statistical techniques such as ANOVA, correlation, regression, percentages, means, and standard deviations were utilized to analyze the quantitative data, while thematic analysis was employed to interpret qualitative responses. Through this comprehensive investigation, the study aimed to shed light on the complex interplay between the school environment, teaching strategies, students' attitudes, and academic achievement in mathematics among Tanzanian students.

The findings reveal a shift in students' attitudes toward mathematics as they progress through their education, transitioning from initially favorable attitudes to more nuanced perspectives. Despite this evolution, there remains a significant positive correlation between attitudes and academic performance among students. The study underscores the influential role of students' attitudes and enjoyment of mathematics in shaping their academic outcomes. These attitudes are shaped by various factors, including individual aptitude, instructional practices, social and psychological contexts, and other external influences. Additionally, the research highlights the multifaceted nature of exam failure, which can be attributed to a range of factors such as educational deficiencies, testing methodologies, institutional resources, teaching approaches, and comprehension challenges. In light of these findings, Mazana *et al.* (2019) suggest avenues for further research and advocate for adjustments in teaching methodologies aimed at fostering students' interest in mathematics and improving their performance in the subject. Various definitions of students' attitudes toward mathematics can be found in the literature. For instance, Kibrislioglu, (2016) defines attitude toward mathematics as encompassing one's

preference for or aversion to the subject, inclination to engage or abstain from mathematical activities, belief in one's proficiency in the subject, and conviction regarding the usefulness or futility of mathematics. In a recent study, secondary school students in Arusha, Tanzania, participated in research by Ngussa and Mbuti, (2017) revealing a moderate association between students' performance and attitude when teachers employed humor as a teaching method. The researchers concluded that enhancing students' positive attitudes could enhance their mathematical performance. Similarly Naungayan, (2022) examined the link between high school students' mathematics achievement and their attitude toward the subject. Using a descriptive correlation design along with a validated questionnaire and documentary analysis, the study found that students' attitude toward mathematics was generally favorable, and their mathematics achievement approached competence levels. The results highlighted the correlation between a student's success in a subject and their attitude toward it. Individual factors, such as a student's attitude toward mathematics, significantly influence their performance in the subject (Andaya, 2014), corroborating the findings of Patena and Dinglasan, (2013). Their research indicated that students' attitudes toward mathematics significantly impact their achievement. Moreover, the respondents generally exhibited a positive attitude toward mathematics. A positive attitude toward mathematics signifies an interest or enthusiasm for the subject. However, despite making efforts to approach the subject positively, many students still find mastering mathematics challenging. According to Suan's, (2014) study, student characteristics such as time management, study habits, attitudes, and interest in mathematics are significant factors in determining a student's success in the subject. This finding aligns with research conducted by Dela Cruz, (2018) which suggests that students with positive attitudes and strong beliefs about their studies tend to perform better. Additionally, research conducted on Australian secondary school students indicates a potential relationship between students' attitudes toward mathematics and their achievement levels in the subject. Female students, in particular, were found to have a higher understanding of mathematics compared to their male counterparts. Further-

more, there was a strong correlation observed between attitude toward mathematics and mathematics achievement, as measured by the LANNA Numeracy and Reading test results.

The study also revealed a significant correlation between achievement and attitude toward mathematics, consistent with previous research findings. It was observed that there was a moderate level of general attitude toward mathematics among the students surveyed. Additionally, the study found a substantial association between students' proficiency in mathematics and their patience levels when solving problems, although no significant relationship was found between students' confidence in their problem-solving abilities. However, the correlation between mathematical aptitude and disposition toward the field was found to be weak. Despite a positive correlation coefficient, there was no meaningful association between the two variables (Escalona, 2015). Regarding attitudes toward mathematics, Flynn, (2013) highlighted discrepancies in some research findings, emphasizing that results may only be representative of the sampled population. Ayuman-Valdez and Guiab, (2015) explored potential predictors of grade six math proficiency among students in the Northeast Cauayan District. The majority of student responses (399) reflected a general average categorized as "Approaching Proficiency," ranging numerically from 80 to 84, with those achieving an average defined as "Proficient" (85-89) coming in second. The study revealed that students' achievement is significantly influenced by their perceptions of their math teachers. It was suggested that implementing an intervention program aimed at enhancing students' perceptions of their teachers could lead to improved performance. While defense orientation and math self-perception showed no significant link and were considered inconsequential, attitude, success orientation, and self-confidence were found to have a minor correlation with mathematics performance. Despite Singaporean pupils' outstanding performance in TIMSS exams, research suggests that their self-concept in learning mathematics and their appreciation of mathematics are lower compared to the international average (Gafoor & Kurukkan, 2015). Self-concept, personal characteristics, and family background factors have been

identified as significant predictors of academic achievement, following attitude (Hamid *et al.*, 2013). Studies have highlighted the detrimental impact of arithmetic anxiety and test stress on Brunei secondary school students' mathematical proficiency, underscoring these psychological factors as significant barriers to academic success (Hamid *et al.*, 2013). Understanding the variables influencing students' achievement in mathematics across various learning levels is crucial for identifying factors that may contribute to success or failure in this subject. Therefore, the present study aims to explore the potential relationship between students' achievement in mathematics and their attitude toward the subject. Conversely, Subia *et al.* (2018) conducted a correlational study using a questionnaire to investigate the association between attitude and math performance among 105 first-year Bachelor of Elementary Education (BEEd) students. Their findings revealed that the respondents' performance in Mathematics I was below average, with a strong correlation between their attitudes and performance in the subject ($r = .792^{**}$, $p < 0.01$ for positive attitudes and performance, and $r = -.940^{**}$, $p < 0.01$ for negative attitudes and performance). Despite recognizing the potential benefits of mathematical puzzles for enhancing critical thinking skills and acknowledging the importance of strong mathematical skills for success in life, the respondents held a negative overall attitude toward mathematics. They expressed fear of math problems and tended to disengage when encountering difficulty. These results highlight the importance of addressing negative attitudes toward mathematics among students and underscore the role of curriculum planners, administrators, and math teachers in improving math-related policies and pedagogies. Moreover, a report published in Ashcraft (2017) indicates that the Philippines is lagging behind other Asian nations in various examinations, both domestically and internationally, partly due to negative attitudes toward mathematics among Filipino students. Additionally, factors such as the shortage of capable elementary school teachers and declining pass rates in the Teacher Licensure Examination contribute to the challenges in mathematics education. Köğçe *et al.* (2018) study further reveals that a significant percentage of elementary school teachers, despite their role in

teaching mathematics, would not have chosen to teach the subject if given the option. This raises concerns about the mindset and attitudes elementary school math teachers may instill in their students, potentially impacting academic success and the quality of education. Considering psychologists' assertions that students' attitudes toward mathematics are formed early in life, there is a risk that students may adopt the negative attitudes of their teachers, highlighting the critical need for interventions to promote positive attitudes and improve mathematics education at the elementary level. According to Rameli and Kosnin, (2016) one of the primary challenges in mathematics education is students' performance in the subject, with many perceiving mathematics as one of the most difficult core courses to learn. This pessimistic outlook may stem from various factors hindering their understanding of mathematics. To gain insight into these impediments, this study investigated the challenges, hurdles, and difficulties faced by students in learning mathematics. Employing a case study design with qualitative investigation, a stratified random sample technique was used to select 150 secondary school students from Forms 2 and 4 to respond to an open-ended questionnaire. The results revealed thirteen subthemes and five main themes: self-factors (low self-regulation, negative perception), teacher-related factors (behaviors, practices, and characteristics), parental influence (lack of emotional, financial, and cognitive support), peer dynamics (negative attitudes, behaviors, and lack of support), and other factors (nature of math and assessment pressure). These findings carry significant implications for practitioners and researchers working with students to help them overcome obstacles in their academic endeavors, particularly in mathematics education.

Moreover, today's students require deeper mathematics knowledge, skills, and values to pursue higher education, engage in the technologically advanced workforce, and become informed citizens (Bearneza, 2020). In response to these needs and changes, the K–12 Enhanced Basic Education Program, a component of the revamped Philippine educational system, aims to develop each student into "a holistically developed Filipino with 21st-century skills." To address these challenges, the Commission on Higher Education

(CHED) issued CMO No. 20 series 2013, outlining the New General Education Curriculum (NGEC) within the framework of the K–12 curriculum. General education, a mandatory component for all undergraduate students regardless of their major, aims to produce well-rounded graduates grounded in humanist principles, with a strong awareness of their identities as individuals, Filipinos, global citizens, and stewards of the environment (Booker & Lim, 2018). Outcomes-based education (OBE) is a method that places the educational system's focus on the knowledge, skills, and abilities that each student must possess to achieve a certain level of competency. The current curricula of higher education institutions (HEIs) are open to incorporating discipline-based learning areas. HEIs are encouraged to delineate the attributes of their ideal graduates as part of their goals and outcomes, which will serve as the basis for developing specific program outcomes (Can *et al.*, 2017). To ensure that these predetermined program outcomes are met, HEIs have the freedom to design curricula that are suitable for their specific contexts and purposes. They can also choose the most effective delivery methods, support facilities, and instructional materials. HEIs have the autonomy to select the distribution method that best aligns with their needs to ensure the attainment of the program's objectives. Mathematics in the Modern World (MMW) is among the general education courses required for all first-year college students. This course delves into the nature of mathematics, its intellectual, practical, and artistic dimensions, and its application in everyday scenarios. At the outset, students are introduced to the nature of mathematics as an exploration of patterns and an exercise in inductive and deductive reasoning. Throughout the course, students are encouraged to transcend the conventional view of mathematics as merely a collection of formulas. Instead, they are prompted to perceive mathematics as a sophisticated language driven by logic and reasoning, as well as a source of aesthetic beauty through the patterns observed in nature. The course aims to demonstrate how mathematics serves as a versatile tool for understanding and managing various contemporary issues. Topics covered include personal finance management, social decision-making, and appreciation of geometric designs, understanding data transmission and security codes, and equitable

allocation of scarce resources (CHED MMW Syllabus). By engaging with these elements, students have the opportunity to apply mathematical concepts in real-world contexts, thereby illustrating the multifaceted nature of mathematics as a mode of knowledge. Through such applications, students can assess their comprehension and aptitude in diverse mathematical contexts. Students' levels of mathematics anxiety and self-efficacy often influence their achievement in college-level mathematics. Educators endeavor to enhance students' self-efficacy, alleviate anxiety associated with the subject, and cultivate positive attitudes towards mathematics. However, teachers may lack consistent, realistic, or effective methods for assessing these constructs. Positive attitudes towards learning mathematics are linked with improved learning outcomes, including readiness and motivation to engage with the subject material, active participation in classroom activities, resilience in the face of challenges, and reflective learning practices. Conversely, college students with low self-efficacy in mathematics may exhibit decreased motivation to study, potentially leading to lower academic achievement in mathematics (CHED Memorandum Order No. 1, Series of 2013).

Numerous studies have explored the attitudes of students towards mathematics and the various factors that influence such attitudes. Within the realm of teaching and learning mathematics, attitudes towards the subject matter hold significant importance (Commission on Higher Education Handbook on Typology, Outcomes-Based Education, and Institutional Sustainability Assessment, 2014), as they directly impact students' mathematical performance. The manner in which mathematics is taught, the level of support provided by the educational system, family dynamics, and individual student attitudes towards learning all contribute to shaping students' perceptions of mathematics. Additionally, students' attitudes towards mathematics have been found to be influenced by instructional strategies that promote active learning, engage students with meaningful content, present math problems and anecdotes, incorporate humor, utilize Socratic questioning, and provide exercises aimed at enhancing abstract thinking and problem-solving skills. These findings highlight the critical role of both

pedagogy and environmental factors in shaping students' attitudes towards mathematics and ultimately impacting their mathematical achievement. Moreover, student-centered and collaborative learning approaches have shown promise in enhancing attitudes and self-efficacy in undergraduate mathematics courses. It's been observed that a student's affinity or aversion to mathematics is influenced by a combination of factors including their individual ability, as well as various educational, social, psychological, and environmental aspects (Konarzewski, 2019). These findings underscore the importance of employing instructional strategies that foster active engagement and enhance students' arithmetic proficiency. Furthermore, to promote student success, it's essential for both practitioners and researchers to emphasize the significance of teachers' warmth and the relevance of their instructional content (Mazana *et al.*, 2019). The Mathematics in the Modern World (MMW) course is a mandatory component of all bachelor's degree programs within the School of Arts, Sciences, and Teacher Education in the Philippines. First-year college students are required to enroll in the MMW course during the first semester of the academic year 2018-2019, marking the initial implementation of the new curriculum. Consequently, evaluating the effectiveness of the new course's instruction and learning outcomes is timely and pertinent. The insights gleaned from this study will undoubtedly inform educators in refining their instructional approaches and shaping future initiatives aimed at enhancing mathematics instruction and the student learning outcomes.

METHODOLOGY:

The study employed a descriptive research method to assess students' attitudes and challenges in learning Mathematics in the Modern World (MMW). Descriptive research, as noted by Kulikova, (2015) offers a systematic, factual, and accurate portrayal of the phenomena under examination. Data collection primarily relied on a survey questionnaire comprising two parts. The first part focused on students' attitudes towards learning Mathematics, utilizing 40 items adapted from the Attitude towards Mathematics Inventory (ATMI) by Tapia (1996). This instrument underwent rigorous validity and reliability testing,

yielding a mean validity score of 4.30 and a reliability coefficient of 0.92 via Cronbach Alpha. The second part addressed the challenges encountered, with the research instrument undergoing validation and expert review to ensure its efficacy. The study involved the participation of all college students enrolled in Mathematics in the Modern World (MMW) at the University of Batangas during the 2022-2023 academic year. The purposive sampling technique, a non-probability sampling method, was utilized to identify the target respondents from a population of 800 students. Sample size computation was conducted using a Rao soft calculator, resulting in a computed sample size of 250, which served as the primary research participants. Data analysis involved tallying and interpreting the consolidated responses using a four-point scale. Statistical treatments employed included frequency count, percentage, weighted mean, ranking, and chi-square tests. Ethical considerations were paramount, with strict adherence to guidelines to maintain confidentiality. Respondents' real names were withheld, and all gathered data and information were kept confidential throughout the study.

RESULTS AND DISCUSSION:

The tabulated data aligns with the objectives outlined at the beginning of the paper, providing a comprehensive overview of students' attitudes and challenges in learning Mathematics in the Modern World (MMW). Statistical descriptions and analyses are appropriately applied to the data, facilitating interpretation and understanding. The presentation, analysis, and interpretation of findings are discussed thoroughly, ensuring clarity and insight into the results obtained from the collected data. Overall, the study effectively fulfills its intended objectives through systematic data presentation and analysis, leading to meaningful interpretations and conclusions.

Demographic Profile of the Respondents

As indicated from the data, it presents and explains the demographic profile of the student-respondents of the study. **Table 1** provides the demographic profile of the respondents, detailing their age, gender, and program of study. The data indicates that the majority of respondents fall within the age range of 19-21 years old ($f=265$, 82.81%), with a higher proportion being

male (f=175, 54.69%), and enrolled in the Criminology course (f=83, 25.94%). This suggests a predominantly young student body, which may result in a homogeneous age group with similar experiences, challenges, and expectations. To effectively cater to the unique needs and preferences of this age

demographic, educators may need to adapt their teaching strategies and resources accordingly. This observation is supported by the findings of Ghasemi et al. (2019), which indicated no statistically significant differences in math achievement between boys and girls, as well as in the proportion of high achievers.

Table 1: Demographic Profile of the Respondents.

Age	Frequency	Percentage
19-21years old	265	82.81
22-24 years old	26	8.13
25-27 years old	18	5.63
28-30 years old	1	0.31
Total:	320	100
Gender	Frequency	Percentage
Male	175	54.69
Female	145	45.31
Total:	320	100
Program of Study	Frequency	Percentage
Associate Computer Technology	20	6.25
Arts and Sciences	75	23.44
Business, Accountancy, Real Estate Management	64	20.00
Criminology	83	25.94
Engineering	65	20.31
Teacher Education	8	2.50
Tourism and Hospitality Management	5	1.56
Total:	320	100

Additionally, the study noted that boys' arithmetic performance exhibited greater variability compared to girls'. These insights underscore the importance of understanding and addressing the specific characteristics and learning preferences of students within this demographic, particularly in the context of mathematics education.

Students’ Attitude towards Learning Mathematics in the Modern World (MMW)

The data below show the data and analysis of students' attitudes towards learning Mathematics in the Modern World (MMW).

Table 2: Attitude towards Learning Mathematics in the Modern World (MMW).

Indicators	Mean	SD	VI
I get a great deal of satisfaction out of solving a mathematics problem.	3.52	0.58	SA
I have usually enjoyed studying mathematics in school.	3.41	0.65	A
Mathematics is fun and exciting.	3.43	0.64	A
I like to solve new problems in mathematics.	3.27	0.72	A
I would prefer to do an assignment in mathematics than to write an essay.	3.27	0.84	A
I like mathematics.	3.27	0.75	A
I am happier in a math class than in any other class.	3.20	0.79	A
Mathematics is a very interesting subject.	3.40	0.67	A
I am comfortable expressing my ideas on how to look for solutions to a difficult problem in mathematics.	3.32	0.72	A
I am comfortable answering questions in math class.	3.30	0.75	A

Mathematics is a very worthwhile and necessary subject.	3.46	0.63	A
I want to develop my mathematical skills.	3.62	0.56	SA
Mathematics contributes to mental development and fosters critical thinking skills.	3.58	0.57	SA
Mathematics holds significance in daily activities and practical situations.	3.53	0.62	SA
Studying mathematics is vital as it ranks among the most crucial subjects for individuals to learn.	3.51	0.60	SA
Regardless of my chosen field of study, mathematics would prove highly beneficial.	3.48	0.63	A
I can think of many ways that I use math outside of school.	3.44	0.63	A
I think studying advanced mathematics is useful.	3.45	0.66	A
I believe studying math helps me with problem-solving in other areas.	3.49	0.61	A
A strong math background could help me in my professional life.	3.46	0.63	A
Mathematics is not one of my most dreaded subjects.	3.34	0.68	A
I can think clearly when working with mathematics.	3.31	0.70	A
Studying mathematics does not make me feel nervous.	3.19	0.83	A
I feel at ease with Mathematics.	3.22	0.75	A
I never feel excessively stressed during math class	3.21	0.73	A
The mention of mathematics brings me a sense of enjoyment.	3.20	0.77	A
The thought of solving a mathematics problem fills me with excitement	3.18	0.78	A
I am not afraid of mathematics at all.	3.11	0.86	A
I am very confident in my abilities in mathematics.	3.11	0.84	A
I can tackle mathematics problems with ease.	3.08	0.84	A
I anticipate performing adequately in any math class I enroll in.	3.28	0.72	A
I rarely experience confusion during my mathematics class.	3.07	0.84	A
I feel a sense of confidence when tackling mathematics.	3.21	0.76	A
I grasp mathematical concepts effortlessly.	3.10	0.83	A
I believe I possess proficiency in solving math problems.	3.16	0.81	A
I am confident in my ability to grasp advanced mathematics concepts.	3.17	0.82	A
I am eager to continue utilizing mathematics throughout my college education.	3.23	0.79	A
I am open to enrolling in additional mathematics courses beyond the minimum requirement.	3.14	0.83	A
I intend to maximize my exposure to mathematics throughout my academic journey.	3.15	0.84	A
I find the challenges presented by mathematics intriguing.	3.30	0.74	A
Overall Mean:	3.30		A

Legend: SA - Strongly Agree, A - Agree; SD - Standard Deviation

Table 2 presents the data regarding students' attitudes toward learning Mathematics in the Modern World (MMW). The results indicate that the majority of students strongly agree on their desire to enhance their mathematical skills, with a mean score of 3.62 and a standard deviation of 0.56. However, it was also noted that some students agreed that they were occasionally confused during their mathematics classes, with a mean score of 3.07 and a standard deviation of 0.84. Overall, the data suggests that students generally exhibit a positive attitude toward learning MMW, with an overall mean score of 3.30. This indicates that students are cognizant of the challenges they face while learning and mastering mathematical concepts. Despite these obstacles, their expressed desire to improve their mathematical abilities demonstrates

their motivation to overcome difficulties and enhance their skills. These findings resonate with the research of Bhusal, (2021) which highlights various factors contributing to students' difficulties in learning mathematics. These include misconceptions and negative perceptions of mathematics, inadequate time devoted to math learning at home, lack of prior knowledge of the subject, disinterest among learners, and ineffective teaching methods employed by teachers. Bhusal also emphasizes the importance of motivating students to learn mathematics, integrating relevant real-life mathematical problems into instruction, and ensuring equal attention to all students regardless of their academic abilities. Addressing these factors is crucial in facilitating effective mathematics learning experiences for students.

Challenges Encountered in Learning Mathematics in the Modern World (MMW) This presents the challenges encountered by the students in learning Mathematics in the Modern World (MMW).

Table 3: Challenges Encountered.

Indicators	Mean	SD	VI
Difficulty with abstract concepts of time and direction.	2.79	0.92	A
Inability to visualize; appearing absentminded or lost in thought.	2.77	0.92	A
Struggles with retaining math facts, concepts, rules, formulas, sequences, and procedures.	2.94	0.87	A
Challenges in adhering to sequential procedures and instructions in mathematical steps.	2.82	0.88	A
Delays in comprehending mathematical concepts presented within word problems	2.78	0.95	A
Confusing operations signs or performing them in the wrong order.	2.77	0.92	A
Difficulty understanding complex mathematical concepts can lead to frustration and a lack of motivation to learn.	2.80	0.93	A
Lack of regular practice to retain mathematical concepts.	2.82	0.86	A
Poor study habits	2.76	0.92	A
Lack of understanding of basic concepts in Mathematics	2.70	0.93	A
Overall Mean:	2.79		A

Legend: SA – Strongly Agree, A – Agree; SD – Standard Deviation

Table 3 outlines the difficulties encountered by students while learning Mathematics in the Modern World (MMW). The data reveals that a majority of students agreed on facing challenges in remembering math facts, concepts, rules, formulas, sequences, and procedures, with a mean score of 2.94 and a standard deviation of 0.87. Conversely, fewer students agreed on lacking understanding of basic mathematical concepts, with a mean score of 2.70 and a standard deviation of 0.93. Overall, students acknowledged encountering obstacles in learning MMW, indicating that mathematics often requires repetitive practice to solidify concepts and retain information. The difficulty

in remembering material may arise from inconsistent practice or review of math content. This finding aligns with the research of Kinanti *et al.* (2020), which suggests that students frequently struggle with recalling and applying mathematical formulas. It underscores the distinction between formula knowledge and conceptual understanding, highlighting the complexity of addressing mathematical challenges.

Relationship between the Students’ Attitude and the Challenges They Encountered in Learning Mathematics in the Modern World (MMW)

Table 4: Hypothesis Testing.

Challenges	Attitudes	
	Pearson’s r	0.043
	df	318
	p-value	0.448

Note: *p<.05, **p<.01, ***p<.001

Table 4 illustrates the relationship between students’ attitudes and the challenges they face in learning Mathematics in the Modern World (MMW). The data indicates a positive and moderate correlation, as the computed p-value falls between ± 0.30 and ± 0.49 , signifying a medium correlation. This suggests that students’ perspectives on learning MMW directly influence the difficulties they may encounter while studying the subject. Further insights from Hwang and

Son, (2021) underscore that certain student characteristics are associated with higher achievement in mathematics. Specifically, students who enjoy studying mathematics and actively participate in math-related activities tend to excel. Additionally, those who maintain positive attitudes towards learning mathematics often experience success in academic performance and access to employment opportunities. Moreover, students who possess confidence in their

mathematical abilities are more likely to perform well in the subject.

The information below shows the proposed intervention programs to address the challenges encountered by the students in learning Mathematics in the Modern World (MMW).

Intervention Programs to Address the Challenges Encountered by the Students

Table 5: Intervention Programs.

Programs	Objectives	Descriptions
Math Mastery Mentorship Program	The Math Mastery Mentorship Program aims to provide personalized one-on-one guidance and support to children struggling with mathematics, helping them build a strong foundational understanding of the subject.	In this program, proficient math mentors are matched with struggling students to provide targeted support. These mentors work closely with the students to identify their specific challenges and develop customized exercises and lessons to address them. The course focuses on fostering a strong understanding of mathematical concepts, improving problem-solving skills, and building confidence in math. Both in-person and online interactions are available to accommodate different learning preferences and needs.
Interactive Online Math Tutorials	The Interactive Online Math Tutorials are crafted to aid students in comprehending arithmetic more effectively by rendering it engaging and accessible.	This program employs gamified content, videos, and interactive online lessons to deliver math instruction. Students have the flexibility to learn at their own pace and receive immediate progress updates. The program is designed to make mathematics more engaging and less intimidating while enhancing conceptual understanding and problem-solving skills.
Mathematics and Real-World Application Workshops	The primary aim of this program is to demonstrate to students the practical applications of mathematics by establishing connections to relevant real-world scenarios.	The objective of these workshops is to showcase to students the practical applications of mathematics across various fields and in everyday life. Students engage in hands-on activities and projects that explore the connections between mathematics and disciplines such as science, technology, engineering, and finance. Through these experiences, the curriculum emphasizes the utilization of mathematics as a valuable tool for decision-making and problem-solving.
Math Support Centers	At math support centers, students have the opportunity to receive personalized assistance with their math assignments, practice problems, and challenging concepts	These centers include math instructors or peer tutors on staff who are accessible to help children with any math-related issues. Students can drop in whenever they need assistance, which promotes a sense of community and support. The main objectives of the program are to reinforce classroom instruction and offer prompt support.
Math Adaptive Learning Software	This program utilizes adaptive learning software to customize arithmetic instruction according to the individual strengths and weaknesses of each student.	Every student's mathematical proficiency is assessed using adaptive learning software, which subsequently tailors a personalized learning path to address their specific needs. This software dynamically adjusts in real-time, providing additional practice on challenging topics while progressing more swiftly through mastered concepts. The curriculum is designed to provide individualized learning opportunities, allowing students to cultivate a strong foundation in arithmetic at their own pace.

CONCLUSION:

The study's conclusions highlight that a significant proportion of students, mainly aged between 19 and 21 and predominantly male, are enrolled in Criminology courses, showing a keen interest in improving their mathematical skills. However, their primary obstacle

lies in retaining mathematical information, encompassing various concepts, rules, formulas, sequences, and procedures. Notably, there appears to be a moderate yet positive correlation between students' attitudes towards mathematics and the difficulties they face in mastering Mathematics in the Modern World

(MMW). To address these challenges, the researcher recommends implementing several intervention programs. It is proposed that students from diverse age groups, courses, and genders should be exposed to a variety of mathematical activities and teaching methodologies within MMW classes. Furthermore, conducting qualitative analyses of students' perceptions, responses, and performance in MMW classes is suggested for gaining deeper insights. Faculty members are encouraged to continuously enhance their teaching methodologies through participation in training sessions and workshops. Additionally, it is advised to present the proposed intervention programs to the dean and academic chairs for their input and feedback. Future research efforts should focus on evaluating the effectiveness of these intervention programs in mitigating the challenges encountered by students in MMW.

ACKNOWLEDGEMENT:

The researchers would like to express their heartfelt appreciation to the President of the University of Batangas, Madam Lily Marlene J. Hernandez, for her encouragement to pursue this research. Special thanks to Dr. Priscilla Mizpah P. Santillana, Dean of the College of Arts and Sciences, for her invaluable guidance and unwavering support throughout the entire research process. Gratitude is also extended to Dr. Romell A. Ramos, Director of the University Research and Publication Office, for his continuous support and guidance. Additionally, the researchers are deeply grateful to the participants who generously volunteered their time and shared their valuable insights; without their contributions, this study would not have been possible. Lastly, the researchers acknowledge all individuals who, in any capacity, directly or indirectly, contributed to the completion of this research endeavor.

CONFLICTS OF INTEREST:

The authors declare that they have no conflicts of interest related to this research study.

REFERENCES:

- 1) "How to Make Math More Engaging for Kids" <https://www.kumon.com/resources/how-to-make-math-more-engaging/>
- 2) Abe, T. O., and Gbenro, O. S. (2014). A Comparison of Students' Attitudinal Variables towards Mathematics between Private and Public Senior Secondary Schools. *J. of Educational Policy and Entrepreneurial Research*, 1(1), 32-39. <http://jeper.org/index.php/JEPER/article/viewFile/4/4>
- 3) Andaya, O. J. F. (2014). Factors that affect mathematics achievements of students of Philippine Normal University-Isabela Campus. *Researchers World*, 5(4), 83. <https://www.researchersworld.com>
- 4) Ashcraft, M. (2017). "Math Anxiety: Personal, Educational and Cognitive Consequences, *Current Directions in Psychological Science*". 11,181-185. <https://doi.org/10.1111/1467-8721.00196>
- 5) Ayuman-Valdez, E., & Guiab, M. R. (2015). Predictors of mathematics performance of Grade VI pupils in a School District in Northern Philippines. *Asia Pacific J. of Research*, I(XXXIV). <https://scholar.archive.org/work/zzcycxkmhcr2rggi4y3j2tf34/access/wayback/>
- 6) Bangalan, R. and Hipona, J. (2020). Mathematics in the Modern World as a Science of Patterns with an Integration of Outcome Based Teaching- Learning Approaches. *Cosmos J. of Engineering and Technology*, 10(2).
- 7) Bearneza, F.J., (2020). The self-efficacy and anxiety in learning mathematics of college students. *Globus J. of Progressive Education*, 10(1), 101-110.
- 8) Becker, A. (2023). How to Make an Impact in Your Intervention Programs.
- 9) Bhusal, B. (2021). Students' Difficulties in Learning Mathematics: A Case Study. (Unpublished Thesis). University Campus, Kirtipur Tribhuvan University, Kathmandu, Nepal.
- 10) Booker, K.C., and Lim, J.H. (2018). Belongingness and Pedagogy. *Youth & Society*, 50(8), 1037-1055. <https://doi.org/10.1177/0044118X16652757>
- 11) Can, I., Koydemir, S., & Cokluk, G. (2017). Changing high school students' attitudes towards mathematics in a summer camp: Happiness

- matters. *Educational Sciences: Theory and Practice*, **17**, 1625-1648.
<http://dx.doi.org/10.12738/estp.2017.5.0373>
- 12) CHED Memorandum Order No. 20 Series of (2013). General education curriculum: holistic Understandings, intellectual and civic competencies.
 - 13) Cherry, K. (2023). The Components of Attitude. <https://www.verywellmind.com/attitudes-how-the-y-form-change-shape-behavior-2795897>
 - 14) Commission on Higher Education Handbook on Typology, Outcomes-Based Education, and Institutional Sustainability Assessment 2014, Philippines.
 - 15) Ghasemi, E., Burley, H. and Safadel, P. (2019). Gender Differences in General Achievement in Mathematics: An International Study. *New Waves Educational Research & Development*, **22**(1), pp. 27-54
 - 16) De La Cruz, J. L. (2018). The Entry Mathematics Performance of the Bachelor of Science in Industrial Technology in Ilocos Sur Polytechnic State College. *KnE Social Sciences*, **3**(6), 7.
<https://knepublishing.com/index.php/KneSocial/article/view/2414>
 - 17) Enu, J., Agyman, O. K., & Nkum, D. (2015). Factors influencing students' mathematics performance in some selected colleges of education in Ghana. *Inter. J. of Education Learning and Development*, **3**(3), 68-74.
 - 18) Escalona, E. (2015). Factors Affecting the NCAE and Mathematics Performance of Fourth Year Students of Candon National High School (master's thesis). Ilocos Sur Polytechnic State College - Sta. Maria Campus, Philippines.
 - 19) Flynn, C. (2013). Cooperative learning in secondary maths classes (Doctoral dissertation). Evergreen State College, USA.
<https://archives.evergreen.edu/masterstheses/Accession89-10MIT/Flynn MIT2013.pdf>
 - 20) Gafoor, K. A., & Kurukkan, A. (2015). Why high school students feel mathematics difficult? An exploration of affective beliefs. Paper presented at the UGC Sponsored National Seminar on Pedagogy of Teacher Education, Trends and Challenges, Kozhikode, Kerala, India.
 - 21) Guevarra, A., et.al. (2017). "A Scrutiny of the Results of the Licensure Examination for Teachers (LET) of Bachelor of Elementary Education Graduates from 2014-2016". *Amalgam Research Journal*, College of Education, Wesleyan University-Philippines (WUP), Caba-natuan City: ISSN 2599-3968, **1**(1), pp 45-51.
 - 22) Hamid, M. H. S., Shahrill, M., & Mundia, L. (2013). Barriers to mathematics achievement in Brunei Secondary School Students: Insights into the roles of mathematics anxiety, self-esteem, proactive coping, and test stress. *International Education Studies*, **6**(11), 1-14.
<https://eric.ed.gov/?id=EJ1068753>
 - 23) Hwang, S. and Son, T. (2021). Students' Attitude toward Mathematics and its Relationship with Mathematics Achievement. *J. of Education and e-Learning Research*, **8**(3), 272-280.
 - 24) Kibrislioglu, N. (2016). An Investigation about 6th Grade Students' Attitudes towards Mathematics. *Procedia-Social and Behavioral Sciences*, **186**, 64-69.
<https://doi.org/10.1016/j.sbspro.2016.04.024>
 - 25) Kinanti, M. A. H., Sujadi I., Indriati, D., & Kuncoro, K. S. (2023). Examining students' cognitive processes in solving algebraic numeracy problems: A Phenomenology study. *J. Elemen*, **9**(2), 494-508.
<https://doi.org/10.29408/jel.v9i2.13266>
 - 26) Köğçe, D., Yıldız, C., and Altındağ, R. (2018). "Examining Elementary School Students' Attitudes towards Mathematics in terms of some Variables," *Procedia*, **1**(1), pp. 291-295.
 - 27) Konarzewski, K., (2019). Primary School Pupils' Attitude toward Mathematics and their Achievement in Mathematics. *New Educational Review*, **56**, 17-28.
<https://doi.org/10.15804/ner.2019.56.2.01>
 - 28) Mabula, S. (2015). Modelling Student Performance in Mathematics Using Binary Logistic Regression at Selected Secondary Schools a Case Study of Mtwara Municipality and Ilemela District. *J. of Education and Practice*, **6**(36), 96-103.
 - 29) Mazana, M. Y., Montero, C. S., & Casmir, R. O., (2019). Investigating Students' Attitude towards

- Learning Mathematics. *Inter. Electronic J. of Mathematics Education*, 14(1), 207-231.
- 30) National Examinations Council of Tanzania (NECTA) (2016). Examination statistics. Dar es Salaam: National Examination Council of Tanzania.
- 31) Naungayan, R. R. (2022). Attitude towards mathematics and mathematics achievement of secondary school learners in Banayoyo-Lidlidda District. *Puissant*, 3, 395-407.
- 32) Ngussa, B. M., & Mbuti, E. E. (2017). The Influence of Humour on Learners' Attitude and Mathematics Achievement: A Case of Secondary Schools in Arusha City, Tanzania. *J. of Educational Research*, 2(3), 170-181.
- 33) Patena, A. D., & Dinglasan, B. L. (2013). Students' performance on mathematics departmental examination: Basis for Math Intervention Program. *Asian Academic Research J. of Social Science & Humanities*, 1(14), 255-268.
- 34) Phonapichat, P., Wongwanich, S., & Sujiva, S. (2014). An analysis of elementary school students' difficulties in mathematical problem solving. *Procedia-Social and Behavioral Sciences*, 116, 3169-3174.
- 35) Rameli, M. and Kosnin, A. (2016). Challenges in Mathematics Learning: A Study from School Students' Perspective.
- 36) Ramos RA, Gutierrez MC, and Caguete RR. (2024). Measuring student performance in mathematics in the modern world course using Bloom's and Solo taxonomies, *Int. J. Mat. Math. Sci.*, 6(3), 78-84.
<https://doi.org/10.34104/ijmms.024.078084>
- 37) Sarmah, A., & Puri, P. (2014). Attitude towards Mathematics of the Students Studying in Diploma Engineering Institute (Polytechnic) of Sikkim. *J. of Research & Method in Education*, 4(6).
- 38) Suan, J. S. (2014). Factors affecting underachievement in mathematics. Proceeding of the Global Summit on Education GSE, 5.
- 39) Subia, G., Salangang, L., and Medrano, H. (2018). Attitude and Performance in Mathematics I of Bachelor of Elementary Education Students: A Correlational Analysis. *American Scientific Research J. for Engineering, Technology, and Sciences (ASRJETS)*, 39(1), pp 206-213.
- 40) Syveda, F. (2016). Understanding Attitudes towards Mathematics (ATM) using a Multimodal modal Model: An Exploratory Case Study with Secondary School Children in England. *Cambridge Open-Review Educational Research e-Journal*, 3, 32-62.
- 41) Tshabalala, T., & Ncube, A. C. (2016). Causes of poor performance of ordinary level pupils in mathematics in rural secondary schools in Nkayi district: Learner's attributions. *Nova J. of Medical and Biological Sciences*, 1(1).
<http://novajmbs.com/index.php/jmbs/article/view/13>
- 42) Verschaffel, L., Van Dooren, W., and De Smedt, B. (2012). Mathematical Learning. In: Seel, N.M. (eds) *Encyclopedia of the Sciences of Learning*. Springer, Boston, MA.
https://doi.org/10.1007/978-1-4419-1428-6_448

Citation: Carandang ESP, Caguete RR, and Balmes JMR. (2024). Attitude and challenges in learning mathematics in the modern world (MMW): basis for intervention program, *Int. J. Mat. Math. Sci.*, 6(3), 85-99.

<https://doi.org/10.34104/ijmms.024.085099> 