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Exploring Learners' Perceptions of the Relevance of Mathematical Topics and Technology Integration in Course Subject Mathematics in the Modern World

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Abstract

Mathematics in the Modern World (MMW) is a foundational general education course aimed at equipping students with mathematical literacy applicable to real-life contexts. However, the perceived relevance of its topics and the effectiveness of integrating technology in its delivery remain underexplored. This study investigates learners' perceptions of MMW topic relevance and their attitudes toward technology integration to inform instructional innovation. Using a descriptive quantitative research design, the study surveyed students at Wesleyan University Philippines, where the total population of 10,502 undergraduates enroll in the MMW course across different semesters. Stratified random sampling was employed to ensure representation. Data were collected through structured Likert-scale questionnaires and analyzed using mean scores and adjectival interpretation. Findings revealed that topics such as compound interest (M = 3.78), stocks and bonds (M = 3.75), and the Fibonacci Sequence (M = 3.73) were rated as most relevant due to their perceived real-world applicability. Conversely, statistical topics like regression analysis (M = 2.38) and correlation analysis (M = 2.48) were viewed as least relevant. Students also expressed strong positive attitudes toward technology use in learning, with all items rated "Strongly Agree" (M = 3.38–3.70). The study underscores the importance of aligning mathematical content with practical applications and leveraging technology to enhance comprehension. It recommends curriculum contextualization, pedagogical innovation, and institutional support to address perceptual gaps and improve learning engagement in mathematics education.

Keywords: Mathematics in the Modern World, technology integration, student perception, curriculum relevance, statistical topics, higher education

1. Introduction

1.1. Introduce the problem

Mathematics is widely recognized as a foundational discipline, vital to various domains such as engineering, economics, natural sciences, and technology. Yet, for many learners,

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mathematics remains an abstract and often intimidating subject, particularly when its practical relevance is not explicitly demonstrated (Boaler, 2016). In response to this challenge, the Mathematics in the Modern World (MMW) course was integrated into the Philippine general education curriculum to bridge the gap between theoretical concepts and real-life applications. Designed for non-STEM majors, MMW aims to promote mathematical literacy by contextualizing mathematical concepts in everyday scenarios, encouraging critical thinking, and fostering lifelong appreciation of mathematics (CHED, 2013).

However, despite the course's design, students continue to struggle with perceiving the applicability and value of certain mathematical topics. This disconnect poses a challenge for educators who must not only deliver content but also ensure its relevance is felt by learners from diverse academic backgrounds. As a result, understanding students' perceptions of topic relevance in MMW becomes a crucial step toward curriculum refinement and effective instructional design.

1.2. Describe relevant scholarship

A substantial body of literature has shown that students' perceptions of relevance significantly influence motivation, engagement, and academic performance (Eccles & Wigfield, 2002; Middleton et al., 2015). When students perceive mathematics as directly linked to their daily lives or future careers, they are more likely to invest effort and persist through learning challenges. Conversely, abstract topics that lack clear real-world application often led to reduced interest, heightened anxiety, and negative attitudes (Ashcraft, 2002; Ma & Kishor, 1997).

Simultaneously, the rise of educational technologies has transformed how mathematical content is delivered and experienced. Studies have documented how tools such as dynamic graphing software, simulations, and digital collaborative platforms enhance comprehension and promote interactive learning (Li & Ma, 2010; Koller et al., 2020). Nevertheless, the impact of such tools depends not only on their availability but also on learners' openness to digital instruction, which is shaped by familiarity, accessibility, and pedagogical integration (Zou et al., 2021).

Despite the advances in both curriculum design and educational technology, there is limited empirical evidence connecting students' topic-specific perceptions of mathematical relevance with their attitudes toward technology-enhanced learning. Moreover, much of the current literature is Western-centric, offering minimal insight into Southeast Asian contexts like the Philippines, where diverse student populations and uneven technological infrastructure present unique challenges. This gap necessitates a localized, data-driven analysis that can inform culturally responsive and pedagogically sound instructional practices.

Moreover, this concern has been echoed in numerous studies, which underscore the importance of perceived relevance in shaping students' attitudes and performance in mathematics. When learners recognize the practical application of mathematical concepts, they are more likely to demonstrate motivation, persistence, and deeper engagement with the content (Eccles & Wigfield, 2002; Middleton et al., 2015). Conversely, topics perceived as abstract or disconnected from real-life experiences often result in disengagement, disinterest, or even anxiety (Ashcraft, 2002; Ma & Kishor, 1997). In parallel, the integration of technology in mathematics education has shown promising outcomes, especially with the increasing adoption of flexible and digital learning modalities post-pandemic. Tools such as graphing calculators, computer algebra systems, and interactive simulations have improved conceptual understanding and engagement (Li & Ma, 2010; Koller et al., 2020). Yet, the success of these tools often hinges on factors such as student attitudes, access to technology, and instructional strategy (Zou et al., 2021). Despite these developments, there remains a limited body of work exploring how relevance perception and technology integration intersect, particularly within the context of general education mathematics in Southeast Asia.

1.3. State hypotheses and their correspondence to research design

In response to this research gap, the current study aims to examine learners' perceptions of topic relevance in the MMW course and their attitudes toward technology-mediated instruction. It hypothesizes that students are more likely to find mathematical topics engaging when they perceive clear real-world applications and when such topics are supported by effective technological tools. Furthermore, it presumes that topic-specific relevance and technology integration are interdependent factors influencing students' motivation and comprehension in general education mathematics. The study addresses the following research questions:

1. What are the learners' perceptions of the relevance of topics in the MMW course?
2. Which topics are perceived as most and least relevant, and what factors may contribute to these perceptions?
3. What are students' attitudes towards the integration of technology in the learning of mathematics?
4. How can technology be leveraged to improve perceptions of less relevant mathematical topics?

The findings are expected to yield pedagogical insights that will guide instructional design, curriculum development, and policy enhancements in mathematics education.

2. Method

This section outlines the systematic approach employed to investigate learners' perceptions of the relevance of topics in the MMW course and their attitudes towards technology integration in learning.

2.1. Research Design

This study utilized a descriptive quantitative research design to assess learners' perceptions of the relevance of topics in the MMW course, as well as their attitudes toward technology integration in mathematics education. This design allows for the systematic collection and analysis of quantifiable data through structured survey responses, aiming to identify general patterns, trends, and relationships in students' evaluations of course content and learning tools.

2.2. Research Locale

The research will be conducted at Wesleyan University Philippines, a higher education institution offering the MMW course as part of its general education curriculum. The university has a total student population of 10,502, with all students required to take the MMW course during their academic tenure. Since the course is offered across different semesters and disciplines, it provides a diverse population suitable for analyzing perceptions and attitudes across various educational backgrounds.

2.3. Sampling procedures

This study utilized a stratified random sampling approach to ensure that the sample accurately represented the diverse perspectives of students enrolled in the MMW course at Wesleyan University Philippines. Given the large student population of 10,502, all of whom are enrolled in the MMW course across multiple semesters, the sample was stratified by academic semester to account for any potential variations in student perceptions and experiences.

After careful consideration, three semesters were selected for inclusion in the study:

i. First Semester, Academic Year 2023–2024

ii. Second Semester, Academic Year 2023–2024

iii. First Semester, Academic Year 2024–2025

The choice of three semesters was based on balancing representativeness with practical feasibility. Since all students in the university take the MMW course, the inclusion of three semesters provides a sufficient diversity of perspectives, while maintaining manageable sample sizes. This approach minimizes the logistical burden

associated with collecting data from an excessive number of semesters and maximizes the efficiency of data collection.

A total of 384 respondents was determined to be sufficient for the study, based on standard sample size calculations with a 95% confidence level and a 5% margin of error. These 384 respondents were proportionally distributed across the three semesters, with 128 respondents selected from each semester. This proportional allocation ensures that each semester is represented according to its relative size in the overall student population, thereby enhancing the validity and generalizability of the findings.

Selecting only three semesters, the study ensures that the data is manageable and sufficiently robust to address the research questions. This sampling approach strikes a balance between breadth and depth, capturing a wide range of experiences across different academic cycles while maintaining statistical rigor.

2.4. Data Collection

Data were gathered through a self-administered questionnaire. The data instrument was validated by 5 experts, a statistician and language expert. A pilot testing was conducted to ensure the reliability of the instruments with a score in Cronbach's alpha of 0.87. Moreover, the instrument includes two sections: (1) perceptions of the relevance of MMW topics, and (2) attitudes toward technology integration in mathematics learning. Each item will be rated using a 4-point Likert scale, designed to quantify agreement or perceived relevance.

2.5. Data Analysis

Descriptive statistics, particularly mean scores and standard deviations, will be used to summarize student responses. Topics were ranked by mean to determine those perceived as most and least relevant. Adjectival interpretations were based on pre-established intervals to provide categorical descriptions of the ratings. Data processing were performed using Microsoft Excel or statistical software such as SPSS for accuracy and efficiency.

2.6. Ethical Considerations

The study strictly observed ethical research practices. Prior to data collection, students received an informed consent form outlining the study's purpose, the voluntary nature of participation, and the assurance of anonymity and confidentiality. Ethical clearance was obtained from Wesleyan University Philippines' institutional research ethics board. Participants were informed of their right to withdraw at any time, and all data will be securely stored and used solely for academic and research purposes.

3. Results

The results section presents an analysis of students' perceptions regarding the relevance of topics in the MMW course and their attitudes toward technology integration in learning. The findings are based on data collected from a representative sample and provide insights into which topics students deem most and least relevant, as well as their views on how technology impacts their learning experience. Moreover, the analysis aims to highlight key trends and patterns that inform educational practices and technology integration in mathematics education.

Table 1. ***Learners' Perceptions of Topic Relevance in MMW***

Topics	Mean	Adjectival Rating
Most Rated		
1. Compound interest	3.78	Relevant
2. Stocks and bonds	3.75	Relevant
3. Fibonacci Sequence and the Golden Ratio	3.73	Relevant
4. Simple interest	3.70	Relevant
5. Mathematics in Nature	3.68	Relevant
Least Rated		
1. Measures of central tendency	3.18	Somewhat relevant
2. Measures of dispersion	3.13	Somewhat relevant
3. Normal distribution	3.03	Somewhat relevant
4. Linear correlation analysis	2.48	Somewhat Irrelevant
5. Simple linear regression analysis	2.38	Somewhat Irrelevant

Legend: 1.00-1.74=Irrelevant; 1.75-2.49=Somewhat Irrelevant; 2.50-3.24=Somewhat Relevant; 3.25-4.00=Relevant

The analysis of students' perceptions regarding the relevance of topics in the MMW course reveals significant variation in how different topics are valued by learners. Based on Table 1, five topics were rated as "Relevant," led by Compound Interest (M = 3.78), followed by Stocks and Bonds (M = 3.75), Fibonacci Sequence and the Golden Ratio (M = 3.73), Simple Interest (M = 3.70), and Mathematics in Nature (M = 3.68). These topics are commonly associated with tangible, real-life applications, particularly in financial literacy, investment, and natural aesthetics, which may explain their higher perceived relevance.

In contrast, topics perceived as less relevant include Measures of Central Tendency (M = 3.18), Measures of Dispersion (M = 3.13), and Normal Distribution (M = 3.03), all falling under the "Somewhat Relevant" category. Linear Correlation Analysis (M = 2.48) and Simple Linear Regression Analysis (M = 2.38) were rated "Somewhat Irrelevant." These findings reflect a pattern noted by Boaler (2016), who argued that students are more likely to value mathematical concepts that they perceive as immediately applicable to real-world contexts. This supports the notion that when students fail to see how a topic connects to practical decision-making or career pathways, their engagement may decline (Eccles & Wigfield, 2002).

The disparity between the perceived relevance of practical and theoretical topics underscores the need for instructional strategies that contextualize abstract mathematical concepts. As Middleton, Jansen, and Goldin (2015) emphasize, learner engagement is closely linked to perceived utility. Therefore, integrating real-world examples and application-based teaching of statistical and analytical concepts could help bridge the perception gap and improve students' appreciation of topics that are foundational to data analysis and scientific research.

Table 2. *Learners' Attitude on Technology Integration*

Statements	**Mean**	**Adjectival Rating**
1. I find technology integration in the classroom enhances my learning experience.	3.70	Strongly Agree
2. Using technology in my studies makes learning more interesting and engaging.	3.63	Strongly Agree
3. I feel more motivated to learn when technology is used in my classes.		
4. Technology helps me understand difficult concepts more easily.	3.60	Strongly Agree
5. I believe that technology integration improves my academic performance.	3.58	Strongly Agree
6. I find it easier to collaborate with my classmates using technology tools.	3.55	Strongly Agree
7. Technology use in the classroom helps me develop important skills for the future.	3.53	Strongly Agree
8. I feel comfortable using various technological tools and platforms for learning.	3.50	Strongly Agree
9. I prefer assignments and projects that involve using technology over traditional methods.	3.48	Strongly Agree
10.Technology integration in education makes lessons more personalized to my learning needs.	3.40	Strongly Agree
	3.38	Strongly Agree

Legend: 1.00-1.74=Strongly Disagree; 1.75-2.49=Disagree; 2.50-3.24=Agree; 3.254.00=Strongly Agree

Table 2 shows that students hold overwhelmingly positive attitudes toward the use of technology in mathematics education. All items received ratings within the range of 3.38 to 3.70**,** with all falling under the "Strongly Agree" category. The highest-rated item "Technology integration in the classroom enhances my learning experience" (M = 3.70)—indicates that students acknowledge the value of digital tools in enriching their

educational experiences. This aligns with findings from Li and Ma (2010), who observed that technology can improve student outcomes by enabling visualization, exploration, and dynamic learning environments.

Students also strongly agreed that technology makes learning more engaging (M = 3.63), enhances understanding of complex concepts (M = 3.58), and improves academic performance (M = 3.55). These perceptions support the conclusion by Zou et al. (2021) that learners respond positively to technology when it is effectively integrated into instruction. However, Boaler (2016) and Koller et al. (2020) caution that the successful implementation of such tools depends on pedagogical alignment and access equity.

Although the lowest-rated item, "Technology integration makes lessons more personalized" (M = 3.38) still received a "Strongly Agree" rating, it suggests that some learners may not yet experience fully adaptive or tailored learning through current technologies. This reveals an opportunity for future improvements in instructional design, particularly with platforms that support individualized pacing, feedback, and differentiated instruction.

The intersection of perceived topic relevance and positive attitudes toward technology presents a compelling case for the integration of digital tools to address instructional gaps. Students already value mathematical topics with evident real-world applications, and they show strong openness to technology-enhanced learning. As such, embedding abstract or statistically oriented content within interactive, tech-supported contexts such as data simulations, visual analytics, or real-life case studies could enhance students' understanding and appreciation of those concepts.

This approach is consistent with the assertions of Eccles and Wigfield (2002) regarding motivational theory: learners are more likely to engage with content they find meaningful and achievable. Furthermore, integrating instructional technology can operationalize Boaler's (2016) framework for developing mathematical mindsets, wherein students explore concepts not as static procedures but as dynamic tools for inquiry and problem-solving. In this way, technology becomes not just a supplement, but a strategic lever for instructional transformation and learner empowerment.

4. Discussion

The results of the study present a compelling narrative about how students perceive the relevance of mathematics topics and their openness to technology as a mediating tool for learning. The overall perception aligns with existing theories of learning motivation, instructional relevance, and technology integration in mathematics education.

Firstly, topics such as compound interest, stocks and bonds, and the Fibonacci sequence received the highest relevance ratings from students. These findings are consistent with the work of Frejd and Bergsten (2016), who noted that mathematical content perceived as directly applicable to daily life or professional contexts tends to garner more learner interest. For instance, financial mathematics is closely tied to personal economic decision-making, which can enhance perceived value and applicability among learners.

Conversely, statistical topics such as linear correlation and regression analysis received the lowest relevance ratings. This may be attributed to the abstract nature of these topics, which can seem disconnected from immediate student experiences. Niss (2007) argued that abstraction in mathematics must be carefully contextualized to resonate with learners, especially in general education courses. This may explain why students struggle to see the purpose behind topics that are essential in research, data science, and social sciences.

Moreover, students' favorable attitudes toward technology integration in mathematics support the growing body of research suggesting that digital tools can enhance comprehension and engagement. According to Pierce and Ball (2009), when students use tools such as graphing calculators and dynamic software, they can manipulate and visualize mathematical objects more easily, which can increase understanding of difficult topics. This was reflected in strong student agreement across all ten attitude items related to technology use.

One interesting implication of the findings is the potential of technology as a bridge to improve perceptions of relevance in abstract mathematical topics. Studies such as those by Drijvers (2015) have emphasized the potential of digital environments to contextualize abstract ideas through interactive and dynamic representation. For example, regression analysis, often considered theoretical, can be made accessible when students are given real-world datasets to manipulate using visualization tools.

The findings also highlight the importance of designing instructional strategies that reflect students' sociocultural realities. As Nasir, Hand, and Taylor (2008) noted, students bring cultural and contextual knowledge into the classroom, which should be incorporated when introducing mathematical concepts. Instructional design that integrates real-world problems, especially those relevant to students' communities and interests, can improve the perceived value of less favored topics.

Another consideration is the role of curriculum flexibility and personalization. The positive perception of technology's role in making lessons more personalized (M = 3.38) hints at a need for differentiated instruction. As Kay, Leung, and Tang (2018) discuss, adaptive technology platforms can adjust the difficulty level and content pacing based on real-time student feedback, enhancing learning experiences particularly in mixed-ability classrooms.

Importantly, the discussion cannot ignore the role of teacher competence in the successful use of technology. According to Bingimlas (2009), teacher readiness, confidence, and training significantly affect the effectiveness of technology integration. Thus, for technology to serve as a genuine equalizer and engagement tool, teachers must be equipped with both technical skills and pedagogical strategies to implement it meaningfully.

Finally, institutional support remains a key factor. The infrastructural and policy support for technology-enhanced learning, as noted by Tondeur et al. (2017), determines whether innovations in mathematics instruction can be scaled and sustained. The challenge is not only in recognizing student preferences, but in creating systemic conditions that enable alignment between curriculum, instruction, and learner experience.

5. Conclusions

The findings of this study reveal critical insights into learners' perceptions regarding the relevance of mathematics topics in the MMW course and their attitudes toward technology integration in mathematics education. It is evident that students perceive topics with tangible real-life applications such as compound interest, stocks and bonds, and the Fibonacci Sequence as more relevant to their personal and professional lives. In contrast, statistical concepts like regression analysis, correlation, and measures of central tendency were perceived as less relevant, indicating a gap between curriculum design and learners' lived experiences and expectations.

Additionally, the consistently high mean scores across all statements in the technology attitudes scale suggest that students strongly support the integration of digital tools in their learning processes. They acknowledge the value of technology in enhancing comprehension, motivation, collaboration, and personalization of instruction. This favorable disposition toward educational technologies presents an opportunity for curriculum developers and educators to bridge the perceived relevance gap by leveraging digital tools to contextualize abstract or complex mathematical concepts.

The study highlights the need for a paradigm shift in the delivery of mathematics instruction from a content-centric to a context-aware, technology-enriched pedagogy. This

shift not only aligns instruction with learners' expectations and future workforce needs but also promotes a more inclusive and meaningful mathematics education.

In light of the study's findings on learners' perceptions of mathematical relevance and their attitudes toward technology integration, several strategic directions are recommended to enhance the effectiveness of the MMW course. These recommendations target four core areas: curriculum design, instructional practices, technology integration, and institutional support—each essential for ensuring that mathematics education remains relevant, engaging, and future-oriented.

First, the curriculum must prioritize relevance by integrating mathematics topics within real-life and career-based contexts. This strategy is especially crucial for abstract areas such as regression and correlation, which can be made more tangible when linked to applications in business analytics, social science research, and evidence-based policy-making. Curriculum developers should consider embedding interdisciplinary case studies and experiential learning modules to help students recognize the everyday utility and interdisciplinary value of mathematical reasoning.

Second, the integration of technology-enhanced learning tools should be expanded. Given the study's strong indication of students' positive attitudes toward digital learning, platforms such as Desmos, GeoGebra, and dynamic educational simulations should be systematically adopted. These technologies support the visualization of complex ideas, foster active learning, and offer immediate feedback features that can substantially boost engagement and understanding across diverse learner profiles.

Third, faculty training must be strengthened to support pedagogical innovation. Educators should be equipped not only with proficiency in using technology but also with the pedagogical strategies needed for its effective classroom application. Institutions are encouraged to invest in continuous professional development programs focused on blended learning frameworks, Technological Pedagogical Content Knowledge (TPACK), and learner-centered instructional design, which collectively enhance the quality of mathematics instruction.

Finally, institutional policies should be aligned to support sustainable technology use and equitable learning experiences. Higher education leaders must ensure robust infrastructure, reliable access to digital tools, and inclusive strategies that address the digital divide. Furthermore, the establishment of structured feedback mechanisms is recommended to continuously capture student experiences and perceptions, facilitating data-informed improvements in course delivery and overall learning outcomes.

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