

Learning Experiences of Students on the Least Preferred Topics in Mathematics

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Abstract: Mathematics education forms the foundational framework for cultivating crucial skills and competencies vital for navigating an ever more intricate and numerical society. Despite its significance, students often encounter challenges and express reluctance towards certain mathematical topics, thus warranting a deeper exploration into the factors influencing students' learning experiences. However, within the realm of mathematics, there often exist topics that students find challenging or least preferred. Understanding the learning experiences of students on these least preferred topics is vital for educators to enhance teaching strategies, curriculum design, and ultimately foster a more engaging and effective learning environment. The study aims to explore the learning experiences of students on the least preferred topics in Mathematics, specifically to identify the least preferred topics of students in Mathematics in the Modern World with Biostatistics and to determine the learning experiences of students on these topics. The research used mixed method, where quantitative method was used for the first statement of the problem followed by qualitative method for the second statement of the problem. The respondents and participants are First Year Nursing Students since these are the students with Biostatistics in its curriculum. The results show that the least preferred topics of the students are the lessons on measures of variability and growth models. This can be explained by the experience of students having information overload where limited time was given to master the lessons. That is why it is recommended for teachers to execute creative and innovative strategies to help students enjoy even the hardest topics in Math 100N.

Keywords: Mathematics education, least preferred topics, Mathematics in the Modern World with Biostatistics, growth models, measures of variability

1. INTRODUCTION

The twenty-first-century student is immersed in a digital age characterized by information abundance and instant connectivity. As such, the nature of the least preferred academic topics has shifted, with regard to students demonstrating a proclivity towards subjects that intersect with emerging technologies, sustainability, and interdisciplinary studies. The traditional boundaries between disciplines are increasingly blurred as students seek holistic approaches to address complex real-world challenges.

Mathematics education serves as the cornerstone for developing essential skills and competencies necessary for navigating an increasingly complex and quantitative world (National Research Council, 2001). Despite its significance, students often encounter challenges and express reluctance towards certain mathematical topics, thus warranting a deeper exploration into the factors influencing their learning experiences. It is also crucial for the development of critical thinking, problem-solving skills, and logical reasoning abilities among students (Boaler, 2016). However, within the realm of mathematics, there often exist topics that students find challenging or least preferred (Hannula, 2019). Understanding the learning experiences of students on these least preferred topics is vital for educators to enhance teaching strategies, curriculum design, and ultimately foster a more engaging and effective learning environment.

Moreover, the global nature of today's educational landscape exposes students to a rich tapestry of cultural, social, and political issues. Thus, their preferences for certain topics may be influenced by a desire to engage with matters that hold global significance, reflecting a growing awareness of interconnectedness and the need for a broadened worldview.

On the contrary, there remains a gap in the literature regarding the specific learning experiences associated with the least preferred topics within the discipline. This research aims to

address this gap by delving into the nuances of student engagement, comprehension, and persistence when confronted with mathematics topics they find particularly challenging or uninteresting.

A particular discipline that demands a solid foundation in mathematics is the Nursing education, ensuring proficiency in dosage calculations, statistical analysis, and the comprehension of quantitative aspects within healthcare. As the landscape of healthcare becomes increasingly data-driven, the integration of biostatistics with traditional mathematical concepts becomes imperative for nursing professionals. Biostatistics, a branch of statistics applied to biological and health sciences, provides the analytical tools essential for evidence-based decision-making in the healthcare domain (Berger and Matthews, 2006).

However, there is a paucity of research focusing on the unique preferences of nursing students regarding mathematical topics, particularly those that bridge the gap between mathematics and biostatistics (Rickey and Stacey, 2015). By mapping the mathematical minds of nursing students, this research seeks to identify the specific areas within mathematics that resonate with this cohort and to ascertain the potential impact of integrating biostatistics into their mathematical education.

In a research conducted by Rotgans and Schmidt (2014), they found out that among all educational topics, mathematics classes were identified to be the least engaging. As a result of this impression, students' interest in the full study program they were enrolled in significantly decreased. However, the students believed that mathematics itself is not less interesting, but the courses can be improved by providing more adequate learning resources and structure. Hence, this study suggests that math courses should be improved in different ways. And so, knowing the least preferred topics of the students in Mathematics in the Modern World with

Biostatistics, will allow instructors to align and look for the most appropriate and interactive activities for these topics.

Another research conducted in Mandaue City, Cebu, Philippines by Capuno, et. al (2019), researchers concluded that students' attitudes and study habits are significant factors that affect their performance in mathematics. It was recommended that the utilization of an enhancement plan be implemented in the teaching of mathematics to junior high school students. One way to do so is by assessing the attitudes of the students towards mathematics through identifying which topics are more preferred and which topics are least preferred by the students. This information can help educators and curriculum developers to understand the specific areas where students may struggle or have less interest.

The intricate interactions between cognitive, affective, and environmental elements have been the subject of numerous research that have examined the factors influencing students' preferences and attitudes toward mathematics (Hannula, 2019). Even with all of this study, there is still a significant vacuum in the literature when it comes to the particular educational experiences related to the discipline's least popular themes. By combining current research and theoretical frameworks, this thorough study seeks to close this knowledge gap by clarifying the factors influencing students' experiences with mathematics' least favorite subjects.

Furthermore, comprehending the cognitive and affective mechanisms that underlie students' experiences with mathematical topics that they find least appealing might provide light on more general concerns like math anxiety, self-efficacy beliefs, and learning motivation (Hannula, 2019).

According to Boaler (2016), examining how students' learn about the least favorite math topics is important as it can help develop inclusive teaching strategies that accommodate a range of learning styles. Teachers can better meet the requirements of each individual student and create a good learning environment by figuring out what causes students to struggle or become disengaged with particular mathematical ideas. Also, teachers must examine the reasons behind the students choosing their least preferred topics to carefully choose a better strategy.

One prominent theoretical framework for understanding students' engagement with mathematics is the socio-cultural perspective, which emphasizes the role of social interactions, cultural norms, and contextual factors in shaping learning experiences (Vygotsky, 1978). From this perspective, students' preferences for specific mathematical topics may be influenced by factors such as peer interactions, family expectations, and societal perceptions of mathematics. In addition, Vygotsky's Zone of Proximal Development or ZPD, refers to the difference between what a learner can achieve independently and what they can achieve with the guidance and support of a more knowledgeable other (Vygotsky, 1978). Least preferred topics may lie outside students' current ZPD, requiring additional scaffolding and instructional support to facilitate learning.

On the other hand, self-determination theory emphasizes the importance of autonomy, competence, and relatedness in promoting intrinsic motivation and engagement in learning (Deci & Ryan, 2000). Students may exhibit less interest and engagement in least preferred topics if it is perceived as undermining their sense of autonomy or competence.

Moreover, situational perspectives emphasize the importance of social and contextual factors in shaping learning

experiences (Greeno, 1997). Least preferred topics may be influenced by the interaction between students, teachers, and the learning environment, highlighting the need for instructional approaches that consider these contextual dynamics.

On the local context, nursing students are required to take a course in mathematics. Specifically, Mathematics in the Modern World with Biostatistics (with a course code of Math 100N integrated by CHED (Commission on Higher Education) Memorandum No. 15, s. 2017. It is a three-unit course classified as General Education which means that it is a course that must be taken by all undergraduate students regardless of degree program. Based on the course description of CHED in CMO No. 20, s. 2013, Mathematics in the modern world deals with the nature of mathematics, appreciation of its practical, intellectual, and aesthetic dimensions, and application of mathematical tools in daily life. However, on the side of nursing students, Mathematics in the Modern World is integrated with biostatistics to align with their degree program. This uniqueness of Math 100N arouses researchers to study its implementation, assessment, and effectiveness. In which, outcomes will significantly affect and improve the delivery of Math 100N.

Generally, the findings of this study will redound to the improvement of teaching and learning process, especially in Mathematics in the Modern World with Biostatistics (Math 100N). And as many researches about mathematics anxiety and challenges continuously emerge, this study could help educators, adapt teaching methods to align with students' interests, leading to increased engagement, motivation, and improved learning outcomes especially to the least preferred topics of the students in mathematics. Tailoring instruction to students' preferences enhances the overall teaching and learning experience. Teachers may also think of additional intervention for those subjects or topics.

Research on favored subjects directly benefits students since it gives students the confidence to participate actively in their education. Being aware of student preferences enables them to speak up for what they want, which enhances the fun and significance of learning and it allows them to know the topics they need to try learning more.

The study will also help the researchers discover critical areas in the teaching and learning Mathematics in the Modern World with Biostatistics (Math 100N). Hence, a new theory or technique on learning mathematics may be arrived at.

Statement of the Problem

The study aims to explore the learning experiences of students on the least preferred topics in Mathematics, specifically to answer the following questions:

- 1.) What are the least preferred topics of students in Mathematics in the Modern World with Biostatistics?
- 2.) What are the learning experiences of the students on the least preferred topics in Mathematics in the Modern World with Biostatistics in Nursing?

2. METHODOLOGY

This part shows the research design, population and locale of the study, data gathering instruments, and treatment of data.

Research Design

The research method used in this study is mixed method, that is quantitative subsequently followed by qualitative methods. Quantitative research, according to Creswell (2013), emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. The researchers used quantitative method since data in numeric form were gathered from the respondents to identify the least preferred topic/s of the students in mathematics in the modern world with biostatistics. After which, qualitative method was utilized to determine the learning experiences of the students. This follows a sequential-explanatory design where results from quantitative data can be explained by the results of the qualitative data.

Population and Locale of the Study

The study focused on first-year nursing students of the University of the Cordilleras (UC) as its respondents. The academic institution is located in Baguio City, Philippines and the school year that the researchers considered is school year 2023-2024. The respondents are composed of first-year students from the College of Nursing as they are the only department that has biostatistics in Mathematics in the Modern World. For statement of the problem one, which is quantitative, the researchers used Cochran's formula to identify smaller sample size. As defined by Cheprasov and Singh (2023), Cochran's formula is a statistical formula used to calculate the sample size required for a categorical data survey. This formula is commonly used in designing surveys to ensure that the sample size is sufficient for making statistically valid inferences. Thus, 245 students were surveyed out of 1,086 first-year nursing students of the University of the Cordilleras. For qualitative data a total of 15 students were interviewed, where the basis for the number is when no new themes are identified already by other participants. The criteria in choosing the 15 participants is first their willingness to participate for the interview, second is the students should have finished Math 100N with a passing grade and lastly the researchers practiced their prerogative in which theoretical saturation is achieved in which other inputs of participants are not taken to account due to its similarity with previous participants.

Data Gathering Instruments

For the collection of data on the least preferred topics of the students in Mathematics in the Modern World with Biostatistics, the researchers prepared a survey questionnaire that was administered through Outlook Forms and it is composed of two parts: a.) Personal Information and b.) Questionnaire on the preferred topics in Math 100N. The researchers used survey questionnaire because "Surveys have internal and external validity" (Mathers et. al., 2009, p.6). The first part is on personal information, and it includes the Gender and contact number of the respondents. The second part is a survey questionnaire on the students' preferred topics in Math 100N where students are asked to rank the topics according to their preference, 1 being the most preferred and 15 being the least. The last part are guide questions on the

learning experiences of the students that was done through an interview.

Treatment of Data

For the data gathered under quantitative research, the researchers used ranking to treat the data in which those that have the highest sum is determined to be the least preferred until the lowest sum which is the most preferred. For qualitative data, the usage of thematic analysis was used in which different common themes from various respondents were identified and tallied, after which corroborations and related literatures were included.

3. RESULTS AND DISCUSSION

This part presents the gathered data, their analyses, and interpretations.

Topic Preference of Students in Mathematics

Table 1 shows the ranking of least preferred topics in Math 100N. Where the first rank is the most preferred and the topics at the bottom are the least preferred.

Table 1. Ranking of Preferred Topics in Math 100N

Topics	Rank
Mathematics in our world (Patterns and Sequence)	1
Language of Sets	2
Hypothesis Testing: Pearson's r	3
Hypothesis Testing: ANOVA	4
Descriptive Statistics: Measures of Central Tendency (Mean, Median, and Mode)	5
Hypothesis Testing: Z-test	6
Functions	7
Problem Solving Strategies	8
Hypothesis Testing: T-test	9
Equations	10
Hypothesis Testing: Chi-square	11
Introduction to Statistics with Sample size	12
Descriptive Statistics: Measures of Position (Quartile, Decile, and Percentile)	13
Growth Models	14
Descriptive Statistics: Measures of Variability (Standard deviation and Variance)	15

Further, the table also shows that the least preferred topic of the students is the lesson on measures of variability that includes standard deviation and variance, wherein it ranks 15th out of 15th. This implies that the students do not prefer this topic that much maybe because of its abstractivity. Aside from this, measures of variability takes a lot of time to process and solve problems.

And this corroborates with the study of Schwanenflugel (1991), wherein topics that involve abstract concepts and mathematical formulas are hard to understand. Some students may struggle with grasping these abstract ideas, finding it challenging to relate them to real-world situations. The lack of concrete examples may make the topic less engaging for them. Aside from this, since the computations involved in measures of variability, such as standard deviation can be complex and require several phases. The intricacy of the computations may terrify students who find mathematics difficult, making them despising the subject.

Furthermore, the second least preferred topic of the students is on growth models, where it ranks 14th out of 15th. This topic is the last topic discussed during prelims. Since only a few of the students like this, aside from its complexity and abstractivity, it also suggests that one of the factors that affects the preference of the students is time constraints. The students might not prefer this much as this is the last topic in prelims. Thus, the students' fatigue can be a factor in which students are somewhat tired because different topics were already discussed prior to growth models. Furthermore, students can feel both physically and psychologically exhausted. Students may find it challenging to properly interact with the content or to stay interested in the final topic as a result of this exhaustion.

The study of Liu et al. (2023) further explains that the time is indeed another factor that can influence students' preferences for topics. Since the students do not have yet a lot of things to do during the first week or two, the students can still grasp new concepts unlike for the topics being discussed on the latter part of the semester. In addition, since the last topic might involve reviewing or summarizing previously covered material or a combination of different topics discussed during the previous discussions. Students may perceive it as repetitive or unnecessary, leading to disinterest.

Students' preferences for specific topics are a complicated and diverse phenomenon that are influenced by a wide range of circumstances. First and foremost, tastes are greatly influenced by personal interests. Subjects that connect with students' interests, hobbies, and future professional goals are more likely to be chosen by them. For instance, a student who is interested in technology would favor computer science or engineering courses. In order to better engage students, educators and institutions must have a thorough understanding of these internal motivations and adjust education curricula and teaching strategies accordingly.

Second, students' tastes are greatly influenced by the teaching method in which teachers deliver and discuss the topic which shows their overall efficacy as teachers. Students' interest and pleasure in a particular topic can be increased by dynamic and engaging instructors who use interactive teaching methods, create a positive learning environment, and provide real-world applications of the subject matter. Conversely, dull teaching methods or lack of application to real-world situations can prevent students from growing to enjoy a particular subject. As a result, how well students are taught has a significant impact on how students feel about and favor various academic fields.

Finally, students' least preferred topics are also influenced by external forces and societal norms. Social trends, parental guidance, and cultural expectations can all gently steer students toward particular academic specializations. For example, students' decisions may be influenced by outside opinions about the worth or status of particular careers. Preferences can also be shaped by peer pressure and the social dynamics of the academic setting. Students may be lured to courses that are more well-liked by peers or seen as having greater social standing. To promote a more varied and inclusive learning environment, educators and institutions must acknowledge and respond to these outside influences.

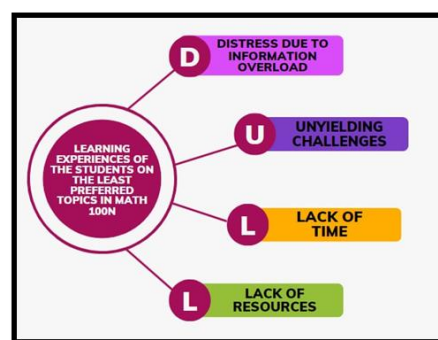
Overall, it can be said that teachers cannot control the preferred and least preferred lessons of students in Mathematics in the Modern World with Biostatistics, as there are a lot of factors that may affect such preference. It may be because of interest, peer, experiences, and many more.

It is deduced that students exhibit varying preferences, influenced by a multitude of factors.

Learning experiences of the students on the least preferred topics in Math 100N

Figure 1 shows the learning experiences of the students on the least preferred topics in Math 100N. Ten out of fifteen students said that there is an information overload that they had experience during the discussion of their least preferred topic. Then, there are eight students that found their least preferred topics as challenging. Next, lack of time is what the four students experienced. Finally, there were two students that talks about lack of resources.

Figure 1. Learning Experiences of the students on the Least Preferred Topics in Math 100N



Mathematics courses are considered to be the least preferred of the students (Rotgans & Schmidt, 2014). Thus providing different strategies will be a great help for the students to enjoy mathematics courses.

Distress due to Information Overload

Most of the nursing students experienced having an information overload during the discussion of their least preferred topic/s. One of the students answered "Measures of variability is my least preferred topic because of the long process of solving" and another student says that "I only prefer it least because the process is long and can sometimes be confusing for me". With this, it is not about the difficulty but more on the process of solving.

This corroborates with the statement from the article posted in mindful health solutions (2023), wherein the constant noise created by information overload has a collective effect on our minds, developing both anxiety and confusion. The perpetual tension and restlessness can rise, affecting our emotional well-being, which can lead to many psychological discomforts. Additionally, lengthy problem-solving processes in a topic can lead students to consider it their least preferred due to factors such as perceived difficulty, boredom stemming from monotonous processes, lack of immediate gratification, pressure from time constraints in academic environments, complexity requiring deep understanding, and erosion of confidence when encountering obstacles or mistakes. These challenges can make students feel overwhelmed, disengaged, and less inclined to invest time and effort in mastering the topic, ultimately impacting their preferences and motivation in their studies.

This means students do not find their least preferred topic as one of the hardest topic in Math 100N, rather, they look on to the process of solving the problems given. Wherein the longer

the process of solving, the more that they consider it as their least preferred topics.

Unyielding Challenging

More than half of the students are saying that they are engaged in the discussion but find topics that are challenging that makes it their least preferred topic in Math 100N. According to some of the students, Growth model is one of their least preferred topics because of its difficulty that they found it as challenging one. In fact, one of the students stated, "I find some topics quite challenging, (but) this did not stop me from gaining new knowledge."

This is supported by the research of Byrne, McPherson, and Canning (2019), wherein the result shows that students may experience cognitive dissonance when faced with difficult information that challenges their sense of intelligence or ability. As a result, they may avoid or minimize the subject. Moreover, students may develop performance avoidance goals, in which they attempt to prevent unfavorable consequences rather than pursue mastery, due to their fear of failing and making mistakes, which are frequently connected to difficult assignments.

Hence, students find some topic to be challenging due to different factors such as difficulty level of the discussion.

Lack of Time

"I just hope we had a longer period of time to discuss the lesson", this is the statement given by one of the students during the interview. Four out of fifteen students are talking about time constraints, wherein students find one topic as one of their least preferred topic because of the time. Wherein, there is a lacking of time during the discussion and the time given for their activities.

This corroborates with the research of Gracin and Trupcevic (2022), wherein the results of their study indicates the importance of understanding time as a resource for effective mathematics education. Additionally, according to them, the lack of time for topics are the topics that usually positioned "near the end". Which is exactly near the end before the scheduled examination, and this is due to different factors such as class suspensions, holidays, and the likes. So, using more time to provide examples for the students' better understanding is a need. Just like what Rosenshin (2012) said, that promoting and fostering classroom discussions can benefit students not only in terms of learning from one another, but also in terms of understanding and remembering the lecture. To sum it up, having more time for discussions can help students become more engaged, prepared, and motivated.

This implies that, giving more time to a more complicated topics is indeed a must for the students to understand the topics better.

Lack of Resources

There are two students that brings out about the resources. According to them, sometimes, they need to have additional resources that will help them in learning more about a certain topic – specifically, their least preferred topic in Math 100.

The statements of the students is supported by the research of Ouyang and Scarber (2020), where it highlighted that insufficient access to educational materials, textbooks, technology, and support resources can hinder students' ability to understand and engage with challenging topics. Moreover, students from underprivileged backgrounds could encounter

more difficulties getting the resources they need to succeed in some subjects, which could cause them to become frustrated and disengaged and make them choose subjects where the resources are easier to get.

This means that, lack of resources can contribute to students considering a topic their least preferred due to the barriers it poses to effective learning and engagement.

It is inferred that various factors contribute to students' designation of particular topics as their least preferred.

4. CONCLUSIONS AND RECOMMENDATIONS

This part presents the conclusions and recommendations of this research.

Conclusions

Based on the findings, the least preferred topic of the students in Mathematics in the Modern World with Biostatistics is descriptive statistics, specifically measures of variables. Furthermore, the students were able to experience problems such as information overload, challenging topics, lack of time, and lack of resources that affects their preferences in choosing their least preferred topics in Mathematics in the Modern World with Biostatistics.

Recommendations

Based on the findings and conclusions presented, it is recommended that all stakeholders need to be involved in the planning, design, and execution of different topics in Math 100N. Specifically,

1. For the students to develop keen interest on the least preferred topics, teachers must execute creative and innovative strategies to help students enjoy even the hardest topics in Math 100N.
2. To address such issues, teachers must allot time in chunking, dividing, and separating the topics to reduce information overload and to sustain student engagement.

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