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Least Mastered Topics in Mathematics and Freshmen Students' Perception of Mathematics Learning in the New Normal from a State University in the Philippines

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Abstract

This descriptive study sought to determine the least mastered topics in Mathematics in the Modern World (MMW) course and describe the students' perception of new normal mathematics learning. It was conducted in a State University in the Western Visayas region in the Philippines with 77 freshmen college students as participants. Researcher-made test and asynchronous focus group discussion guide were used as instruments of the study which were analyzed through frequency count, percentage, and bar graph for quantitative data and thematic analysis for qualitative data. Results revealed that the least mastered topics of freshmen college students in MMW were statistics concepts, problem solving, and logic. In addition, students' perceptions of new normal mathematics learning include difficult and challenging; willingness to learn despite the crisis; interesting and exciting mathematics in the new normal; and positive attitude towards mathematics learning. Hence, higher educational institutions might explore possibilities of curricular innovations, technology integration in mathematics instruction, pedagogical retooling for teachers, and recalibration of instructional materials to respond to the demands of the new normal or the next normal education. The least mastered topics may inform teachers handling MMW in Philippine Higher Education Institutions (HEI's) to design ways on how to make these concepts more comprehensive and easier to understand by freshmen students.

Keywords: Least Mastered Topics, New Normal Learning, Mathematics Learning, Students' Perceptions, Freshmen Students, Difficulties and Challenges, Mathematics in the Modern World.

INTRODUCTION

The COVID-19 pandemic has drastically affected the education sector around the world including the Higher Education Institutions (HEI's) in the Philippines. Different health and safety protocols were adapted to contain the spread of the virus (Radha et al., 2020) which also limited the conventional face-to-face instruction. This resulted to the sudden changes of the way education was delivered, from the face-to-face interaction to online education through the internet (Radha et al., 2020; Suryaman et al., 2020). In line with this, educational institutions all over the world, including the Philippines through the Commission on Higher Education (CHED) advised other institutions of higher learning in the country to implement online and distance education methods of learning for its classes (Hallare, 2020).

However, despite the efforts of the teachers to make learning effective during the pandemic, challenges with this abrupt transition have been explored widely specifically in mathematics instruction (Carius, 2020). Studies in new normal education have found out various discrepancies and limitations of the system particularly on the side of the students.

Some of the limitations in new normal learning as encountered by the students include network connection, finances in buying resources like computer and mobile data for online learning (Guansi et al., 2020; Tyaningsih et al., 2021; Mallillin et al., 2021), time management, difficulty to focus while learning online for a longer period of time, stress experienced which might have an impact on student perspective toward learning (Amir et al., 2020), health problems, the environment, and course constraints (Tyaningsih et al., 2021). In addition, students are not used for online classes, and students have adjustment difficulties in their online classes (Mallillin et al., 2021). According to Alipio (2020), low readiness scores were observed among learners in low-income class and rural areas as to the new normal learning. In this result, it could be inferred that these groups of learners are not yet ready for e-learning.

Even before the pandemic, most students perceive mathematics as a difficult subject because of the adverse teaching style, difficulty comprehending the topic, and difficulty memorizing its equations and problem-solving methods (Gafoor & Kurukkan, 2015). Kunwar (2020) claimed that one of the underlying reasons of learners' anxiety in mathematics was their negative perception of the subject. During the pandemic, the study of Ariyanti and Santoso (2021) found out that the average student's positive response towards mathematics before online learning is greater than after online learning. In the Philippines, the study of Guansi et al. (2020) among college students found out that students still prefer the learning process where the teacher explains the lessons followed by an assessment. Mamolo (2022) found that students in the online mode of instruction got a significant decrease in their mathematics motivation and self-efficacy while maintaining high anxiety.

Thus, this study determined the least mastered topics in Mathematics in the Modern World (MMW) of freshmen college students in a state university in the Philippines and explored their perception of mathematics learning in the new normal amidst the pandemic. This will inform the curriculum experts, faculty, and policy makers of HEI's in the country of the topics which the freshmen college students find difficult in MMW and their perceptions of mathematics learning in the new normal which will guide the former for future curricular innovations and policy recommendations for an enhanced mathematics education in state universities during or even after the pandemic.

Methodology

This study employed a descriptive research design. According to Fox & Bayat (2007), descriptive research aimed at casting light on current issues or problems through a process of data collection that enables them to describe the situation more completely. Descriptive study requires the researcher to observe, count, or in some way measure the frequency of a particular variable in a particular setting (Tuckman & Harper, 2012). Hence, this design fitted this study because it sought to identify the least mastered topics in MMW and describe the students' perception of mathematics learning in the new normal.

Moreover, this study was conducted in a State University in the Western Visayas region of the Philippines. To determine the least mastered topics of the students in Mathematics in the Modern World (MMW), 77 first year college students were included in the study coming from three intact groups who were chosen randomly through cluster sampling. It was also noted that the students per section are grouped heterogeneously. In addition, one group consisting of 24 students were included in the asynchronous Focus Group Discussion (FGD) through Facebook Social Learning group to describe their perceptions of mathematics learning in the new normal. Students' pseudonyms were used in the discussion of the qualitative data to ensure anonymity and confidentiality of identities.

Researcher-made test in Mathematics in the Modern World and asynchronous FGD guide were the instruments used in this study. These instruments were validated by experts depending on the nature of the instrument. The

researcher-made test was a 50-item multiple choice test administered to 77 first year college students who have taken the course MMW to determine the least mastered topics of the first four chapters. It was pilot tested to establish its reliability and was found reliable with a reliability coefficient of .87. According to Priyatno (2013), the instrument is reliable if the reliability coefficient value is greater than 0.6. Asynchronous FGD guide was used by the researcher to solicit the students' perceptions of mathematics learning during the pandemic.

In addition, descriptive statistics namely frequency count, percentage, and bar graph were employed to analyze and interpret quantitative data. Thematic analysis was used to analyze qualitative data.

Results and Discussion

Least Mastered Topics in Mathematics in the Modern World

The study found out five least mastered topics of first year college students in Mathematics in the Modern World as shown in figures 1-4 respectively. The least mastered topics of first year college students for the first four chapters of MMW were the following: In chapter 4 (Data Management), "Measures of Dispersion", "Probability and Normal Distribution", and "Linear Regression and Correlation" were the bottom three topics showing 12.99%, 20.78%, and 23.38% of the 77 freshmen students have correctly answered the items in these three topics respectively. These were followed by "Inductive and Deductive Reasoning" in chapter 3 (Problem Solving and Reasoning) and "Elementary Logic: Negation, Connectives and Quantifiers" in chapter 2 (Mathematical Language and Symbols) in which 31.17% students of the former and 37.66% students of the latter got the correct answers in these topics respectively. The bottom five bars in figures 1-4 with the lowest percentages were considered as least mastered topics in MMW. The percentages were computed by dividing the number of students who got the test items on every topic per chapter correctly by 77 (total number of freshmen students).

It can be observed that the bottom three least mastered topics of freshmen college students in MMW were under the data management chapter or elementary statistics concepts followed by problem solving and logic-related topics. This is not surprising because according to Abad & Arellano (2020) in their study of high school mathematics in the Philippines as preparatory for college mathematics, the learners' level of achievement in Probability and Statistics was deficient since they considered this course as a complicated area of mathematics (Abad & Arellano, 2020). To add, many students experience barriers to successful learning in statistics due to anxiety, motivation, or difficulty with quantitative understanding (Laugerman and Saunders, 2019). In addition, this result might be because online mathematics learning during the pandemic was difficult for the freshmen college students. Almarashdi and Jarrah (2021) found out that students' most negative perceptions were about missing the interaction with teachers and colleagues and disapproving of the unfavorably long screen times. This result is relevant since the process of online distance learning has become more common in the Philippines due to the COVID-19 pandemic. Bringula et al. (2021) also advanced that students faced technological, personal, domestic, assessment, pedagogical, consultation, and test anxiety challenges which affected their mathematics self-concept.

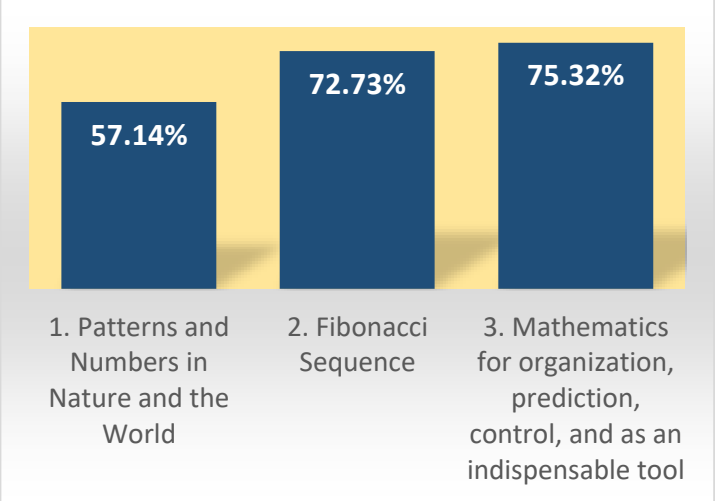

Figure 1. *Percentage of Correct Responses of Freshmen Students per Topic in Chapter 1 – "Mathematics in Our World"*

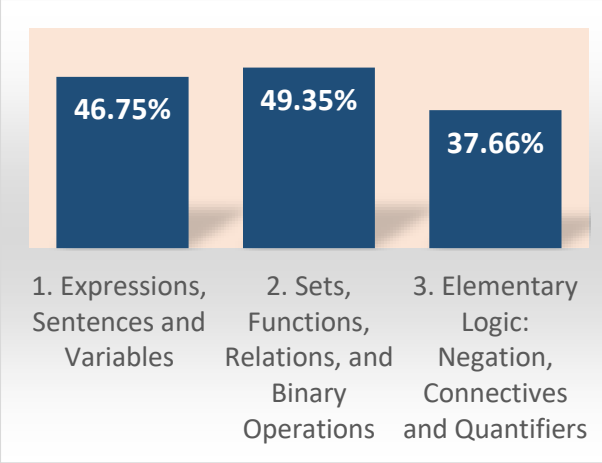

Figure 2. *Percentage of Correct Responses of Freshmen Students per Topic in Chapter 2 – "Mathematical Language and Symbols"*

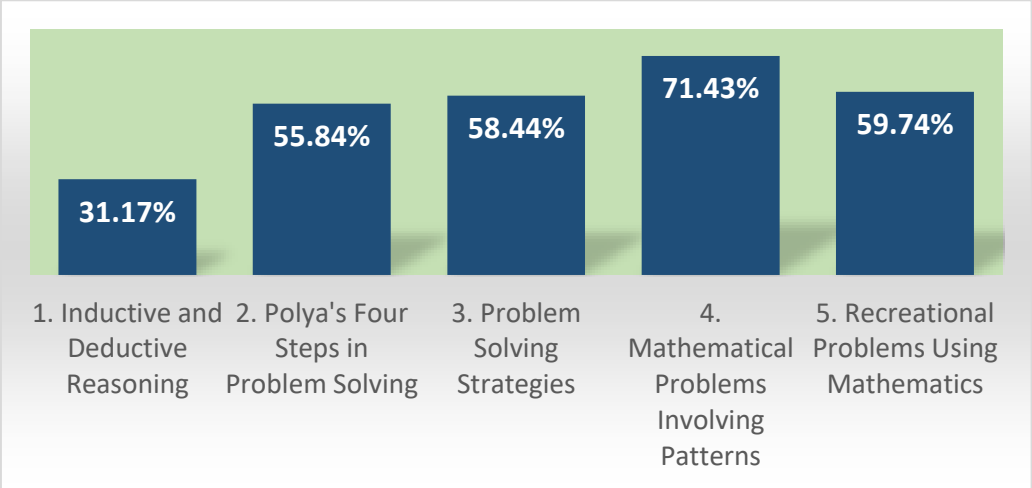

Figure 3. *Percentage of Correct Responses of Freshmen Students per Topic in Chapter 3 – "Problem Solving and Reasoning"*

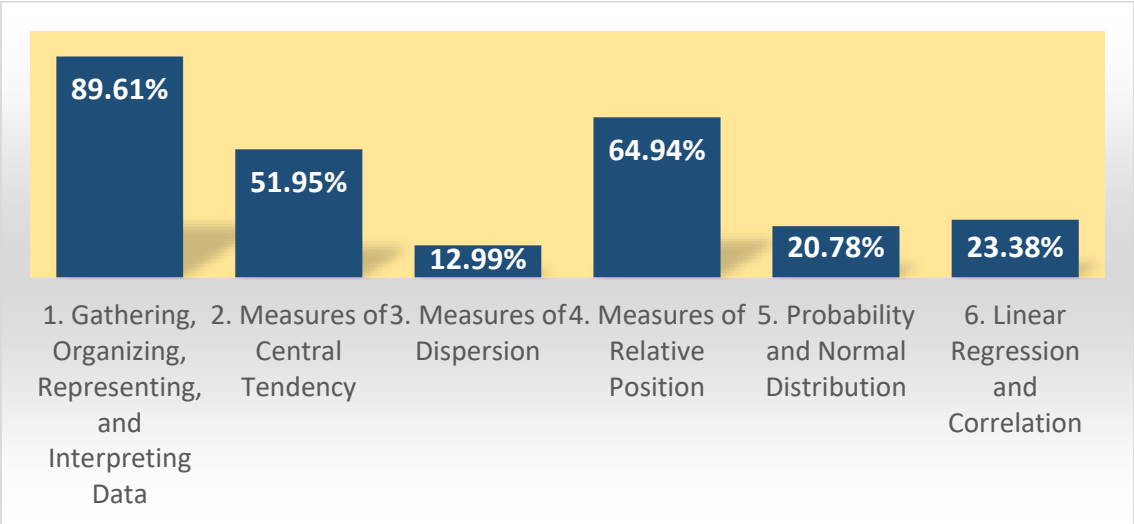

Figure 4. *Percentage of Correct Responses of Freshmen Students per Topic in Chapter 4 – "Data Management"*

Students' Perception of Mathematics Learning in the New Normal

One group of freshmen college students, 24 of them, were included in the asynchronous online focus group discussion (FGD) regarding their perceptions of learning mathematics in the new normal. They were allowed to use their mother tongue or native language so that they can express their thoughts better but majority of them answered in English. After the asynchronous online FGD, the researcher conducted a thematic analysis of their responses which came up with four themes manifesting their perceptions of mathematics learning during the pandemic namely: difficult and challenging; willingness to learn despite the crisis; interesting and exciting mathematics in the new normal; and positive attitude towards mathematics learning.

Difficult and Challenging. Most of the participants shared a common idea that mathematics learning in the new normal is challenging and difficult. This point of view might have been influenced by their not so good experiences in mathematics classes before the pandemic. In addition, they might have an innate anxieties and fear in numbers or mathematics. This was supported by what Student 1, Student 2, Student 3, and Student 4 have shared.

Student 1: "I am not that fond in this subject which is Mathematics, and it is my least favorite subject because ever since, I find it really difficult unlike other subjects that I can still cope with..."

Student 2: "I can see that this subject would be hard for it is math, my weakness..."

Student 3: "Honestly, math has been my weakness since high school, I'm one of those students who get anxious every time I am asked to answer a problem or solve an equation."

Student 4 further added that: "Actually I'm not a good in this subject because it's difficult for me."

Furthermore, some of the participants have a low self-esteem in terms of mathematics, numbers, problem solving, and analysis. These doubts on their dispositions of mathematics are also significant factors contributing to their perception of mathematics learning in the new normal as difficult and challenging. This was exemplified by Student 8, Student 9, and Student 10.

Student 8: "I know that this subject is more challenging because it talks about resolving numerical values and properties and I know that I have only enough ability to comprehend those things."

Student 9: "Honestly I'm having a hard time with mathematics because I'm a slow learner."

Student 10: "It's really challenging especially in analyzing a problem, my weaknesses when it comes in analyzing."

Willingness to Learn Despite the Crisis. However, despite the negative perceptions of the students regarding learning mathematics in the new normal, they are still willing and open to explore the possibilities of loving it and making the most of their learning experiences in the new normal. This was highlighted by Student 5, Student 6, and Student 7.

Student 5: "I can sense that this subject is difficult, but I am willing to gain knowledge and understand the importance of Mathematics."

Student 6: "My expectation in this subject is that it will be difficult to understand some lessons while learning but despite the difficulties I am willing to obtain new knowledge and acknowledge the importance of Mathematics everywhere."

Student 7: "I also like encoding, helping my parents and understanding social studies through surfing it online as my idle time. But in this subject, I think it would be reading barcodes without translation. Difficult but still willing to learn."

Interesting and Exciting Mathematics in the New Normal. On the other hand, it is also worthy to note that some of the students are still excited to learn and explore mathematics despite of the difficulties fostered by the new normal education. The students expressed the

idea that mathematics learning in the new normal can still be fun, interesting, and enjoyable. Since majority of the students belong to generation Z, the perception of having an exciting and interesting mathematics is not new through various engaging activities which can make it more fun. This is evident in the responses of the following students.

Student 10: "I hope that math will be enjoyable even though it's really challenging especially in analyzing a problem."

Student 11: "... I'm not that good in mathematics but may I enjoy and feel the excitement in solving math problems in this new normal."

Student 12: "I expect that I can learn a lot from Mathematics in the Modern World. I also wish that they have fun exciting activities."

Student 13: "I think it is an interesting subject and maybe I can know more about it and learn new knowledge."

Student 14: "I hope this subject will help me realize that math is enjoyable and not something to be scared of."

Student 15: "I wish more fun in learning Mathematics."

Student 16 seconded her statement, "although there are obstacles and difficulties in studies right now due to this pandemic which hindered everyone to go face-to-face, still I am expecting having fun in this subject."

Positive Attitude Towards Mathematics Learning. Furthermore, the participants also advanced the idea that despite the pandemic, their expectation and perception of learning mathematics in the new normal embody positivity. This may be one of their ways to alleviate the struggles of this new normal education. Majority of them perceived that they can still gain comprehensive understanding and relevant knowledge in mathematics for practical usage and meaningful learning amidst the pandemic.

Student 18 explained that "We are still in the middle of this pandemic health crisis and educating students and learning from the teachers is very difficult. I expect effective modes of learning even we are not in a classroom proper which will help us learn more things about the subject matter."

Student 19 cited that, "...Hoping that this subject will be more interesting to me and help me to understand and this subject is easy. Also, I can easily understand even though we are in this setup."

Student 20 further added that "I can feel that this subject will motivate me to learn more that can increase the knowledge I've learned before and help me to solve different problem that was related to math that I can also apply in real life."

Student 21: "… I expect that this subject will make me love Mathematics and see the beauty in it even though we are facing a new normal mode of learning. It will not become a hindrance to understand the lessons and will serve as a challenge to make us learn."

Student 22: "I expect to learn the importance and use of mathematics in our daily lives and in the modern world."

Moreover, some of the participants also perceived a simple, guided, meaningful, and easy to understand mathematics content and delivery in the new normal for optimal learning.

According to Student 23, "My expectation from this subject is easy and simple. Hoping that it can give us better understanding about the topics ..."

Aside from being easy to understand, Student 24 also pointed for a meaningful mathematics takeaway, "…I hope that by the end of this semester, what we have learned will imprint in our minds and be used in the next steps towards our success."

The findings on perceptions of online mathematics learning are in consonance to the study of Dowker et al. (2016) who reported that, based on numerous studies, anywhere from 2% to 68% of students have mathematics anxiety. Gautreau et al. (2016) noted that

negative stereotypes and prior learning experiences are two of the prevalent factors that influence mathematics anxiety and attitude. In addition, the study of Ariyanti & Santoso (2021) in Indonesia on online mathematics learning prior and after the pandemic also attests the findings above that the students find this new normal way of learning as challenging based on the student's responses towards mathematics.

Even the transition of the mode of learning was smooth, but for others, it was rough, especially for those from underdeveloped countries like the Philippines (Simbulan, 2020). Though flexible online learning is an excellent platform, some issues occur that affect both students and teachers. The pandemic harms students' behavioral and emotional functioning, notably focus and alleviating difficulties caused by seclusion, financial standing, health implications, and anxiety (Copeland et al., 2021). Mamolo (2022) conducted a study in the Philippines to ascertain the students' level of mathematics motivation, self-efficacy, and anxiety before and after exposure to online learning. The results showed that students in the online mode of instruction got a significant decrease in their motivation and self-efficacy while maintaining high anxiety.

Despite their negative perceptions towards mathematics learning in the new normal, students still have positive outlook towards mathematics learning as manifested by their willingness to learn the subject and the excitement to learn mathematics concept despite the crisis. It is in consonance to the study of Almarashdi and Jarrah (2021) wherein students perceive that learning through the LMS is interesting despite the negative mathematics self-concept. These findings suggest that they believe that their abilities can still meet the demands of the course. They are confident that they can still perform well despite the challenges and uncertainties they are facing.

Interesting and exciting online mathematics also supports the findings of Cox (2017) that students prefer technology because they believe that it makes learning more interesting and fun. This also concurs with the findings of Villanti et al. (2017) that in the modern era where almost everything can be done online, this follows that the type of students and schools are catering right now can be tech savvy and technologically literate. Hence, learning can still be fun and exciting in the new normal with these techno-savvy learners. In addition, the use of technology-mediated instruction in mathematics excites students which stimulate their interests and in turn creates a positive impact to their attitude towards mathematics, appreciation of mathematics concepts, and their performance (Nabayra, 2022a; Nabayra, 2022b; Nabayra, 2020a; Nabayra, 2020b; Hermita et al., 2021; Pal and Patra, 2020). Thus, the need and demand for the integration of technology in education was even heightened by the pressures and challenges of the pandemic (Pal & Patra, 2020).

Conclusion and Recommendations

This study investigated the least mastered topics of freshmen college students in mathematics and explored their perceptions of mathematics learning in the new normal from the perspective of a rural State University in the Philippines. The findings of the study highlighted that the least mastered topics were on the concepts of statistics, logic, and problem solving which make sense since these topics were included in the latter parts of the basic education curriculum in the Philippines in the Junior High School level. The kind of new normal learning environment may have also affected the results of the least mastered topics since it's difficult for the teachers to teach math concepts like statistics, problem solving, and logic in an online or even flexible learning environment which limited personal communication unlike in personal face-to-face interaction (Barlovits et al., 2021). This only shows that freshmen students still have problems and deficiencies on their knowledge and conceptual understanding of these mathematics concepts as they enter the university system.

Moreover, the freshmen students' perception of mathematics learning in the new normal exemplified the expectations and viewpoints of typical students in a rural state university who considered new normal learning as difficult and challenging. As revealed by their responses, this point of view was influenced by their previous negative experiences of mathematics learning in the pre-pandemic era and their anxiety and fear of the subject. However, the willingness to learn the subject, excitement, and positive attitude towards mathematics never dwindled despite the challenges brought by the COVID-19 pandemic. Students are still hopeful of a meaningful mathematics learning experience in the new normal which could make the subject easy to understand and simple through various engaging tasks despite the limitations of the pandemic. The positive attitude of the students towards mathematics learning in the new normal was also spawned by their beliefs that they can learn practical concepts in mathematics even amidst the pandemic which they can apply in real-life. Their confidence on their teachers who will provide quality and effective mathematics learning experience was also cited by the freshmen students as one of the factors why they are interested in learning the concepts of mathematics even in these challenging times. All these boil down to the typical indomitable trait of Filipinos amidst the crisis.

Thus, educational institutions specifically in higher education like the state universities in the country may find ways on making mathematics learning a worthwhile experience for the college students in the new normal. They might explore possibilities like curricular innovations, technology integration in mathematics instruction, pedagogical retooling for teachers, and recalibration of instructional materials to fit the demands of the new normal or the next normal education. Universities and colleges may also enhance their internet connections and ICT infrastructure to support the transformation of instruction from the usual face-to-face to flexible, blended, or hybrid learning models. These perceptions of freshmen students might give them ideas on how to deliver quality instruction not just in mathematics but in other disciplines as well. The least mastered topics may inform teachers handling MMW in Philippine Higher Education Institutions (HEI's) to design ways on how to make these concepts more comprehensive and easier to understand by freshmen students.

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