International Journal of Academic Multidisciplinary Research (IJAMR)
ISSN: 2643-9670
Vol. 5 Issue 2, February - 2021, Pages: 37-43

Roadblocks in Teaching Mathematics in the Modern World

Thelma V. Pagtalunan, Ph.D.

Professor II , Mathematics Department
College of Science
Bulacan State University, Philippines

Abstract: *Mathematics in the Modern World (MMW) is one of the new subjects offered under the New General Education Curriculum, which is on its second year of implementation. As per CMO No. 20, series of 2013, The course begins with the nature of mathematics as an exploration of patterns (in nature and in the environment) and as an application of inductive and deductive reasoning. Moreover, MMW is not only based on theories but is actually connected to everyday living in terms of how to manage limited resources, personal finances, appreciating geometric designs, and even making social choices. The participants of the study were the faculty members of the Mathematics Department of the College of Science, Bulacan State University, Philippines, who were selected via purposive sampling. Data from the respondents were primarily gathered from the respondents through an interview guide formulated by the researcher. It consisted of open-ended questions relating to the participants' experiences in the teaching of Mathematics in the Modern World (MMW). The following recommendations are suggested: (1) provision of additional training and seminars for faculty members so that they would be more well-equipped in teaching MMW; (2) construction of a reference material (i.e. textbook) in MMW which could be done by faculty members handling the subject; (3) Make MMW more activity oriented so that the students will be more engaged and participative in class discussions; (4) conduct benchmarking activities to top college.*

Keywords: *mathematics learning, teaching*

Introduction

The enactment of Republic Act No. 10533, otherwise known as the " Enhanced Basic Education Act of 2013", brought about a significant change in the educational system in the Philippines. One among them is the addition of two years in the Secondary Education (Grades 11 & 12). After a learner undergoes Junior High School (Grades 7-10), he/she will have to though an additional two years of Senior High School wherein there are several tracks to choose from, namely : Academic, Arts & Design, Sports, and Technical-Vocational Livelihood. Within these tracks are several strand such as Accountancy Business, & Management, General Academic Strand, Humanities and Social Sciences for the Academic Track and Information Communications Technology, Industrial Arts, and Home Economics for the TVL Track.

These changes necessitated some revisions and modifications in the curriculum, both in the Basic Education and Higher Education Levels. In particular, the Commission on Higher Education (CHEd) reorganized the subject offerings of colleges and universities in line with the K to 12 Program and devised the New General Education Curriculum which had its pilot implementation during the Academic Year 2018-2019. Some subjects which were previously offered were cascaded to the Senior High School and new subjects were introduced such as Understanding the Self, Readings in Philippine History, Ethics, Purposive Communication, and Mathematics in the Modern World or MMW. This is in line with CMO No. No. Series of 2013.

Relatively, MMW is still new, considering that the New GEC is only in its second year of implementation. According to the said CMO, The course begins with the nature of mathematics as an exploration of patterns (in nature and in the environment) and as an application of inductive and deductive reasoning. Moreover, MMW is not only based on theories but is actually connected to everyday living in terms of how to manage limited resources, personal finances, appreciating geometric designs, and even making social choices. As such Mathematics in the Modern World is like an amalgam of different mathematics subjects, there is algebra, geometry, statistics, and even mathematical logic. Unlike any other mathematics subject, it is not focused on one learning area alone, covers an array of related learning areas, following the spiral progression approach. However, according to the National Council of Teachers of Mathematics, new standards provide guidance and direction, and help focus and clarify common outcome, but these standards do not tell teachers, coaches, administrators, parents, or policymakers what do at the classroom.

Teaching a new course is really a challenge on the part of instructors and professors. Although there is a common course syllabi, certain innovations and adjustments have to be made in order to suit the needs of the learners. Another possible challenge is of course the time element needed to cover all the topics. MMW is not only limited to a particular topic in mathematics and the instructor or professor has to cover all the topics included in the syllabi in one semester only. Moreover, do the students already have the prerequisite knowledge of the other mathematics subjects, which they supposedly acquired in their senior high school?

Generally speaking, not every student appreciate Mathematics, it is even considered as a difficult subject. In a study, it was pointed out that students lacked training in critical or logical thinking and problem-solving analysis and comprehension [1]. On the other hand, Mohd Rameli (2016) cited five main challenges in terms of learning Mathematics : 1) self-factors, which pertain to negative perception and lack of self-regulation ;2) teacher factors, citing behaviors, practices, and characteristics of the

teacher of Mathematics, 3) parents (lack of cognitive, emotional, and financial support ; 4) friends (negative attitudes, behaviors); and 5) other factors which point out to the nature of Math itself and assessment pressure.

Similarly, another study stated the following key problems faced by Mathematics teachers : 1) classroom management ; 2) lack of student participation ; 3) lack of opportunity to join Mathematical conferences, seminars, and the like. As such, it could be said that learning Mathematics is more of the affective dimension, it involves attitude [2]. A study mentioned three factors towards mathematics achievement : perceived parental influences, teachers' affective support, and classroom instruction [3]. The key therefore is to engage the students so that they could learn Mathematics.

Most of the researches are about factors associated with learning Mathematics. However, there is a dearth of studies on problems encountered by the faculty members themselves in teaching mathematics subjects, particularly Mathematics in the Modern World. These, among others, motivated the researcher to conduct a study on the challenges and difficulties that a teacher of Mathematics in the Modern World experiences.

The study "Roadblocks in Teaching Mathematics in the Modern World" aims to explicate on the following questions :

1.What are the common difficulties a teacher encounters/experiences in teaching Mathematics in the Modern World?

2.What are possible ways of addressing these challenges?

Methodology

Design

This study is a qualitative study since it aims to gain insights in the prevailing trends and is interpretative and contextualized. Moreover, qualitative research is a type of educational research in which the researcher relies on the views of participants; asks broad, general questions; collects data consisting largely words (text) from participants; describes and analyzes these words for themes. Qualitative research aims to deepen the understanding of a certain phenomenon, which is in this case, the teaching of Mathematics in the Modern World, by focusing on the experiences of the faculty members who have taught the subject and gain significant insights from them. The study also employs the Survey as the main data gathering tool.

Respondents

The participants were asked open-ended questions relating to their experiences in the teaching of Mathematics in the Modern World. This kind of approach is able to provide the respondents the freedom to say what they feel about a topic, which provides the researcher with an exploratory data that may unleash important issues, opportunities, issues, or quotes.

Afterwards, the researcher explained to the respondents the purpose of the study. Participation in the study was primarily on a voluntary basis. Next, the respondents' consent were sought before administering the survey questionnaire. Also, the identities of the respondents were kept confidential and they were assured that all the data which will be gathered from the study will be strictly for academic purposes only.

The participants of the study were the faculty members of the Mathematics Department of the College of Science, Bulacan State University, Philippines, who were selected via purposive sampling. Mangaran & Garcia (2011) states that purposive sampling is done when the subject satisfies the criteria laid down by the researcher. Meanwhile, purposive sampling uses small sample sizes, its goal is to increase credibility, and not to encourage representativeness. From among the faculty members of the Mathematics Department, 14 who were teaching MMW were selected as participants in the study.

Data Gathering

Data from the respondents were primarily gathered from the respondents through an interview guide formulated by the researcher. It consisted of open-ended questions relating to the participants' experiences in the teaching of Mathematics in the Modern World (MMW). Moreover, the researcher employed a semi-structured interview in order to obtain relevant information from the participants. Semi-structured interview is used when the researcher prepares a specific set of questions but could ask follow-up questions to the participants for them to elaborate their answers, thus, it would be easy for the researcher to gather additional information and to have an in-depth perspective on the responses of the interviewee.

The following were the questions asked from the participants.

1.What is your view/perception about Mathematics in the Modern World? How similar/different is it from the other Mathematics subjects?

2.As a teacher, what were the challenges that you encountered in teaching the said subject?

3.From among these challenges, which do you think is/are the most prevalent?

4.How would you possibly address these challenges so that there would be a meaningful teaching-learning process?

Data were analyzed using narrative analysis. This approach in analyzing data is used to analyze text that may come from variety of sources including transcripts from interviews, diaries, field notes, surveys and other written forms. Narrative analysis often involves reformulating stories presented by people in different context and based on their different experiences. In the present study, the researcher prepared a set of questions wherein the participants were free to give their answers/insights to the

same. The participants were also given the freedom to expound/explain their answers. Afterwards, common themes from their responses were coded and analyzed accordingly.

Results

Table 1-a. Summary of Responses for Item No.1

Item No.	P1	P2	P3	P4	P5	P6	P7
1. What is your view/perception about MMW? How similar/different is it from other Mathematics subjects	*Has a very broad coverage* *Involves calculation* ***Involves technology***	*Appreciate that Math is not only numbers but* ***also in nature*** *More simple than Pre-Calculus (old curriculum)*	*Involves* ***application of Mathematics*** *About the appreciation of Math*	***Activity-oriented*** *Different sequencing of topics*	*Combination of selected topics* ***interesting*** *also involves computation*	*Intended to help students* **appreciate and apply what they have learned** *not that technical* *focused on how we utilize Math in everyday scenarios*	*does not really emphasize computation* *majorly about the* ***extent of application of Math*** *to the world* *aims to promote critical thinking*

Table 1-b. Summary of Responses for Item No.1

Item No.	P8	P9	P10	P11	P12	P13	P14	Common Theme/s
1. What is your view/perception about MMW? How similar/different is it from other Mathematics subjects	*requires familiarization on the subject matter* *different due to non-presence of pure computations*	*science of patterns* ***Math appreciation*** *Nature appreciation* *Logic and reasoning* *Foundation More on math appreciation, mathematical ability, logical reasoning*	*Wide array of topics* *Overview of higher level Mathematics*	*More general* *Overview* *Needs improvement (content)*	*Nature of math as math itself* ***Uses in the lives of humans*** *Being discussed according to the use of Mathematics in life*	*Interesting to discuss* *Students* ***appreciate the beauty of Mathematics*** *Similar to other Math subjects in terms of logic, reasoning*	*Helps students understand patterns, relationships* ***Appreciation of Math*** *Focus connecting to real life* *No serious computations*	***Practicality of Mathematics***

It could be surmised from the preceding tables that from among the responses, what emerged as their common response was about how MMW teaches the students how to ***appreciate Mathematics*** and see its ***practical application*** to a person's day-to-day life. Since it was noted that MMW does not really emphasize computations and is not that technical compared to other

mathematics subjects. The focus of MMW is really on the more practical side of Mathematics, i.e. the presence of patterns, relationships, in our surroundings.

Table 2-a. Summary of Responses for Item No.2

Item No.	P1	P2	P3	P4	P5	P6	P7
2. As a teacher, what were the challenges that you encountered in teaching the said subject?	*Use of technology* *Attitude of students* ***Lack of instructional materials*** *Inadequacy of trainings for faculty members*	*Hard to teach the non-Math majors*	***Lack of instructional materials***	*Use of technology* *Content/lessons ("a little bit of everything")* *Learning competencies of students* *Attitudes of students*	*Study topics that are new/unfamiliar* *Lesson Organization*	*Students lack pre-requisite knowledge* ***Lack of resources /materials*** *Lack of trainings and seminars* *Loaded curriculum*	***Lack of reference materials*** *Coverage of the topics*

Table 2-b. Summary of Responses for Item No.2

Item No.	P8	P9	P10	P11	P12	P13	P14	Common Theme/s
2. As a teacher, what were the challenges that you encountered in teaching the said subject?	*Lack of preparation (concept explanation)* ***Need to read different reference s*** *Personally appreciate the subject matter*	***Lack of materials reference books*** *Insufficient knowledge (scope of the subject)*	*Visualization of topics* *Difficulty on the students on the use of fractals, golden ratio, etc.*	*Topics aren't interconnected* *Vague content* *Students are often confused*	*Most of the topics are new* *Doesn't cover only one topic* ***Lack of resources***	*Challenge in terms of discussing the first part (less on computations but stories about Mathematicians and their contributions)*	*Need to use LCD* *More research* *Think of many activities*	***Inadequacy of materials and resources***

The preceding tables (Table 2-a and 2-b) depict the responses of the participants on the question pertaining to the challenges that they had encountered in teaching MMW. It could be gleaned that most of the participants opined that ***lack of materials and resources*** is the common challenge that they encountered in terms of delivering the lessons in MMW. Since it was noted that the said subject covers a wide array of topics, if there is no common textbook or reference material used, there is a tendency that each teacher may cover less or cover more of a certain topic or lesson. Thus, there could be discrepancies in terms of lesson content and coverage. Another, since the topics in MMW are quite new, teachers should be more creative in presenting them, thus, the use of LCD projectors, audio and video materials become inevitable.

Table 3-a. Summary of Responses for Item No.3

Item No.	P1	P2	P3	P4	P5	P6	P7
3. From among these challenges, which do you think is the most prevalent?	***Lack of instructional materials***	*Teaching students to* ***understand the process of solving mathematics problems***	***Lack of instructional materials***	***Learning competencies of students*** *(some are non-STEM)*	*Learning topics not familiar*	***Lack of pre-requisite knowledge*** *of the subject*	***Lack of common reference materials***

Table 3-b. Summary of Responses for Item No.3

Item No.	P8	P9	P10	P11	P12	P13	P14	Common Theme/s
3. From among these challenges, which do you think is the most prevalent?	*Need to be more creative in introducing Math* ***No particular reference materials approved for use*** *Coverage is diverse*	*Insufficient knowledge in the scope of the subject*	***Make them (students) understand*** *the association of Fibonacci numbers to the application of golden ratio in nature*	*Vague content*	*Most of the topics are new* ***We do not have enough resources***	*No Response*	*Creating challenging activities* *Use of visual aids*	***Lack of instructional materials*** ***Lack of pre-requisite knowledge of the subject matter***

Tables 3-a and 3-b presents the responses of the participants when they were asked the question regarding the most prevalent challenge that they encountered in teaching MMW. A further perusal of the table reveals that *lack of instructional materials and lack of pre-requisite knowledge of the subject matter* emerged as the common themes. According to the participants, the topics in MMW is not confined to a specific discipline in Math like Algebra, Trigonometry, Statistics, and the like. Hence, this demands pre-requisite knowledge of the subject matter for both the teacher and the student.

Table 4-a. Summary of Responses for Item No.4

Item No.	P1	P2	P3	P4	P5	P6	P7
4. How would you possibly address these challenges so that there would be a meaningful teaching-learning process ?	***Construct a module or*** *any instructional material* ***Seminars and conferences must be given to the faculty members***	*There should be an* ***effective strategy*** *that the teacher can use*	***Construction of a learning material/ module***	***Additional trainings***	***Trainings/ Seminar Workshop***	*Let students have review lessons, independent study* *Motivation and initiative (students)*	***Sourcing out lessons from other references***

Table 4-b. Summary of Responses for Item No.4

Item No.	P8	P9	P10	P11	P12	P13	P14	Common Theme/s
4. How would you possibly address these challenges so that there would be a meaningful teaching-learning process ?	***Continue the training*** *of faculty* ***Localized references***	***Complete training*** *and materials to be used*	***Use of technology*** *(audio-video materials)*	*Expand the syllabus* *Have an online class*	*Research on the internet and watched video clips*	***Attend trainings*** ***Provide manual to the students***	*Give some research about the topic* *Group report* *Manipulative or hands-on demonstration*	***Retooling of Faculty Members***

The preceding tables (4-a and 4-b) convey the responses pertaining to how the faculty members would possibly address the difficulties that they had encountered in teaching MMW. It could be surmised that the participants mostly responded the provision of trainings and seminars for faculty members and construction of a module or learning material to be used for the subject. Thus, it was collectively coded as *retooling of faculty members*. Attendance to seminars and conferences would keep the faculty members abreast with the current trends in MMW, including content and pedagogical strategies and methodologies.

Discussion

Several studies aim to address the problems encountered by Mathematics teachers [4] [5]. The use of technology computer-assisted instruction, alternative modes of delivery, and differentiated instruction are some suggestions on how to improve mathematics education and make mathematics teaching and learning easier, so to speak. Furthermore, teachers should integrate in their lessons the value and practicality of Mathematics not only in solving mathematics-related problems but also in real-life situations [6][7][8].

Conclusions

The following were the conclusions derived from the study :

1.Teacher-participants perceive MMW as a subject that deals with the practical application of Mathematics to everyday life ;

2.The common problems that the faculty members encountered in teaching MMW were lack of a common instructional materials and inadequacy of trainings for the faculty members handling the said subject ;

3.That for the faculty members retooling the faculty will be the most effective way of addressing the challenges in teaching the subject.

Recommendations

In line with that, the following recommendations are suggested for possible adoption/implementation :

1.Provision of additional training and seminars for faculty members so that they would be more well-equipped in teaching MMW.

2.Construction of a reference material (i.e. textbook) in MMW which could be done by faculty members handling the subject.

3.Make MMW more activity oriented so that the students will be more engaged and participative in class discussions.

4. Conduct benchmarking activities to top colleges and universities so that their best practices might be adapted.

References

[1] Acula D. & Suasiso O. (2007). Factors related to students' learning difficulties in mathematics. TECHNOLOGICAL INSTITUTE OF THE PHILIPPINES RESEARCH JOURNAL, Vol. 4 No 11. Quezon City.

[2] Poudel, M. (2015). Problem faced by mathematics teacher at higher secondary. level. Tribhuvan University, Kathmandu, Nepal;

[3] Pagtalunan, T. (2019). Determinants of students learning in mathematics in the modern world. APPLIED SCIENCES EDUCATION E-journal.

[4] Mohd Rameli, M.R. (2016). Challenges in mathematics learning : a study from school students' perspective.

[5] Magayon, V. & Tan E. (2016). Learning mathematics and differentiated instruction in the Philippines : a phenomenographical study on struggles and successes of grade 7 learners. INTERNATIONAL JOURNAL OF EDUCATION STUDIES IN MATHEMATICS, 3 (3) 1-14.

[6] Devadas, S.D. & Yoon Fah Lay. (2017). Factors affecting students' attitudes towards mathematics : a structural equation modelling approach. EURASIA JOURNAL OF MATHEMATICS, SCIENCE. AND TECHNOLOGY EDUCATION. ISSN : 1305-8223 (online). DOI : 101.12973/ejemster/80356. Accessed on January 23, 2019.

[7] Asio, J.M.R., & Riego de Dios, E.E. (2018). 21st century attributes and skills of a teacher in the perspective of college students. *Zenodo*. http://doi.org/10.5281/zenodo.3961838

[8] Francisco, C.DC., & Celon, L.C. (2020). Teachers' instructional practices and its effects on students' academic performance. *International Journal of Scientific Research in Multidisciplinary Studies*, *6*(7), 64-71. http://dx.doi.org/10.21474/IJAR01/987.