

Outcomes of the Course Mathematics in the Modern World: A Phenomenological Study

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Abstract

Mathematics in the Modern World is a new General Education course in undergraduate level designed for the appreciation of Mathematics. The course is intended for the students to see the value and applicability of Math in the various facets of human endeavor. As a new course, its impact on teachers and students necessitates further understanding. The use of phenomenology as a qualitative research design enabled the researchers to explore the phenomenon, Mathematics in the Modern World, through the lens of the actors—teachers and students—to extract the meanings, structures, and essence of the course. Through this design, the study is unremitting to any existing framework and rooted in the lived experiences of the actors. The study involved the students and teachers of Northwest Samar State University. The data revealed the positive and negative views of students and teachers on the course. Students' lived experiences suggest that the course provides a feeling of belongingness through class activities. On the other hand, other students experience negative psychosomatic impacts such as "boredom", "dizziness", and "sleepiness". The teachers' lived experiences reveal that the teaching process of the course impacts students' behavior, performance, and outlook towards Math. The essence of Mathematics in the Modern World unveils that the course addresses the stigma through participative and facilitative encounters that highlight its real-life application. Such encounters are influenced by the quality of teachers, and the attributes and challenges of a learner. Anchored on these results, the study recommends that to meet the intended objectives of the course, interventions such as bridging programs, psychosocial mediations, teaching strategies, and curriculum development review, should be explored to capture an outcomes-based education that addresses the stigma, supports students' learning, emphasizes practical applicability, and fosters good study habits.

Keywords: *Mathematics in the Modern World, teaching strategies, outcomes-based education*

Introduction

The Commission on Higher Education revisited the general education curriculum, which generated a substantial reduction from the existing 63 units to only 36 GE units. This new general education curriculum is anchored on eight courses, including the course, Mathematics in the Modern World (Valencia, 2015). Mathematics in the Modern World is a course designed for Math appreciation, concerning topics on Algebra and its relevance to the day-to-day student encounters.

This course is expected to provide students with opportunities on solving problems that allow them to understand and value the applicability of Math in various fields and human endeavors (DLSU, 2015). Studying its impact, to both students and teachers, cognizant of the intended course outcomes, is important to enhance the teaching and learning experience of the course. The outcomes-based education calls for exceptional instruction and innovations on instructional materials to make sure that the students are

meeting the course outcomes. Hence, the study is conducted to understand the essence of teaching and learning the course through phenomenology, to gain insight on the course objectives and its effect on the students and teachers.

Statement of Objectives:

As a phenomenological study, the exploration of both actors (the instructors and the students) reflects a metaphorical mirror. This depicts that the student's performance should manifest the intended course outcomes to unveil the essence of teaching and learning Mathematics in the Modern World. The study posed five key research questions to guide it in its qualitative exploration as follows:

1. What are the lived experiences of the students who underwent the course Mathematics in the Modern World?
2. What are the lived experiences of the instructors teaching the course Mathematics in the Modern World?
3. What are the meanings, structures, and essence of the lived experiences in learning and teaching Mathematics in the Modern World as described by:
 - 3.1 the learners, and
 - 3.2 the teachers?
4. How do these lived experiences in teaching and learning Mathematics in the Modern World relate in terms of meanings, structures, and essence?

Review of Related Literature

As a study anchored on lived experiences of the subjects, the study did not primarily rely on pre-existing notions. The review concerns the aspects of teaching and learning as a process, and the factors related. A run-through on Mathematics in the Modern World is included to understand the purpose of the course and the roots of its revisions.

Mathematics in the Modern World

Based on the curriculum revision, Mathematics in the Modern World is described as a course on "the nature of Mathematics, appreciation of its practical, intellectual, and aesthetic dimensions, and application of Mathematical tools in daily life" (Commission on Higher Education, 2013, p. 6). This should provide the students an opportunity to go beyond the mainstream notion of Mathematics, which is often perceived and regarded as merely a compilation of formulas. Through this, students can see Mathematics and its aesthetics, through the patterns of nature, and as a powerful language itself, reigned by logic and reasoning (Commission on Higher Education, 2013).

The course learning plan outlined by the CHED (CMO NO. 20, 2013) underscores the following outcomes:

Knowledge. Discuss and argue about the nature of Mathematics, what it is, how it is expressed, represented, and used (p.2); Use different types of reasoning to justify statements and arguments made about Mathematics and Mathematical concepts (p.2); Discuss the language and symbols of Mathematics (p.2).

Skills. Use a variety of statistical tools to process and manage numerical data (p.2); Analyze codes and coding schemes used for identification, privacy comma and security purposes (p.2); Use Mathematics in other areas such as finance, voting, health and medicine, business, environment, arts and design comma and recreation (p.2).

Values. Appreciate the nature and uses of Mathematics in everyday life (p.2); Affirm honesty and integrity in the application of Mathematics to various human endeavors (p.2).

The teacher is the captain directing the destination in the metaphor of the learning process as a ship. Meanwhile, the students are passengers. Numerous factors may impact the learning process, as identified by Mondal (2020). Intellectual factor refers to an individual's mental level or intellect, this may affect the student in a way that it could implicate serious difficulty in mastering schoolwork. Emotional and social factors, on the other hand, include instincts, emotions, and other social dynamics such as cooperation and rivalry, which is related to a complex psychology of motivation. A teacher's personality is also a factor and it connotes to the individual character of the teacher that affects the learning environment and the failures and success of a learner. This indicates that the way the teacher deals with the students determine the kind of behavior they manifest in the learning situation.

In the context of the learning process, especially in Mathematics, National Numeracy (2013) showed that negative or bad experiences of students in learning Math lingered to 25% of the students. This bad experience attributes to Math anxiety and results in avoidance of the subject (Chin, 2012). This is the stigma of Math was shown to contribute to students' poor performance in the Philippines (Jaudinez, 2019). Additionally, when a single student is anxious about Math this creates a negative attitude among other students towards Math as well (Lomsadze, 2017).

Teaching Process

This conceptualization on how Math stigma hampers students education was supported in an exposition (Lomsadze, 2017) wherein it was emphasized that traditional teaching of Mathematics, which includes procedure memorization leads to the notion that "Mathematics is an arbitrary and a limited realm of study" (para. 4). The disconnected approach in the Math teaching process can contribute to the stigma, if not the root of the stigma. This could be addressed through teaching strategies.

Interactive teaching highlights the role of the teachers and their relationship with the students in the instructional process (Xhemajli, 2016). The teacher acts as the "instigator of interaction" (p. 31). Interactive teaching, while seen as a favorable method that promotes learning, it is also challenging on the part of the teachers (Xhemajli, 2016). Interactive and facilitative learning is shown to be effective in various researches. Educational Dividens(2020) presented that when students "apply their knowledge to a real-world problem" (para. 1) and "apply their Math, science, and language arts knowledge while using the technology, teamwork and workplace skills" (para. 1), they learn the concepts and also earn the skills "that prepare them for life"(para 1). This notion has also been circulated in various policies of DepEd (DepEd No. 21, 2019), CHED, and even in some philosophical roots of strategies and methods of teaching, specifically in experiential learning, (Corpuz & Saldanan, 2015) and constructivism (Bruner, 1960).

The Self in the Context of Learning

Theoretically, the negative experience occurs when a student relates the study process and the structural complexity of learning. Such a process is defined in three dimensions i.e., utilizing, internalizing, and achieving (Biggs, 1979). These dimensions have "a cognitive and an affective component" (p. 381). The affective component details the motivational aspect of the student to learn.

The concept of self-awareness helps in mending the impacts of Math anxiety and stigma. A self-aware adult is described to possess an independent self-concept, problem-centered, directing their learning, and internally motivated (Steiner, 2014). The mind

therefore already conditioned and assimilated (Corpuz & Saldanan, 2015) the stigma to Math and ones' senses.

Methodology

Research Design

The study follows a qualitative research design to extract the essence of teaching and learning. This form of research is interpretive and existentialist, therefore, the perspectives of the subjects are being studied (Willis, 2007). This is an appropriate design for uncovering the essence of the course.

A sole instrument will be utilized in the study in a form of an interview (Giorgi, 1994), which was conducted one-on-one and not a group to ensure that their narrative of the phenomenon is not influenced by the other subjects of the study. The initial question posed in this phenomenological study was: "In as much detail as possible, tell me what it was like for you to teach/learn Mathematics in the modern world". This is a necessary open-ended question to incite a wider range of responses. Follow-up questions based on the tacit knowledge of the researcher were generated to expound the experience.

Leading questions are never used in the conduct of a phenomenological study and the data must be anchored purely on the narratives of the subjects (Giorgi, 1994). The validation of the instrument was conducted through a pilot interview to assess the following areas: (1) utility of the question to elicit the subjects' responses; (2) set follow up questions and (3) analytical soundness of the responses for the research questions of the study. These components were judged by three (3) experts in the process similar to content validation (Zamanzadeh, et al., 2015).

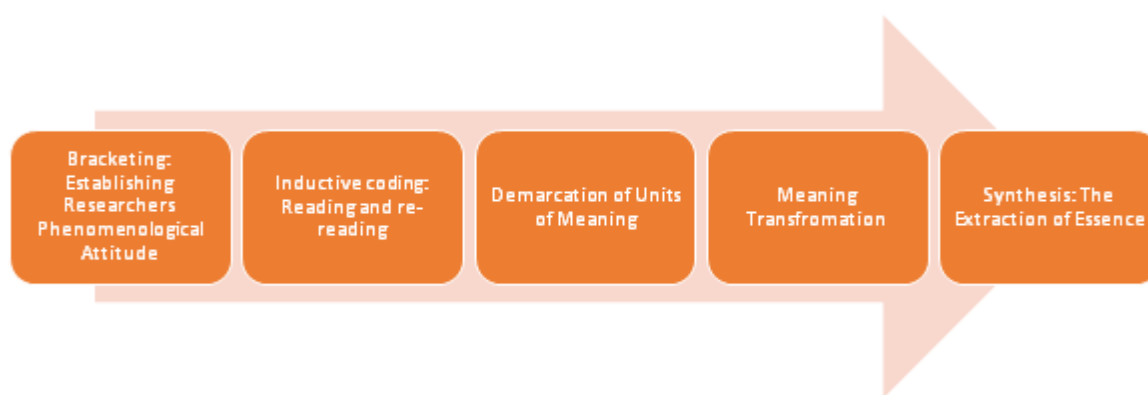
The participants for this study are from a pre-defined population of people, hence, purposive in nature of sampling selection (Fraenkel & Wallen, 2009). These are the teachers and students who took Mathematics in the Modern World course at Northwest Samar State University. Since the phenomenon entails the teaching and the learning process, and the number of teachers teaching the course was minimal. All teachers teaching the course will take part in the study. On the other hand, the students who took the Mathematics in the Modern World course, typically the first years and aged 18 years old or above, from the five (5) different colleges (main strata) of the NWSSU, were equally represented in the study.

With a signed consent, an audio recording of separate in-person interviews with each of the participants was made. In the conduct of the interview, techniques, and strategies, guided by the researchers' mental notes in the progress of the interview, was implemented to generate non-leading follow-up questions or re-open the narratives. The interviews were transcribed into text for further analysis. All identifying information that may reveal the participants' and other people's identities were replaced with pseudonyms or other fictitious representations as are appropriate to maintain the privacy of those interested parties.

Analyzing phenomenological research commenced after the interview was transcribed. The analysis follows a general qualitative data analysis steps (Willis, 2007) with intricacies as illustrated by Husserl (2008/1931), Giorgi (1994), Broome (2011). The analysis procedure as summarized in Figure 2 shows that the initial step of the analysis is for the researcher to bracket their pre-conceived notions to look at the data with a fresh perception (Broome, 2011). The researcher must set a phenomenological attitude to look at the data as it presents itself without "doubt or belief" (p.12). This is necessary to stay true to the phenomenological slogan "back to the things themselves" by Husserl (2001/1901) as cited by (Broome, 2011). The second step is to read and re-read the

transcript and generate coding done inductively, anchored on theory building usually applied to grounded theory (Strauss & Corbin, 1990). Next is to identify demarcation points to assign the structures that occur in the meaning, theorized from the lived experience of the subjects. This recognizes *landmarks* (Giorgi, 1994) that lead to observable indicators. Finally, meaning transformation is generated from the structures. The combination of the landmarks or demarcations is bridged to a transcendental level of descriptive expressions of definitions of a phenomenon (Broome, 2011).

The theoretical framework i.e., constructivism and experiential learning theories were used as a lens to transcend the data from its raw form as expressed by the subjects of the study. The final stage, which is the synthesis, is the merging of all meaning transformed to form the constitution (Giorgi, 1994; Broome, 2011) of the teaching and learning Mathematics in the Modern World. In general, this is where the essence of the phenomenon is unveiled and defined according to the elements of the constructs of such a latent phenomenon. The diagram below show the data analysis procedure.



Results and Discussions

The findings of the study emerge from the narratives of the subjects, which highlights the preconceived notion of Math. The shared meanings, structures, and essence of teachers and students unveiled a reflective phenomenological learning and teaching experience of the subjects of the study.

The Lived Experiences of the Students of Mathematics in the Modern World

The students' perception of Math was based on their experiences before enrolling in the course. There are opposing views towards Mathematics in the Modern World and the students include descriptors such as: "challenging", "easy", "interesting" and "fun", "as important as other subjects", "fosters a sense of belongingness" and "just okay" in describing their experience. Of the positive views from the narratives, what is interesting is that the course fosters a sense of belongingness. This feeling of belongingness is attributed to the activities conducted in the class, which gives the student a positive outlook towards the course.

The course was described to be easy because one can be in control of the learning process i.e., "*You can research about the lesson*" (CC_P, Pos. 17).

The reported positive impacts of Mathematics in the Modern World range from the appreciation of the course, to a change in perception or the mitigation of the stigma in Math. This impact reflects an attitudinal level, such as efficacy and a sense of responsibility. Another student added that Math is important "*because it can lessen the person's introversion (CD_J, Pos. 55)*". These narratives encapsulate how learning the course shifts the positions of the students towards the course, from undesirable to useful.

The final narrative acknowledges that liking Math has nothing to do with whether “*you are good or not in it*” (CA_B, Pos. 51) but on its utility to human endeavor.

Despite these positive perceptions, there are reported negative views of the course. The negative views range from the lesson being difficult to students simply wanting the class to end. Also, the feeling of simply disliking Math is echoed by some students as they claim: “*I am having a hard time understanding the lesson it’s because I don’t like Math*” (CA_M, Pos. 16). The narration also provides a specific instance of disliking math–*problem-solving*. Another student was also asked if anything was interesting about the course. Bluntly, the subject replied: “*There’s none and I’m not interested in Math* (CB_M2, Pos. 49-50).

Also, some students show psychosomatic responses attributed to not liking Math. This includes the feeling of being “*dizzy*”, “*boredom*”, which links to be being “*sleepy*”, and the description that Math is “*stressful*”.

Another interesting narrative was on the experience of *discrimination*. This was elucidated by a student who is eager in studying Math so that one will not be discriminated against as: “*You are already a college student, but you do not know how to solve a problem*” (CB_M1, Pos. 31).

Although the narration has a silver lining to it, what remains is evidence of discrimination of not learning Math, which many attributes to the stigma about Math.

This analysis of the lived experiences of the students noted that students with above-average performance do not have any negative view of the course. Average performers of the course have divided views towards Mathematics in the Modern World. Finally, students whose performance in the course is below average or those who failed in the course all provided negative views towards the course.

The Lived Experiences of the Teachers of Mathematics in the Modern World

In this discussion, the lived experiences of the teacher-subjects are weaved as one to convey the phenomenon. It is presented in the turning points of teaching and learning, which is *beginning instruction*, *during instruction*, and *after instruction*.

Beginning instruction. When teacher-subjects were asked about the topics on the course, they provided a perspective that Mathematics in the Modern World that highlights the significance of Math and gives the historical narratives of Math. What is also interesting to note is the fact that the course highlights the importance of Math to life. This includes the study of Math as finding patterns, involves statistics, Math in nature or environment, investment and finance, Math as language as well as problem-solving.

During Instruction. Teaching the course was dubbed to be different from other courses. Interesting findings show that the journey of teaching and learning process encourages students’ creativity, provides an exposition of students to showcase their knowledge in the arts, a room for them to explore and act on roles in the teaching-learning process i.e., a listener, an audience, and reactors.

The same narrative also conveys that teaching Mathematics in the Modern World facilitative in nature. Another important aspect of this dynamics is the teachers’ reflection on students’ performance and capacity, which drives the lesson further to a direction that is responsive to the student’s needs as expressed “*I evaluate what discussion is good for my students*” (Teacher D, Pos. 36).

The dynamics also show that students are allowed to explore and convey their understanding or conceptualization that they identify to be efficient. Indeed, “*in the*

subject Mathematics in the Modern World, you can do lots of activities” (Teacher D, Pos. 34).

After Instruction. Following the appropriate lesson sequence, assessment and evaluation serve as a culmination to every topic taught. Instead of the usual examinations, students do a performance task. This shifts the traditional assessment procedures to something authentic and attuned to Outcomes-based Education. One teacher-subject share the requirement for the midterm in the class with the corresponding reactions of the students to wit: “In the midterm I let them make art, art like mandala and appreciation, so by that, they’re enjoying, they were like “Sir kaupay man san sudsinisudsana [Sir this is good]” (Teacher A, Pos. 26).

On the other hand, assessment procedures also reveal some points of interventions for the class, the teacher’s interaction, and how they process the students’ performance are essential keys to unpack the lesson and clarify any misconceptions related to the topic. These interactions are important to ensure that outcomes of the course are delivered if otherwise the teacher share that: “I let them repeat their report and let them research further about the topic” (Teacher B, Pos. 34).

Varying foundation knowledge levels also affect their performance in Math, as shared “maybe their foundation with Math subject is not good” (Teacher A, Pos. 54) along with their innate individual differences.

The teachers’ method of teaching utilized for the course is generally integrative, facilitative, and reflective. These three keywords highlight the course to be application centered and performance-based articulated inconsistent decision-making in the classroom and on the focus to identify students who greatly need intervention.

The Meanings, Structures, and Essence as Described by the Learners

Meanings being conceptualization of the subjects under study to glean the essence of a certain phenomenon (Giorgi, 1994) in this case the learning process was presented in four themes. The underlying structure across all themes was then drawing the positions of the students in the learning process. Lastly, the essence of learning Mathematics in the Modern World is drawn emanating from the meaning and structure. Table 1 presents a summary of themes, structures, and essence.

Theme 1: Positive views towards learning Mathematics in the Modern World is based on how well it impacts one’s life. The positive views towards Mathematics and how it impacts one’s life is the conveyor to the journey of self-awareness. Undoubtedly, the experience becomes more relevant when it conveys to one’s self, to one’s inner sanctum, to one’s self-awareness. A self-aware adult is described to be of independent self-concept, directing their learning, problem-centered and internally motivated (Steiner, 2014).

Theme 2: Negative views towards learning Mathematics is aggregated by the stigma on Math. Stigma is a term coined as “a mark of shame or discredits” (Merriam-Webster, n.d.). This provides that stigma on Math is a mark on Math being difficult. These negative views of the students could be interpreted because of the stigma of Math. These negative conceptions linger in the faculty of their mind and surface as psychosomatic reactions. The mind, therefore, was in a way already conditioned and assimilated (Corpuz & Saldanan, 2015) the stigma on Math. This leads to simply wanting any lesson or discussion on Math to end as exposed by the student.

Theme 3: Negative views towards learning Mathematics is augmented by the disconnect to one's endeavor. Another negative perception of Math is that it has nothing to do with one's self. The narratives identified that Mathematics in the Modern World is not related to the program they are enrolled. Thus, some students simply aim to pass. The negative views are existential proof that one's views to the course were augmented by the disconnect of the course to one's endeavor.

Theme 4: Negative views towards Math is analogous to below-average performance in Math. No student performing above average raised any negative view of the course. This provides a mirror between the two phenomena—the phenomenon of failing and the phenomenon of not liking the course.

Structure 1: Views towards Mathematics in the Modern World is an articulation of Experience. The views therefore on Math—*aggravated by stigma, negative views to Math as analogous to poor performance, disconnect to one's endeavor, and impact one's life*—is in a way a retracing of experience, as it conforms to one's preconceived notions. In general, experience impacts perspectives.

Theme 5: Mathematics in the Modern World is centered on real-life applications. The narratives reveal that the central theme of the contents is on how it can be applied to real-life situations.

Theme 6: Mathematics in the Modern World is outcomes-based and involves doing non-traditional assessment and evaluation. Traditional and non-traditional modes of assessing and evaluating students were utilized in the course. The principle that governs such a choice of conveying the lesson and measuring students' performance was based on an outcomes-based education approach as promulgated by CHED.

Theme 7: Effective teaching approach to Mathematics in the Modern World highlights participative and facilitative learning. Participative and facilitative modes of delivering instruction were acknowledged by the students. Although, there are other forms of activities that were conducted, all these points to participatory and facilitative learning.

Structure 2: Participative and facilitative learning bridges outcomes-based education for Mathematics in the Modern World highlighting real-life applications. Themes 5, 6, and 7 highlights that the learning process was facilitative and participatory and centers on forwarding real-life applications of the reported contents of the course. Besides, it underscores the utility of outcomes-based education by tapping traditional and non-traditional assessment and evaluation procedures.

Theme 8: Characteristics of a teacher drives the effectiveness of the teaching approach. The teachers' personality is a factor that may affect the learning process (Mondal, 2020). It is underscoring that interactions of personalities, that of student and teachers, attributes to the type of behavior that may spring from the teaching and learning process. Thus, the teachers' characteristics, being a good teacher, approachable, kind and considerate direct how the student would behave as well thus:

Structure 3: Teachers teaching characteristics make and unmake views towards Mathematics in the Modern World. It is underscored that personalities interact, and they may be compatible or not. The interactions in the narrative resulted in views, which logically can be claimed as: positive interactions result in positive views, while negative interaction results in negative views. The good characteristics of the teacher provide an atmosphere that is conducive to learning. Thus, teachers' characteristics are crucial in the learning process of the students.

Theme 9: Personal positive attributes of learning propels success in Mathematics in the Modern World. Apart from the intellectual factor that attributes to success in a certain course, emotional and social factors (Mondal, 2020) may also affect the learning

process of the students. This was articulated in the narratives of the students where positive personal attributes were linked to success and the negative attributes to a non-participative nature of the learner.

Theme 10: Personal challenges and constrictions impact success in Mathematics in the Modern World. The challenges of the students center on internal and school-related factors, which were also seen as contributors to success in the course (Mondal, 2020). The constrictions of the person are the limits of what one can do. Students' issues of financial concerns and management of their course loads are something that has truly provided a base of how far they can achieve.

Structure 4: Personal challenges can be mitigated by personal positive attributes towards learning Mathematics in the Modern World. The narrative posited that despite circumstances, the will of the person can prevail. The narrative also calls to look at the silver lining of the issues that the students are facing in the learning process as one author puts it "to learn we need not be told" (Argel, 2008, p. 231).

All these conceptualizations of the learning experience of the students in Mathematics' in the Modern World lead to the essence of learning the course.

Essence 1: Nightmare to Dreams: Learning Mathematics in the Modern World is a participative and facilitative encounter with real-life applications of Mathematics bordered by the quality of the teacher, and the attributes and challenges of the learner. The learner comes from different backgrounds and experiences and is confronted with varying challenges. These challenges may stem from personal issues of belongingness, or stigma towards a subject say Math. These are the limits to oneself. Though it is true one can stretch and even at times go beyond the threshold of one's limit, but the journey may be arduous.

The teacher too can come in various shapes. The teacher may be old, maybe single, married, maybe affluent, with the depth of experience say 32 years, or a mere two years and may be challenged as well.

From the narrations, the school is the sphere where the phenomenon under discourse, is experienced. The very essence of the learning experience of the students in Mathematics in the Modern World could be likened to a *nightmare and dreams*. Nightmare, because after twelve years of schooling it still haunts them. Dreams, because now they are seeing the end of the rainbow. The instances in which such experience translates to a nightmare or a dream depends on the level of participative or facilitative the encounter they receive from learning Math through real-life applications. From this encounter, they decide based on their limitations or use their attributes to wade off from the witch in the nightmare.

The Meanings, Structures, and Essence as Described by the Teachers

Theme 11. The conceptualization of the purpose of Mathematics in the Modern World is misaligned. The findings of the study reveal that there is a degree of misalignment on the intention of the course to the requirements of other degree programs. This is expressed by a seasoned teacher-subject, who has been in service for 32 years. The narrative evokes that the course is redundant as it should have been discussed in secondary education and not in an HEI, whose purpose is to produce professionals.

Structure 5: the utility of the course Mathematics in the Modern World is detracted by the rigor of the program enrolled by the learner. The theme being a misaligned conceptualization is a context that has to be revisited in another lens which leads to a propositional issue of whether or not Mathematics in the Modern World is a necessary general education course for subjects that are in the first place Math centered.

Essence 2: Teaching in general must capture what the program intends to deliver not what the course advocates. The narrative of the teacher-subject provides a conviction that other courses are necessary, and the introduction of such course to a program, whose focus is primarily Mathematics, is futile.

Theme 12: Teaching Mathematics in the Modern World is an Opportunity to Shift Method of Traditional Teaching Math with emphasis on the student at the center of the teaching and learning process. The narratives of teaching Mathematics in the Modern World have shown how non-traditional teaching styles and assessments were adapted. The teaching process shows how teachers also learn new roles in the teaching process. Also, *interactive teaching* highlights the role of the teachers as they relate to their students in the instructional process (Xhemajli, 2016). The teacher functions as an “instigator of interaction” (p. 31). Interactive teaching, seen as a favorable method to forward understanding among students, is also challenging on the part of the teachers (Xhemajli, 2016). Thus, handling Mathematics in the Modern World provides an opportunity for the teachers to go out from their comfort zones—teaching Math as something fun, facilitative, and interactive. This is also consistent with the theory of constructivism, wherein teaching is focused on a procedure of meaning-making and knowledge building (Corpuz & Saldanan, 2015). Such modality of teaching is also related to experiential learning theory (Corpuz & Saldanan, 2015) as students learn by making sense of direct everyday experiences.

Theme 13: Teaching Mathematics in the Modern World Mitigates the Stigma of Mathematics. The negative or bad experience of students in learning math was shown to have lingered to 25% of the students (National Numeracy, 2013). This bad experience attributes to math anxiety wherein students feel anxious and resulting in avoidance in math (Chin, 2012). This is the stigma of Math that in the Philippines was shown to contribute to students' poor performance (Jaudinez, 2019). Theoretically speaking, the bad experience occurs as the student relates to the study process and the corresponding structural complexity of their learning. Such a process is defined in three dimensions i.e., utilizing, internalizing, and achieving (Biggs, 1979). These dimensions have “cognitive and an affective component” (p. 381). The affective component details the motivational aspect of the student to learn.

Theme 14: Teaching Mathematics in the Modern World evokes students as the center of the teaching and learning process. This notion is not new and is promulgated in various policies of DepEd (DepEd No. 21, 2019), CHED, and even in some philosophical roots of strategies and methods of teaching specifically in experiential learning (Corpuz & Saldanan, 2015) and constructivism (Bruner, 1960). What the study reveals is the instance in which these promulgations are put to practice and have shown positive effects on students as reported.

Structure 6: Teaching Mathematics in the Modern World is a dialogue between students and teachers in appreciating math and its human connections, accessed using facilitative and interactive strategies that embraced the Outcomes Based Education Policy. The nuances which were logically twined for themes 2, 3, and 4 leads to a structure, a dynamic of interaction between the teaching

processes and its focus. Teaching Mathematics in the Modern World transcended to a mechanism that reflects student learning, responsive to students' contexts, prior learning, and to personal experiences It is a dialogue between the teacher and the student through interactive and facilitative teaching and assessments. It is also noted that this structure, teachers, and students' interaction, is reinforced by policies specifically the Outcomes Based Education that is promulgated by CHED.

Essence 3: Boring to Fun, Isolation to Interaction: The essence of teaching Mathematics in the Modern World is for students to appreciate math and bridge the

stigma of the past to the realities of its utility to once life. Through the course, the boringness of math was shifted to fun and the isolation of its concepts to the interaction with other conceptualization in math and real-life applications. Teaching Mathematics in the Modern World is not just for the students to learn a new concept in math but to relearn it. This is through a perspective where students will no longer be anxious about it, where the purpose of math is underscored, and where its complexity is rationalized for its significance and contribution to human endeavor.

The General Essence of Mathematics in the Modern World

The limited intersections between themes derived from the students and teachers constrict the creation of a new structure. The few intersections are expected from the narrative as it is pure to each perspective crucial to a phenomenological study of the interaction between groups. However, the essence of teaching and learning was constructed as a medley of intersection and with the codas of peculiarities of the experiences of each group of respondents to wit:

A nightmare to dreams, boring to Fun, isolation to interaction: Teaching and Learning Mathematics in the Modern World is geared towards the appreciation of math by bridging the stigma of the past, through a participative and facilitative encounter with real-life applications, bordered by the quality of the teacher and the attributes and challenges of the learner

Conclusions and Recommendations

This presents the summary of findings on the lived experience of students and teachers towards learning and teaching Mathematics in the Modern World, leading to the identification of meaning, structures, and essence captured in the conclusion of the study. From the revelations of both teachers and students, guided by the imperatives of the conclusions, the recommendation was laid to ground.

Students' lived experience. The positive views of students towards the subject provide for a connection to the feeling of belongingness in the class activities. This translates to the appreciation of the course, to change in perception—the mitigation of the stigma that is math, and to the attitudinal levels of impact such as efficacy and sense of responsibility. On the other hand, the negative views towards the course are dominated by its claims of difficulty like in the instance of *problem-solving*. Narratives of psychosomatic episodes were also heard from the students. The experience of *discrimination* was also shared.

On the aspect of, course requirements traditional to the authentic form of assessment and evaluation were utilized in multitude, employing varied techniques that are unusual to the previous practice of teaching math.

The students shared that teaching approaches are outcomes-based and are participative and facilitative. The teacher was also reported to employ discovery and exploratory learning by facilitating the students in the learning process.

Teachers' characteristics were reported to impact students' motivation, *confidence*, level of "*independent learning*". With this, the students forward some recommendations for the improvement in the teaching approach to include *establishing of rapport among students, the inclusion of research or processing mechanism as students' compile reports, to teach the course procedurally, the use of language that is best to convey the lesson, and to consider reciting the math subjects in the morning.*

Students' behavior in the learning process includes "*positive mindset, good time management, reflective of faults, passionate*", conducts "*self-study*" and the "*sense of enjoyment.*" Also, "*good relationship with classmates*" provides a strong "*support mechanism*" through peer mentoring and mutual help among students. These contribute

to building their habit of schooling and succeed in the course. As a reflection of the learning experience, a student presented a conceptualization to success which is that of “enough grade” and “gaining more knowledge.” The realization reveals the difficulty of math which can only be conquered by *trying it*.

Teachers’ lived experience. Mathematics in the Modern World is a combination of other areas in mathematics highlighting its significance by providing historical narratives. The course also highlights the importance of math to life underscoring the study of math as finding patterns, involves statistics, math in nature or environment, investment and finance, math as language as well as problem-solving. However, criticism was flaunted for the course as it should have been taught in high school and seen as redundant with other subjects.

Teaching the course Mathematics in the Modern World promotes interaction between students and teachers and among students themselves. The teaching process was reported to enhance students’ creativity and participation in the teaching-learning process. Dynamics of teaching in Mathematics in the Modern World is entirely facilitative with teachers reflecting on students’ performance and capacity.

Assessment and evaluation include examinations and performance tasks consistent with Outcomes-based Education. The approach to math as a “light”, identified positive effects on students’ behavior on mathematics, as well as to their performance. Specifically, the course increased efficacy to math, awakened the students to the beauty of mathematics, contributed to removing the stigma about Mathematics, and increased the performance on the subject.

Meanings, structures, and essence of the lived experiences in learning and teaching Mathematics in the Modern World as described by the learners. The first set of structure which conveys *the views towards Mathematics in the Modern World is an articulation of experience*. The second structure provides that *participative and facilitative learning bridges outcomes-based education for Mathematics in the Modern World highlighting real-life applications*. Third, *teachers teaching characteristics make and unmake views towards Mathematics in the Modern World*. This is informed by the characteristics of a teacher drives the effectiveness of the teaching approach. The last structure for students learning experience that was explicated from the study conveys *personal challenges that can be mitigated by personal positive attributes towards learning Mathematics in the Modern World*.

In general, the essence of learning Mathematics in the Modern World provides” A Nightmare to Dreams: Learning Mathematics in the Modern World is a participative and facilitative encounter with real-life applications of mathematics bordered by the quality of the teacher and the attributes and challenges of the learner.

Meanings, structures, and essence of the lived experiences in learning and teaching Mathematics in the Modern World as described by the teachers. A total of four themes were drawn from the narrative of the teachers which was twined to deliver two sets of structures.

The first structure focused *on the utility of Mathematics in the Modern World as dwarfed by the rigor of the program enrolled*. This was premised from the conceptualization of the purpose of Mathematics in the Modern World as misaligned. Second, teaching Mathematics in the Modern World is a dialogue between student and teacher in appreciating math, its human connections, it posits a shift from traditional to active learning strategies and embraced the Outcomes Based Education in HEIs.

The above conceptualization and dynamics provided for two sets of essence one are on teaching in general and the other is on teaching the course Mathematics in the Modern World: (1) The essence of teaching, in general, must capture what the program intends to deliver not what the course purports to advocate; (2) Boring to Fun, Isolation to Interaction: The essence of teaching Mathematics in the Modern World is to facilitate

students to appreciate math and bridge the stigma of the past to the realities of its utility to once life.

General essence. The structures that were drawn separately from the narratives were retained in the study to emphasize the holistic essence of teaching and learning experience in Mathematics in the Modern World as:

A nightmare to dreams, boring to Fun, isolation to interaction: Teaching and Learning Mathematics in the Modern World is geared towards the appreciation of math by bridging the stigma of the past through a participative and facilitative encounter with real-life applications, bordered by the quality of the teacher and the attributes and challenges of the learner.

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