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ABSTRACT

Mathematics in the Modern World is viewed as an essential course for students' eventual development of logical reasoning and understanding. Hence, this study used qualitative approach through systematic literature review to revisit the concept and essence of mathematics in the modern world. With the few research hits generated in the review, the course is emphasized to be essential as a discipline that builds fundamentally. A characterization of the existing research in mathematics that is directed toward the modern world has been produced as a result of an attempt to generate an overview of how Mathematics in the Modern World is understood and researched with an attempt through a systematic review. Emphatically, this is the point at which the ideas that were generated by this review of the area actually become clearer when one realizes that even while the course is considered valuable in day-to-day life, the course Mathematics in the Modern World is rather challenged regarding how it might be converted into practices in the classroom. The findings of this review prompt inquiries concerning the implications for future research and practical use.

Keywords: Appreciation of mathematics, application of mathematical tools, literature review, Mathematics in the Modern World, nature of mathematics

INTRODUCTION

Revisions to the general education (GE) curriculum in higher education institutions were made possible by the inclusion of general education courses in the K–12 curriculum requirements. This update aims to expose undergraduate students to a variety of fields of study and ways to understand social and natural realities, with the intention of promoting the development of intellectual skills and civic virtues in the process. This integration advances the paradigm shift toward competency-based learning standards in higher education in the Philippines and the pursuit of educational reforms that include the K–12 basic education curriculum in consideration of the College Readiness Standards (CEB Resolution No. 298–2011; CMO No. 13, s. 2020). Additionally, this integration explores innovations that are in line with the standards for college readiness.

One of the General Education (GE) courses that has been added to the higher education curriculum is Mathematics in the Modern World. The nature of mathematics is examined in this subject, along with the understanding of its practical, intellectual, and artistic components, and the use of mathematical tools in everyday life. The first lesson in this course will provide an overview of the nature of mathematics as an investigation of environmental and natural patterns and as a use of both inductive and deductive reasoning. The application of mathematics to solve issues in the actual world is then discussed. By examining these themes, students are urged to get past the conventional view of mathematics as just a collection of formulas and instead see it as a source of aesthetics in the logically and rationally governed patterns of nature. The idea of how mathematics can be used as a tool for understanding and coping with various aspects of modern living, such as managing one's finances, making social decisions, appreciating geometrical designs, understanding codes used in data transmission and security, and fairly allocating scarce resources, to name a few, is also explored. The course then moves on to a survey of how mathematics functions as a tool for comprehending and addressing these problems. These elements enable students to actively participate in mathematics across a wider range of activities, each of which emphasizes a distinct aspect of mathematics as a way to recognize and assess the students' understanding and application of mathematical concepts.

Mathematics in the Modern World is considered to have accomplished the goal it set out to accomplish when it was developed and incorporated into the educational canon of higher learning institutions ever since it was made mandatory for all general education students in the year 2020. It is with the assumption that the researchers have made that the abundance of literature on this course as an area of study interest has stimulated increased interest and attention to better emphasize its value in the field of teacher education. Therefore, the purpose of this study is to synthesize the material that was researched on Mathematics in the Modern World in

order to have a clearer picture on the changes and obstacles in the integration and providing of the course, which may serve as input for reflective teaching in mathematics.

RESEARCH METHODOLOGY

In this study, a qualitative method was taken, and a thorough examination of previous research material was performed. Searches conducted in the databases of Google Scholar and Mendeley, which together offer complete access to literature dealing with education, were used to discover the research literature that was utilized in this study.

The review made use of a number of different criteria for inclusion. To begin, each of the contributions needed to be published in academic journals that are reviewed by peers. In order to ensure that the research conducted was of a scholarly nature, this criterion was utilized. Second, in order to maintain consistency with the primary emphasis of our investigation, the articles that were chosen to be included had to directly address the topic of mathematics in the contemporary world. Third, the timeframe that was decided upon is from 2020, which is when the giving of the course first began, until May of 2023. Fourth, due to the limitations of our linguistic capabilities, we could only incorporate articles that were written in English.

In a more concrete sense, these criteria framed the searches by utilizing phrases from three different search blocks, namely: nature of mathematics, perception on dimensions, together with use of mathematical tools in daily life. The search block under "nature of mathematics" contained a number of keywords related to the field of education for teachers. Words like "appreciation of mathematics practical, intellectual, and aesthetic dimensions" were found in the search block for "appreciation of mathematics dimensions," while "application of mathematical tools in daily life" was found in the search block for "mathematical tools." Within each block, words were joined using the Boolean OR operator, and between blocks, they were mixed using the AND operator. In Mendeley, a search for the search phrases was conducted in the abstracts, whereas in Google scholar, a search was conducted in the abstract, keywords, and titles. The reasoning for this was that conducting a search on Google Scholar using simply the abstracts produced an extremely low number of relevant results.

The search produced a total of 25 items as its result. After that, the articles that were going to be featured underwent a second round of screening, which consisted of reading the entire text. A screening procedure identical to the one described above was carried out, which resulted in the elimination of an additional 12 articles for the reasons stated in the previous paragraph. As a direct result of this, the literature evaluation consisted of only 13 different papers.

The article itself served as the unit of analysis, and the following headings were used to organize the tabular summaries of each individual item: 1. The title, the author(s), the publication, and the 2. The method(s) of research and the research design, 3. The research questions, the justification for the research question, and/or the purpose or objective of the investigation, and 4. The findings of the study.

A few of the articles were read concurrently and then independently coded in order to guarantee coherence and agreement among the authors. Clarification was achieved through comparison of the coding. Throughout the process, there were frequent conversations concerning the coding. According to Gough et al. (2017), the procedures of evaluating and synthesizing the data are primarily inductive and attempt to open up new understandings of complicated events.

RESULTS AND DISCUSSION

The following table presents the key details in the reviews made following the title and name of author/s, method/design, objective, and findings.

On Mathematics in the Modern World

Title/ Authors	Research Method/Design	Objectives	Findings
Ellvan, M., & Edig, M. M. N. (2022). "Looking through the New World of Mathematics: Experiences of College Students in Mathematics in the Modern World Course"	Phenomenological qualitative research design	The study specifically investigated the lived experiences of college students taking the subject Mathematics in the Modern World.	Students in college frequently deal with difficulties including engaging in class, having access to resources, and using effective learning techniques. Additionally, they have positive attitudes, learning management skills, and digital proficiency. Additionally, they focused on connecting the course material to the outside world in their ideas.

Morilla, R., Omabe, R., Tolibas, C. J., Cornillez Jr, E. E., & Treceña, J. K. (2020). "Application of machine learning algorithms in predicting the performance of students in mathematics in the modern world"	correlational and predictive research design	The aim of the study was to predict students' performance in the course using different machine learning algorithms.	The performance of the students in the course is excellent. Additionally, there is a strong correlation between students' final scores and their attendance, quizzes, recitation, midterm exam, and final exam.
Bangalan, R. C., & Hipona, J. B. (2020). "Mathematics in the modern world as a science of patterns with an integration of outcome based teaching-learning approaches"	Descriptive survey	The study's objective was to determine students' awareness, experiences and attitude.	Due to their understanding of the value of mathematics both personally and socially, students had a favorable attitude toward mathematics in the modern world.
Verdeflor, R. N., & Pacadaljen, L. M. (2021). "Outcomes of the course mathematics in the modern world: A phenomenological study"	Phenomenology qualitative research design	In order to glean the meanings, structures, and core of the course, the study examined Mathematics in the Modern World as a phenomena via the eyes of the actors.	Students' opinions of the course range from favorable to unfavorable. According on the actual experiences of the students, the course fosters a sense of community through class activities. But pupils also report unpleasant psychosomatic effects like "boredom," "dizziness," and "sleepiness." According to teachers' own experiences, the way they teach has an effect on how their pupils behave, perform, and view math.

On Nature of Mathematics

Title/ Authors	Research method/design	Objectives	Findings
Butun, M. (2021). "Preservice Science and Mathematics Teachers' Mathematics Anxiety and Beliefs about the Nature of Mathematics"	Descriptive Survey	The study examined preservice science and mathematics instructors' anxiety and perceptions regarding the nature of mathematics objectively.	There is evidence that preservice teachers have strong opinions about the nature of mathematics but little anxiety related to math.
Yazlik, D., Altun, S., Kaya, D. (2022). "Reflective Thinking Levels of the Mathematics Teacher Candidates and their Philosophical Thoughts on the Nature of Mathematics"	Relational survey model	The purpose of the study was to gauge how reflectively thinking and philosophically inclined school mathematics teacher candidates were.	Candidates for mathematics teaching positions exhibit a high degree of reflection and philosophical thought.
Çelik, M. (2021). "Investigation of the Preschool Teacher Candidates' Philosophical Views on the Nature of	Relational scanning model	Examine teacher candidates' and philosophical views on the nature of mathematics.	Majority of teacher candidates have an absolutist view about mathematics

Mathematics”			
Luitel, L. (2020). “Exploring Teachers' Experiences on the Nature of Mathematics Based on Their Curricular and Pedagogical Practices: A Phenomenological Inquiry”	Phenomenological inquiry using Habermas's theory of knowledge constitutive interest	On the basis of the research question, which is how mathematics instructors experience the nature of mathematical knowledge during their curricular and pedagogical practices, examine mathematics teachers' experiences on the nature of mathematics with a focus on their curricular and pedagogical practices.	Mathematics curricula that are motivated by both emancipatory and practical interests support a counter-hegemonic view of mathematics teaching and learning and may foster critical consciousness.

On Appreciation of Mathematics Dimensions

Title/ Authors	Research method/design	Objectives	Findings
Souza Neto, JAD, Vilela, DS, & Farias, JVD (2022). “Strategies for the Consecration and Appreciation of Mathematics through OBMEP”	Theoretical-methodological framework of Pierre Bourdieu	Present a sociological view of OBMEP competition	There are ways to cultivate values, elevate, and validate academic mathematics. Through OBMEP, it is also made clear that academic mathematics is the cornerstone and driving force behind the nation's advancement in science and technology.
Sariyasa, Apsari, R. A., Salsabila, N. H., Wulandari, N. P., & Junaidi. (2022, December). “Digging deeper: Germinating students' appreciation toward mathematics through STEAM”	Qualitative-quantitative method	It is the study's aim to investigate on students' appreciation of mathematics and its connectedness with Science, Technology, Engineering and Art, otherwise called STEAM	It is argued that teacher training institutions must assist students' growth to become proficient math instructors by recognizing the importance of mathematics in human knowledge and daily life.
O'Meara, N., Fitzmaurice, O., & Johnson, P. (2022). “Career Mathways: evaluating a novel initiative aimed at enhancing students' attitudes towards and appreciation of mathematics”	Pre-post student surveys and teacher interviews	The goal was to assess Career Mathways' effects on changing students' views in this area.	The appreciation of students for the value of mathematics, particularly among lower-achieving students, was moderately but favorably influenced by Career Mathways.

On Application of Mathematical Tools in Daily Life

Title/ Authors	Research method/design	Objectives	Findings
Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2021). “Teaching mathematics with mobile devices and the Realistic Mathematical Education (RME) approach in kindergarten”	Systematic research	Utilize new learning platforms to your advantage and effectively acquire new knowledge by engaging in activities that are relevant to your current interests and real-world situations in learning disciplines like mathematics.	Kindergarten classrooms integrating mobile devices with developmentally appropriate apps.

		using graph theory to help with problem-solving abilities.	
Lazarova, L. K., Stojkovicj, N., Stojanova, A., & Miteva, M. (2022, March). "Application of graph theory in teaching and understanding of the mathematical problems"	Descriptive research		Students can visualize these types of issues and quickly become ready for various mathematical competitions by using the fundamental ideas of graph theory.

The above tabular presentation of the literature review summarizes the characteristics of the studies so that readers may relate to the representability of the articles. From the above review, there has been a slight focus on topics explored in Mathematics in the Modern World. A possible explanation for the dearth of studies is the relative newness of the course offering in higher education as it was only offered in 2020. Using the block searches, the search engine has produced relatively few literature that investigated on Mathematics in the Modern World in general, the nature of mathematics, appreciation of mathematics, and application of mathematical tools in daily life. In addition, the design in all articles reviewed is mostly similar such that for general view on the course, the use of qualitative approach using phenomenological inquiry and correlational predictive design. In the case of nature of mathematics, qualitative approach using phenomenology is likewise used with relational design. For the appreciation of mathematics, the design varies from theoretical-methodological, to written and descriptive design, to surveys and interviews. In regard application of mathematical tools, systematic research and descriptive design were used. In view of the objectives of the research reviewed, most literature aimed to explore and examine the variables in Mathematics in the Modern World. With reference to findings, most literature reviewed confirmed essential and positive feedback to learning Mathematics in the Modern World.

CONCLUSION AND RECOMMENDATIONS

The literature review makes possible the revisit to the concept and essence of modern world for which schools must prepare students which in view of the review made, bears slight focus owing to the few hits that were generated through the key words for the online search. This has important implications to the progress made and the development of inquiry-based presentation of Mathematics in the Modern World. However, with the few research hits generated in the review, the course is emphasized to be essential as a discipline that builds fundamentally. A characterization of the existing research in mathematics that is directed toward the modern world has been produced as a result of an attempt to generate an overview of how mathematics in the modern world is understood and researched by a systematic review. This review led to the attempt. Indeed, this is where the insights processed by this review of the field truly serve as enlightenment realizing that while the course is deemed useful in daily life, the course Mathematics in the Modern World remains surprisingly tacit about how it can be translated into practices in the classroom. Results of this review raise concerns with regard the implications for future research and practical use.

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