A study on enhancing the learning of mathematics concepts through authentic modules in grade 8 classes in Sri Lankan schools

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Abstract- This study explores the augmentation of mathematics concepts through the implementation of authentic learning modules in grade 8 mathematics classrooms. To achieve this objective, several classroom studies were conducted across various provinces, employing new mathematics authentic modules, and relevant data were collected through questionnaires and observation sheets. The results indicated that students attained commendable levels of proficiency in mathematics content, 21st-century skills, learning outcomes, and educational objectives. Nonetheless, it was observed that attention should be given to time management and the number of activities within each chapter to effectively engage students. On the teachers' side, providing adequate training in new educational trends, module utilization in the classroom, and integrating technology with activities becomes imperative.

I.INTRODUCTION

This executive summary provides an overview of a comprehensive study that delves into the application of authentic learning modules to improve mathematics concepts in grade 8 classrooms. The research sought to explore the impact of these modules on students' proficiency in mathematics content, 21st-century skills, learning outcomes, and educational objectives. Several classroom studies were conducted across diverse provinces, utilizing new mathematics authentic modules, and data were gathered through questionnaires and observation sheets. The study highlights the positive outcomes achieved through this approach, while also identifying areas that require attention and improvement.

II.STATEMENT OF PROBLEM

The general education system provides students with transferrable skills that prepare them to gain knowledge, acquire new competencies, and broaden their perspectives so that they may better adapt to the needs of a changing society. To achieve these targets, every government in the world, after every cycle of reform, has made significant changes in their current education. The government of Sri Lanka also every eight-year cycle, has made this change in their education.

As Sri Lankans, to fulfill the family, society, country, and universal requirements we must change the teaching-learning process to an authentic process with achieving 21st century skills. Authentic education is the current trend in the world, therefore, as a country, we also need to align with the world to get better opportunities for our younger generation. So, it is our responsibility to introduce an authentic learning approach with 21st-century skills in mathematics curricula. For this purpose, authentic learning modules are planned to introduce in grades 1 to 11 in Sri Lanka. This is the first time the modules plan to implement to be tested and redesign according to the efficiency of the students' and teachers' responses. Since this is new to the teacher as well as to the students' proper evaluation should be done regarding the modules in the student view and the teacher's view. This overall evaluation of the teaching-learning process will help to improve the effectiveness of the modules introduced in grade 8.

In 2024, educational authorities in Sri Lanka are expected to introduce a modular-based and authentic learning approach in general education. This is a new approach in Sri Lankan classrooms, and also we expect this can make the classroom very active and increase the deep understanding of mathematical concepts among the children. Therefore, this study has been undertaken to investigate the effectiveness of the learning of mathematics concepts through authentic-

learning modules in secondary-level classrooms in Sri Lanka. The focus of this study was to investigate, explore and reduce the problems which arise while developing modules and suggest ways to improve the authentic-learning through authentic learning modules in mathematics.

III.RESEARCH METHODOLOGY

To address the research objective, a mixed-methods approach was adopted, encompassing both quantitative and qualitative data collection methods. Classroom studies were conducted in various provinces, ensuring a diverse sample of students and contexts. The newly developed authentic learning modules were introduced into the grade 8 mathematics curriculum, and data were gathered through structured questionnaires to assess students' academic performance, as well as observation sheets to evaluate their engagement and participation in the learning process, and also teachers' performance regarding the module uses in the classroom.

IV.OBJECTIVES AND RESEARCH QUESTIONS:

This study is to investigate the effectiveness of the learning of mathematics concepts through authentic learning modules in the grade 8 classrooms in Sri Lanka.To achieve the above objective, the following research questions have been prepared.

1. Content and activities in the authentic module are suitable to achieve the objectives of the teaching-learning process.
2. How are the modules on mathematics are using to achieve the learning outcomes?
3. Are the modules properly implemented and practiced at schools?
4. What are the amendments to be made to the grade 8 mathematics module?
5. What types of further assistance should be given to the teacher to make students learn mathematics?

V.REVIEW OF LITERATURE

Since the 16th century, the concept of "Authentic learning" has been advocated by philosophers like Descartes, Rousseau, and Herder. Authentic learning emphasizes learning through real-world experiences, allowing individuals to connect knowledge to practical applications. In the realm of education, the authentic learning approach has gained popularity, particularly in the teaching of mathematics. This literature review aims to explore the effectiveness of authentic learning in developing mathematics modules.

Numerous studies have been conducted to assess the impact of authentic learning in math classrooms. For instance, Yasar and Adiguzel (2017) compared the outcomes of a real-world statistics learning module with traditional instruction for high school students. The authentic learning group showed significantly higher success scores and a more positive attitude towards statistics, attributed to the meaningful context provided by the authentic module. Similarly, Beyaztas and Kilic (2019) used an authentic learning module to teach geometry to middle school students, resulting in higher achievement scores and better comprehension of geometric concepts compared to standard instruction.

Authentic learning has proven effective in developing problem-solving abilities as well. Stohlmann et al. (2011) demonstrated that middle school students who engaged in an authentic learning module for algebraic problem-solving showed greater proficiency than those in traditional teaching. Klieme et al. (2008) found that high school students using authentic learning to solve mathematical problems exhibited higher problem-solving abilities and a better understanding of mathematical topics.

Furthermore, authentic learning has shown promise in fostering mathematical reasoning abilities. Lesh et al. (2000) observed that middle school students using an authentic learning approach to design and build a roller coaster demonstrated superior mathematical thinking skills compared to those receiving conventional instruction. Authentic learning is firmly rooted in constructivist learning theories, including those of Jean Piaget, Jerome Seymour Bruner, and Lev Semyonovich Vygotsky. Constructivism posits that learning is most effective when learners actively engage with real experiences, building on pre-existing knowledge to construct new understanding.

Authentic learning is recommended as a powerful approach that boosts motivation, prepares students for their future careers, and makes complex concepts easier to assimilate by blending theory with practice. It is crucial to connect real-life situations with mathematical concepts to create authentic modules that enhance students' learning capacity.

However, preparing authentic modules poses

challenges in identifying suitable real-life situations that align with mathematical content. Teachers must find entry points to connect real-life examples with mathematics lessons effectively. The relevance of authentic learning is emphasized by the disconnect some students feel between school mathematics and its practical applications. Integrating authentic learning challenges and activities into mathematics modules and training is key to bridging this gap and improving students' learning and understanding of mathematical ideas.

Overall, the literature review highlights the effectiveness and importance of authentic learning in mathematics education, emphasizing its potential to enhance students' engagement, success, and attitudes towards the subject. Educators should consider incorporating authentic learning approaches to improve mathematics learning outcomes.

VI.RESEARCH DESIGN AND SAMPLE

During the tryout of the modules, data will be collected through observation and an assessment tool. When members of the research team* and master teachers from the school observe tryouts, observation tools will be used to collect data. And the evaluation tools will be developed and used to measure the effectiveness of the proposed authentic learning modules during the classroom teaching-learning time. Which evaluation tools are handled by students as well as the teachers.

The sample of the research is 12 schools in Western Province, Northern Province, Uva Province, Central Province, and Sabaragamuwa Province. Those schools were selected from urban and rural areas of the selected provinces including 1AB, 1C, and Type 2 schools. A further sample of schools enriched with the gender varieties such as male schools, female schools, and mixed schools, and the medium of instruction is Tamil. Questionnaires were responded to by the teachers and students of those schools in the sample. Information was gathered from a total of 132 respondents such as teachers, students, and the research team.

VII.DATA ANALYSIS

There were three data collection tools used to collect information regarding the research. First is the student questionnaire, second is the teacher questionnaire, and third is the observation tool. The data given in the completed questionnaires by the respondents were entered using SPSS software separately. When analyzing qualitative data, the data were first coded, and in the case where they were quantifiable percentages were calculated.

During and after the classroom teaching-learning process, the research team assessed the activities of the module done by the students and marked by the mathematics teacher. This is also considered for the conclusion about the effectiveness of authentic modules in the mathematics learning process.

VIII.RESULTS AND FINDINGS

The outcomes of the study revealed promising results regarding the effectiveness of authentic learning modules in augmenting students' understanding of mathematics concepts. Students demonstrated commendable levels of proficiency in mathematics content, showcasing improved problem-solving abilities and critical thinking skills. Moreover, their performance in 21st-century skills, such as collaboration and communication, exhibited notable enhancements. The implementation of authentic learning modules also positively influenced the attainment of desired learning outcomes and aligned with the broader goals of education.

IX.CHALLENGES AND RECOMMENDATIONS

Despite the positive results, the study identified certain challenges that warrant attention for a more refined implementation of authentic learning modules. Time management within each chapter emerged as a crucial aspect that requires careful consideration. To ensure maximum engagement and effective utilization of the modules, it is essential to strike a balance between the depth of content coverage and the time allocated for activities. Moreover, the number of activities included within each chapter should be carefully curated to maintain focus and prevent overwhelming students.

On the teachers' side, there is a pressing need for providing adequate training in new educational trends and techniques for utilizing these modules effectively with appropriate levels of teaching aid usage. Teachers play a pivotal role in facilitating the learning process, and their proficiency in incorporating authentic learning activities and integrating technology with classroom activities can significantly impact students' learning outcomes. Therefore, professional

development programs should be offered to equip teachers with the necessary skills and knowledge to harness the full potential of authentic learning modules.

X.CONCLUSION

In conclusion, this study establishes the positive impact of authentic learning modules in grade 8 mathematics classrooms. The findings reveal that such an approach fosters students' proficiency in mathematics content, 21st-century skills, and learning outcomes, and aligns with the broader goals of education. While the study highlights the need for attention to time management and activity selection, it underscores the significance of providing teachers with appropriate training and support. Moving forward, the successful integration of authentic learning modules in mathematics education can revolutionize the teaching-learning process, ushering in a more engaging and effective learning experience for students, while preparing them for the challenges of the 21st-century world.

REFERENCES

[1] Bulut, A. S., Yildiz, A., & Baltaci, S. (2020). A comparison of mathematics learning approaches of Gifted and Non-Gifted Students. *Turkish Journal of Computer and Mathematics Education*. https://doi.org/10.16949/turkbilmat.682111

[2] Dede, A. T., Hidiroğlu, Ç. N., & Güzel, E. B. (2017). EXAMINING OF MODEL ELICITING ACTIVITIES DEVELOPED BY MATHEMATICS STUDENT TEACHERS. *Journal on Mathematics Education*, *8*(2). https://doi.org/10.22342/jme.8.2.3997.223-242

[3] Koh Noi Keng (2010), *Learning Mathematical Concepts Through Authentic Learning*, Mathematics Education Research Group of Australasia ED520764, Australia.

[4] Pauline Vos (2018), *How Real People Really Need Mathematics in the Real World-Authenticity in Mathematics Education*. Department of Mathematics, University of Agder, Norway.

[5] Sedere, M. U. (2019). *21st Century Expectation: Education Meeting Knowledge Economy*. White Falcon Publishing.

[6] Stohlmann, M., Moore, T. J., & Roehrig, G. H. (2012). Considerations for Teaching Integrated STEM education. *Journal of Pre-College Engineering Education Research*, *2*(1), 28–34. https://doi.org/10.5703/1288284314653

[7] Tran, D., & Dougherty, B. J. (2014). Authenticity of Mathematical Modeling. *The Mathematics Teacher*, *107*(9), 672–678. https://doi.org/10.5951/mathteacher.107.9.0672

[8] *Unemployment Rate | Central Bank of Sri Lanka*. (2020). Cbsl. https://www.cbsl.gov.lk/en/economic-and-statistical-charts/unemployment-rate-chart

[9] Yasar, O., & Adiguzel, T. (2010). A working successor of learning management systems: SLOODLE. *Procedia - Social and Behavioral Sciences*, *2*(2), 5682–5685. https://doi.org/10.1016/j.sbspro.2010.03.928

[10] Zhao, X., Van Den Heuvel-Panhuizen, M., & Veldhuis, M. (2016). Teachers' use of classroom assessment techniques in primary mathematics education—an explorative study with six Chinese teachers. *International Journal of STEM Education*, *3*(1).