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Realistic Mathematics Education Approach on Improving Problem-Solving Skills of Students

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Abstract

The Philippines' education system is still dominated by traditional mathematics teaching, which frequently overlooks the goal of mathematics education—to prepare students to deal successfully with real-life situations. This affects the declining performance of the students in their overall mathematical ability, especially in problem-solving. Hence, this study utilized a pre-experimental design to measure the effectiveness of the Realistic Mathematics Education (RME) approach in the problem-solving skills of the students in terms of understanding the problem, devising a plan, carrying out the plan, and looking back. Furthermore, the cluster sampling technique was used in choosing thirty-five (35) grade 9 students and evaluated their problem-solving ability using a pre-test and post-test assessment. Based on the result, there is a highly significant difference in the mean pre-test and post-test performance of the respondent before and after using the RME approach in all the four phases of problem-solving (p-value=0.000). This implies that the RME is an effective teaching approach that successfully improved the Mathematical proficiency of the students, especially in all aspects of problem-solving skills. According to the findings, the researchers may advise educators to use the RME approach to expose their students to more collaborative teaching-learning processes that incorporate real-world scenarios.

Keywords: *Didactical Phenomenology, Emergent Model, Guided Reinvention, Problem-solving Skills, Realistic Mathematics Education Approach*

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Introduction

Problem-solving is the most necessary concept in mathematics for contextualization and re-contextualization, which guarantee continual learning by transferring basic and complex ideas (Căprioară, 2015). Mathematics education is expected to provide a high-quality education that emphasizes problem-solving and makes the learners globally competitive. As stated by the World Economic Forum (2020), problem-solving is one of the top skills needed for the next five years. Furthermore, the Department of Education developed a curriculum that emphasizes the twin goals of mathematics education, where problem-solving skills belong. But despite these innovations, students' problem-solving skills are still lacking (Nurjamaludin et al., 2021). This problem is evident in the Program for International Student Assessment (PISA) 2018, where the Philippines came in last place out of 79 countries in mathematics (OECD, 2019) and did not reach the average score of 489 and got only 353. In this international assessment, problem-solving skills are acknowledged as the core of mathematics education (OECD, 2013).

Concerning the study of Roman (2019), from the result of national assessments and research from the Philippines over the past 15 years, students show poor Mathematical performance that is noticeable from basic education to higher education levels. Based on the National Achievement Test 2018, students got a low mean percentage score of 35.34% in the Mathematical Ability subtest (Penaso & Gaylo, 2019). Concerning this, the researchers' cooperating teachers perceived Grade 9 students of their school to have poor mathematical skills, especially in problem-solving. It has been evident in previous quarters from the results of their quarterly Mathematics examination. When the pandemic began, it doubled the difficulty for students to learn Mathematics effectively because it is only taught for two hours a week.

Laurens et al. (2018) highlighted that using ineffective teaching approaches has an impact on students' capacity to learn mathematics, particularly in problem-solving. Moreover, a new approach to mathematics teaching was introduced in the Netherlands by Freudenthal Institute that popularly known as the Realistic Mathematics Education (RME) approach. This constructivist-based teaching approach encourages students to investigate and collaborate on their learning with real-world concerns. Guided reinvention, didactical phenomenology, and emergent model are the three core heuristic principles of the RME approach which guide the teaching process design.

Plenty of past international studies showed that the RME is an effective strategy for enhancing mathematics achievement levels (Laurens et al. 2018; see also Zakaria & Syamaun, 2017). However, in comparison to the traditional lecture with problem-solving skills activities, this

teaching style is not widely used in the Philippines. In reviewing related works of literature and studies, the researchers were unable to locate any study conducted in the Philippines that considers the RME approach as a teaching strategy for improving students' mathematical skills to the best of the researchers' knowledge. To fill up the gaps left by previous studies, the researchers will adapt the RME approach to the Philippine educational system and test its effectiveness on the problem-solving skills of the students.

This study was conducted to 1) determine the pre-test performance of the student on Problem-solving skills before the use of the RME approach in terms of understand the problem, devise a plan, carry out the plan, and look back; 2) determine the post-test performance of the student on Problem-solving skills after the use of RME approach in terms of understand the problem, devise a plan, carry out the plan, and look back; and 3) find out if there is a significant difference between the pre-test and post-test performance before and after using the RME approach in the problem-solving skills of the students.

Methodology

The researchers utilized a pre-experimental research design, specifically a one-group pre-test and post-test design. The RME approach was used as the treatment, and the group observed, was the students' problem-solving skills in terms of understand the problem, devise a plan, carry out the plan, and look back. The study's respondents are 35 Grade 9 students from one of the two sections of Almond Academy Foundation Incorporated during the academic year 2021-2022 and were selected using clustered sampling.

Before starting the implementation and discussion using the RME approach, the researchers disseminated the pre-test to the students, then retrieved it afterward. The RME approach was then incorporated, guided by its three core heuristic principles: guided reinvention, didactical phenomenology, and emergent model. The researchers used guided reinvention by providing them with activities that encourage self-exploration through investigation and observation for them to make meaning on their own. For didactical phenomenology, real-life experiences were not only used as examples and parts of the discussion, but the researchers let the students experience the lesson by giving them activities that connect the topic of trigonometry to the real world. In the self-emergent model, models or graphs were provided to support their learning, and students were exposed to drawing the situation on their own to familiarize themselves and make it a routine in every problem solving that they will encounter. Furthermore, as part of the self-emergent model, the researchers used various online platforms and websites to incorporate

tools that will aid their learning. After utilizing the RME approach, the researcher disseminated the post-test with the same level of questioning as the pre-test but not identical. After gathering the data, the results were treated statistically for interpretation.

Findings

The following are the significant findings of this study based on the data analyzed and interpreted. The overall pre-test performance of the respondents in Problem-solving skills falls under the emerging to developing level. In understanding the problem and devising a plan, students got a developing level, while in carrying out the plan and looking back, students have the emerging level of performance. It implies that familiarity with the topic much impacted the performance of the students in problem-solving, they have committed more than two incorrect answers and/or got incorrect answers at all. Outstanding improvement was reflected in the post-test performance of the students after the exposure to the RME approach. Students performed exemplary levels of performance in understanding the problem and devising a plan. In carrying out the plan, students got a proficient level of performance. While in looking back process, students fall under proficient and exemplary levels. It shows that they gained enough learning that enable them to develop different skills and mastered the topic, which contributed to the development of their problem-solving abilities. Moreover, results showed that there is a highly significant difference between the mean pre-test and post-test performance of the students in problem-solving, which all the four phases of problem-solving got a computed p-value of 0.000. This revealed that the use of the RME approach increases the level of problem-solving skills of the students, in all the four-phases. Thus, Realistic Mathematics Education is an effective teaching approach.

Conclusion

From the obtained results, RME significantly increased the performance of the students. This help learners enhance and master the problem-solving ability they need to become lifelong, self-directed learners. Thus, the school and its organization may encourage teachers to explore different teaching strategies, such as the RME approach to improve the teaching-learning process. Findings also manifest that the use of the RME approach is highly interactive and can provide the best learning experiences for the learners. Therefore, teachers may utilize it to expose their students to more engaging and collaborative teaching-learning processes with the incorporation of real-world scenarios using contextualized examples and problems.

Since the study was conducted through an online set-up due to the pandemic, future researchers may conduct a similar study in a face-to-face mode of learning to comprehensively use the RME approach. Also, it is advised to increase the number of respondents and use two classes to have a detailed comparison between the controlled and experimental groups, which falls under the quasi-experimental research design. Moreover, to test the usefulness of the RME approach in other aspects, they may use this parallel approach to the various disciplines of mathematics as well as other subjects like Science and English. In addition, the future researcher may explore each principle and characteristic uniquely found in the RME approach and thoroughly focus on it for designing their learning exemplars. All in all, this study serves as the foundation for future studies to extend the use of the RME approach from the local to the global educational system.

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