PCMJ

Progress in Computer and Mathematics Journal (PCMJ)
volume 3 [November, 2025]
e-ISSN: 3030-6728
Website: fskmjebat.uitm.edu.my/pcmj

IMPROVE INTEREST IN MATHEMATICS THROUGH GAME-BASED LEARNING FOR PRIMARY SCHOOL STUDENTS

NUR ALISSYA ROZI
College of Computing, Informatics and Mathematics, 2023104319@student.uitm.edu.my

NORSHAHIDATUL HASANA ISHAK*
College of Computing, Informatics and Mathematics, hasana@uitm.edu.my

NOOR SURIANA ABU BAKAR
College of Computing, Informatics and Mathematics, suriana_su@uitm.edu.my

Article Info

Received: March 2025
Accepted: September 2025
Available Online: November 2025

Abstract

Mathematics is a crucial topic in our daily lives, not only for education but also for solving real-world problems that require the use of mathematics. Despite the subject's significance in life, some people struggle to learn and grasp mathematics since it is tough to master the methods of solving specific equations and formulas. Primary and high school students frequently dislike mathematics because they are incapable of comprehending the topic and have no interest in learning it. As a result, the solution to this problem is to develop an effective approach to teaching mathematics through game-based learning. Using game-based learning in education not only creates an interactive learning environment, but it may also improve learners' comprehension by providing information that is helpful to them in a way that they understand. This project contains three objectives which are to design a 2D modeling game-based learning of mathematics teaching methods, to develop a 2D game-based learning application for mathematics teaching methods, and to evaluate the effectiveness game-based learning of the mathematics teaching methods. The Agile methodology was chosen for this project because it provides straightforward and understandable requirements for developing a 2D game. This project used three elements from the MDA Framework: mechanics, dynamics, and aesthetics. The project's feedback was evaluated using pre and post-questionnaires, which show that the project is 54.07% effective in implementing game-based learning to learn mathematics. As a result, the objectives of Improve Interest in Mathematics Through Game-Based Learning For Primary School Students were successfully achieved.

Keywords: Mathematics; Game-Based Learning; Primary School Students; Mathematics Teaching Methods; 2D Game

INTRODUCTION

Mathematics is a tool for problem-solving and communication through mathematical computations (Araújo & Ribeiro, 2022). Mathematical expressions are formed by mixing numbers and variables and applying operations like addition, subtraction, multiplication, division, exponents, and others. Learning mathematics has numerous advantages, including enhanced problem-solving abilities, mathematical skills, brain efficiency, and critical thinking. Mathematics has an extensive variety applications in daily life, including banking and financial services, architecture, interior design, computer science, and many more (Sharma, 2021).

Mathematics knowledge is extremely important for students seeking optimum success in their daily lives. As a result, a strong interest in mathematics must be developed and instilled in them so that they can use the concepts they are taught and have gained when needed. Some kids are strongly interested in mathematics but may be hesitant due to their low mathematical performance and abilities. Learning mathematics and teaching methods must be improved to have a positive impact on students' mathematical abilities and performance in the subject. Teachers have a crucial role in finding effective strategies for conveying mathematical concepts. Teachers should focus on leveraging technology to enhance learning and teaching experiences (Khalid et al., 2020).

Primary school students must develop a knowledge and comprehension of mathematics (Zuber & Sulaiman, 2019). This is proven by the 2016 *Ujian Pencapaian Sekolah Rendah* (UPSR) results, which showed that around 95,147 students failed the subject, accounting for 21.6% of the 440,496 candidates who took the test. Students continue to struggle to properly learn mathematics due to teachers' ineffective teaching methods, which has a detrimental impact on their enthusiasm for the subject (Ukobizaba et al., 2021). The present teaching approaches used today do not promote students' complete understanding of what is being taught.

LITERATURE REVIEW

Mathematics is a universal discipline that is critical to the advancement of modern technologies. It greatly facilitates the study of many other fields of knowledge (Simanjuntak, 2021). Health, business, mathematics, and engineering are a few examples. Mathematics helps to strengthen an individual's critical thinking abilities. Students should get an early introduction to mathematics starting in elementary school and continuing through secondary school and higher education (Fajar Rizqi et al., 2023). Mathematics education is still evolving today due to technological advancements like calculators and computers (Simanjuntak, 2021).

Mathematics and Problem-Solving

Problem-solving abilities are high-level cognitive abilities that need the ability to identify the root cause of a problem, break it down, and create successful solutions. This talent helps students learn to address real-world problems, which influences their thinking and knowledge. Students must fully understand the problem before attempting to solve it (Sinaga et al., 2023). Problem-solving abilities are important for learning mathematics since they can help students learn faster and more effectively. Students that can solve difficulties excel in class (Sinaga et al., 2023). As a result, these traits can improve students' mathematical proficiency, transforming them into outstanding individuals.

Mathematics Operations

Mathematical operations are mathematical processes that use numbers to compute values or produce outcomes. Understanding mathematical operations requires a comprehension of the four fundamental operations: addition, subtraction, multiplication, and division. Instead of just conducting computations, students must learn how to apply each operator and the key principles that underpin its use (Raza, 2022).

Problem with Mathematics Operations

Students frequently struggle with mathematics due to a lack of understanding of symbols, difficult methods, and calculation errors (Raza, 2022). Some students aged 10 to 12 are unsure about solving arithmetic questions and lack interest in trying them (Owais Asad, 2022). Students also struggle to understand how to apply the order of operations (Sinaga et al., 2023). For example, students may answer arithmetic problems by combining mathematical

operations from left to right, but this method is improper since it breaks the laws of operation. As a result, the solutions and answers are incorrect. Therefore, all students must understand the order of operations when solving mathematical problems that involve addition, subtraction, multiplication, and division.

PEMDAS as Order of Operations to Problem-Solving

PEMDAS stands for the six mathematical operations which are parentheses, exponents, multiplication, division, addition, and subtraction. Another name for PEMDAS is Brackets, Orders, Division, Multiplication, Addition and Subtraction (BODMAS). PEMDAS refers to the order of operations used to solve mathematical expressions (Anupama S.M. B, 2020). By utilizing PEMDAS to solve mathematical problems, the right and accurate answer can be obtained, as solving using wrong methods can result in an answer that differs from the actual answer.

METHODOLOGY

The Survey Instrument

The platform that will be used to collect information on the evaluation of the effectiveness of the PEMDAS: Order of Heroes game is Google Forms. The game will be provided to participants so that they can download and play it. Scores will be assigned for each question answered by the participant. To evaluate the test's effectiveness, scores will be compared before and after playing the game. Table 1 shows the questionnaire for the preliminary study.

Table 1: Preliminary study questionnaire

Level	Question	Survey Questions
Basic	1	53 + 53 + 53 + 53 + 53 + 53 + 27
	2	34 + 102 + 102 + 102
	3	17 – 25 – 25 + 17 + 17 + 17 + 17 – 25 + 17
	4	12 – 3 – 3 + 2 – 3
	5	5 × 3
Moderate	6	5 × 2 + 4
	7	3 + 4 × 5
	8	5 × (7 – 2)
	9	(3 + 2) × 4
Difficult	10	(6 / 2) × (3 + 4)
	11	4 + (8 / (4 × 2))
	12	6 × 5 – 8 ÷ 2
	13	Sanu packs 12 apples in a box. She was able to fill 3 boxes, but 2 apples were left out. How many apples did she have?
	14	3 out of 24 mangoes in the basket were rotten. Chandar and his two friends share the remaining mangoes. How many good mangoes does each of them get?

The Participants and Procedure

The target audience for this project is school students aged 10 to 12 years old, who will be given a questionnaire to evaluate their PEMDAS skills before and after the game is played. The questionnaire consists of 14 math questions. These questions, which were included in an online survey using Google Forms, involve mathematical operations and word problems that require users' problem-solving and critical thinking skills. Participants are given time to complete the questionnaire before playing the game, to assess their knowledge of PEMDAS.

RESULT AND DISCUSSION

Basic-Level Questions

Based on Table 2 below, the highest improvement was obtained in the fourth question, with an increment of 9 (56.25%) participants answering correctly. The lowest improvement was in the second and fifth questions with one (6.25%) participant increase. The students can solve the fifth question with 15 (93.75%) participants answering the question correctly in the pretest and 16 (100%) participants in the posttest.

Table 2: Basic Level Analysis

Question	Percentage Correct in Pre-test (%)	Percentage Correct in Post-test (%)	Percentage Increase (%)
1	56.25%	75%	18.75%
2	68.75%	75%	6.25%
3	43.75%	56.25%	12.5%
4	37.5%	93.75%	56.25%
5	93.75%	100%	6.25%

Moderate-Level Questions

Based on Table 3 below, the highest improvement was obtained in the third question, with an increment of 8 (50%) participants answering correctly. The lowest improvement was in the second and fourth questions with 3 (18.75%) participants increase. Most of the students cannot answer the second question since it needs the application of PEMDAS when solving the question.

Table 3: Moderate Level Analysis

Question	Percentage Correct in Pre-test (%)	Percentage Correct in Post-test (%)	Percentage Increase (%)
1	87.5%	81.25%	6.25%
2	37.5%	56.25%	18.75%
3	43.75%	93.75%	50%
4	75%	93.75%	18.75%
5	87.5%	81.25%	6.25%

Difficult-Level Questions

Based on Table 4 below, the highest improvement was obtained in the third question, with an increment of 9 (56.25%) participants answering correctly. The lowest improvement was in the fifth question with 2 (12.5%) participants increase. Students find it difficult to answer the fifth question because it is in sentence form.

Table 4: Difficult Level Analysis

Question	Percentage Correct in Pre-test (%)	Percentage Correct in Post-test (%)	Percentage Increase (%)
1	37.5%	93.75%	56.25%
2	37.5%	87.5%	50%
3	12.5%	50%	37.5%
4	31.25%	68.75%	37.5%
5	31.25%	43.75%	12.5%

CONCLUSION

Mathematics learning can be interesting and engaging by using the PEMDAS: Order of Heroes game in the learning process. The evaluation of the user's feedback has proved that this game is effective in teaching primary school students using online questionnaires. The project's feedback was evaluated using pre and post-questionnaires, which show that the project is 54.07% effective in implementing game-based learning to learn mathematics. By implementing a game-based learning method, problems like a lack of interest in mathematics subject and difficulty in understanding the lesson can be solved. Despite several limitations in the project, it can be improved with some improvements for future work using additional elements and contents in the game to make learning more effective.

REFERENCES

Anupama S.M. B. (2020). BODMAS: Much ado about nothing?

Araújo, M. G., & Ribeiro, P. S. (2022). LOGIC AND POSSIBILITIES TO ANSWER THE QUESTION: WHAT IS MATHEMATICS? International Journal of Human Sciences Research, 2(31). https://doi.org/10.22533/at.ed.5582312205104

Fajar Rizqi, A., Adilla, B. L., Sulistiyawati, E., & Taufiqurrohmah. (2023). ANALISIS KESULITAN BELAJAR MATEMATIKA PADA SISWA SEKOLAH DASAR DAN ALTERNATIF PEMECAHANNYA. Jurnal Pendidikan Dasar Flobamorata, 4(1), 481–488. https://doi.org/10.51494/jpdf.v4i1.588

Khalid, M., Saad, S., Abdul Hamid, S. R., Ridhuan Abdullah, M., Ibrahim, H., & Shahrill, M. (2020). Enhancing creativity and problem solving skills through creative problem solving in teaching mathematics. Creativity Studies, 13(2), 270–291. https://doi.org/10.3846/cs.2020.11027

Owais Asad. (2022, January 18). The Conquest of Arithmea: A Game-Based Approach to learning BODMAS. https://doi.org/10.33422/3rd.iaceducation.2021.06.302

Raza, J. M. (2022). Role of arithmetic principles and operations in understanding students' mathematics performance. International Journal of Research Studies in Education, 11(12). https://doi.org/10.5861/ijrse.2022.326

Sharma, P. (2021). Importance and Application of Mathematics in Everyday Life. International Journal for Research in Applied Science and Engineering Technology, 9(11), 868–879. https://doi.org/10.22214/ijraset.2021.38869

Simanjuntak, J. (2021). Perkembangan Matematika dan Pendidikan Matematika Di Indonesia. Sepren, 2(2), 32–39. https://doi.org/10.36655/sepren.v2i2.512

Sinaga, B., Sitorus, J., & Situmeang, T. (2023). The influence of students' problem-solving understanding and results of students' mathematics learning. Frontiers in Education, 8. https://doi.org/10.3389/feduc.2023.1088556

Ukobizaba, F., Ndihokubwayo, K., Mukuka, A., & Uwamahoro, J. (2021). From what makes students dislike mathematics towards its effective teaching practices. Bolema - Mathematics Education Bulletin, 35(70), 1200–1216. https://doi.org/10.1590/1980-4415v35n70a30

Zuber, M. M., & Sulaiman, H. (2019). Exploring the effectiveness of e-learning in increasing students' achievements in mathematics at the primary school level. AIP Conference Proceedings, 2184. https://doi.org/10.1063/1.5136372