



INTERNATIONAL EXHIBITION & SYMPOSIUM ON PRODUCTIVITY, INNOVATION, KNOWLEDGE & EDUCATION

“Optimizing Innovation in Knowledge, Education and Design”

EXTENDED ABSTRACT



e ISBN 978-967-2948-56-8



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eISBN 978-967-2948-56-8

Published by:
Universiti Teknologi MARA (UiTM) Cawangan Kedah,
Sungai Petani Campus,
08400 Merbok,
Kedah,
Malaysia.

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Assalamualaikum warahmatullahi wabarakatuh,



First and foremost, I would like to express my gratitude to the organizing committee of i-Spike 2023 for their tremendous efforts in bringing this online competition a reality. I must extend my congratulations to the committee for successfully delivering on their promise to make i-Spike 2023 a meaningful event for academics worldwide.

The theme for this event, 'Optimizing Innovation in Knowledge, Education, and Design,' is both timely and highly relevant in today's world, especially at the tertiary level. Innovation plays a central role in our daily lives, offering new solutions for products, processes, and services. By adopting a strategic approach to 'Optimizing Innovation in Knowledge, Education, and Design,' we have the potential to enhance support for learners and educators, while also expanding opportunities for learner engagement, interactivity, and access to education.

I am awed by the magnitude and multitude of participants in this competition. I am also confident that all the innovations presented have provided valuable insights into the significance of innovative and advanced teaching materials in promoting sustainable development for the betterment of teaching and learning. Hopefully, this will mark the beginning of a long series of i-Spike events in the future.

It is also my hope that you find i-Spike 2023 to be an excellent platform for learning, sharing, and collaboration. Once again, I want to thank all the committee members of i-Spike 2023 for their hard work in making this event a reality. I would also like to extend my congratulations to all the winners, and I hope that each of you will successfully achieve your intended goals through your participation in this competition.

Professor Dr. Roshima Haji Said
RECTOR
UiTM KEDAH BRANCH



WELCOME MESSAGE (i-SPIKE 2023 CHAIR)



We are looking forward to welcoming you to the 3rd International Exhibition & Symposium on Productivity, Innovation, Knowledge, and Education 2023 (i-SPIKE 2023). Your presence here is a clear, crystal-clear testimony to the importance you place on the research and innovation arena. The theme of this year's Innovation is "*Optimizing Innovation in Knowledge, Education, & Design*". We believe that the presentations by the distinguished innovators will contribute immensely to a deeper understanding of the current issues in relation to the theme.

i-SPIKE 2023 offers a platform for nurturing the next generation of innovators and fostering cutting-edge innovations at the crossroads of collaboration, creativity, and enthusiasm. We enthusiastically welcome junior and young inventors from schools and universities, as well as local and foreign academicians and industry professionals, to showcase their innovative products and engage in knowledge sharing. All submissions have been rigorously evaluated by expert juries comprising professionals from both industry and academia.

On behalf of the conference organisers, I would like to extend our sincere thanks for your participation, and we hope you enjoy the event. A special note of appreciation goes out to all the committee members of i-SPIKE 2023; your dedication and hard work are greatly appreciated.

Dr. Junaida Ismail

Chair

3rd International Exhibition & Symposium Productivity, Innovation, Knowledge, and Education 2023 (i-SPIKE 2023)

ONE PIECE MATHEMATICS BOARD GAME (1PM3)

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ABSTRACT

Mathematics plays a vital role in developing students' cognitive abilities and analytical reasoning. Often, difficulties in solving mathematical problems stem from a limited understanding of fundamental concepts, leading to frustration and disengagement. To address this, the innovative board game called 1PM3 was designed to enhance students' comprehension of arithmetic principles, transforming the learning experience into an enjoyable and low-pressure environment that reduces math anxiety. The 1PM3 board game aligns with Sustainable Development Goal 4.0 by promoting inclusive and equitable quality education through its engaging and effective approach to teaching mathematics. This study aims to investigate the impact of 1PM3 on problem-solving proficiency among 35 Pre-Diploma students who participated in the "Mathtournament 2023" at UiTM Sarawak Branch, Mukah Campus. The game, divided into three mathematical chapters, focuses on functions, simultaneous equations, and formula transformation (*Business Mathematics*). Data was analysed using thematic analysis, incorporating game observation and surveys to gather comprehensive insights of 1PM3 effectiveness in addressing students' mathematical learning abilities. The findings of the study indicate a significant improvement in problem-solving skills among participants. The competitive and interactive elements of the game effectively sustain students' interest and motivation throughout the learning process. As a result, 1PM3 emerges as a valuable educational tool for teaching and learning mathematics. As educators continue to explore innovative methods, integrating

1PM3 into mathematics teaching practices can pave the way for a more engaging and effective learning experience for students.

Keywords: 1PM3, board game, math anxiety.

INTRODUCTION

Mathematics is often regarded as a difficult subject by students, which will directly impact their motivation to learn it. The use of conventional teaching methods such as lecturing may not be effective for some students due to the subject matter's perceived lack of appeal. To ensure that students' interest is maintained, engaging learning methods are necessary to enable them to acquire the basic concepts of mathematics. The teaching of mathematical problem-solving is viewed by Szabo et. al. (2020) as a method of developing 21st century skills; thus, students will become competent in mathematics problem-solving. Kartika et. al. (2019) stated that learning through educational games is one of the most effective means of expanding students' creative thinking skills. In addition, they also asserted that the capacity to think creatively in mathematics is a dynamic process that requires the students to produce complicated concepts, so they can better comprehend the subject. Therefore, an innovative mathematics game known as *One Piece Mathematics Board Game* (1PM3) has been developed as an educational game to attract students' interest and engagement in learning mathematics. Emphasizing a low-pressure learning environment, the game embrace mistakes as valuable learning opportunities to test the students' ability in solving mathematical problems related to *Equations* and *Functions* quickly.

RESEARCH OBJECTIVES

This study evaluates 1PM3's ability to reduce math anxiety, promote interactive learning, and foster a growth mindset that encourages students to embrace problem-solving challenges in mathematics in a positive learning environment.

RESEARCH METHODOLOGY

The researchers utilised thematic analysis as a methodological approach to collect and analyses data obtained from survey replies and observations made on a sample of 35 participants. The primary objective of the data analysis was to investigate the method in which participants engaged with the game and to examine the impact of the 1PM3 board game competition on their experiences of mathematics learning.

GAME DESIGN

1PM3 is a board game that tests students' abilities in solving mathematical problems involving basic concepts of equations and functions, where participants are required to complete three stages of the game, and this game can be played in groups or individually. The stages of the game are divided into chapters represented by three game stations; *Game 1: Functions*, *Game 2: Simultaneous Equations*, *Game 3: Transformation of Linear Equations*; for participants to complete whereby the winner is determined based on the shortest time spent in finishing the game.

Table 1. Game 1: Functions

Each participant is required to choose or match the accurate answer for each question. Participants are provided with question cards containing function questions and small pieces of wooden boards that have the value of x.	
STEP 1:	Participants queue in their respective groups and prepare to run towards the first station in an orderly manner/in sequence.
STEP 2:	The first participants of each group will shuffle the cards containing function questions, and then pick a card to solve the question.
STEP 3:	The participants must select a piece of small wood that contains the value of the answer in the envelope provided.
STEP 4:	The participants place the answer in the right box containing the answer on the 1PM3 board.
STEP 5:	Once the first participants return to the group, the second participants advance towards the station.
STEP 6:	The game continues until all questions are matched with accurate answers.
STEP 7:	All group members proceed to the second station for the second game.

Table 2. Game 2: Simultaneous Equations

Participants are required to discuss in their own groups to select a set of simultaneous equations with 3 linear equations and 3 variables that possess the same variable values. They are provided with 6 cards, each encompassing 3 linear simultaneous equations with 3 variables and small pieces of wooden boards that have the value of the variables x, y, and z.	
STEP 1:	Participants discuss in their groups to find the values of x, y, and z that satisfy the simultaneous equations on the given cards. They are allowed to use the <i>Elimination Method</i> or <i>Substitution Method</i> to solve the simultaneous equations.
STEP 2:	Participants select 2 sets of cards that have the same values of x, y, and z. Alternatively, participants can use trial and error to guess the values of x, y, and z that satisfy the equations without requiring lengthy calculations.
STEP 3:	Then, participants attach the set of cards and small wooden boards containing the values of x, y, and z to the designated space on the 1PM3 board.
STEP 4:	All group members proceed to the last station after completing this stage.

Table 3. Game 3: Transformation of Linear Equations

Participants are required to deduce a hidden letter that will form from the arrangement of numbers on the 1PM3 board, consisting of a sequence of numbers. Each group will be given an envelope containing a piece of paper with a sequence of numbers from 1 to 25, a set of question cards; where each group will receive a different set of questions that will result in different letter answers from the number sequence; and small round stickers.	
STEP 1:	Participants discuss in their groups to solve the given questions on the question cards.
STEP 2:	White stickers will be placed on numbers (1-25) according to the answers obtained from the question cards.
STEP 3:	Subsequently, the completed paper with numbers will reveal one hidden letter, which will be given to the referee for verification.
STEP 4:	Finally, participants need to utilised creativity to form the shape of the letter according to the letter obtained. The first group to successfully complete this stage will be declared the winner.



Figure 1. Participants engaging in games

RESULT FINDINGS

The findings of the study indicate a significant improvement in problem-solving skills among participants. Observation during the competition found that students were more engaged and enthusiastic in attempting to solve the mathematical questions provided in the 1PM3 game compared to completing practice questions or mathematics assignments given in class, hence demonstrated an improvement in their understanding of mathematical concepts.

NOVELTY

The novelty of the 1PM3 board game lies in its combination of innovative learning strategies, its focus on reducing math anxiety, and its dedication to fostering a positive and engaging learning atmosphere. By focusing the power of games to teach mathematics effectively, 1PM3 offers a fresh and impactful approach to enhancing students' mathematical abilities and problem-solving skills. The game is also designed to incorporate mathematical logic in problem-solving to boost students' critical thinking abilities.

COMMERCIALIZATION POTENTIAL

1PM3 offers individual and group game modes, accommodating versatile learning preferences and educational environments. Its affordability enhances market appeal, making it accessible for mathematics teaching in various settings. As gamified learning gains popularity in educational settings, 1PM3 is well-positioned to capitalize on the growing educational gaming market by delivering an engaging and effective learning experience.

CONCLUSION

The outcomes of this study affirm the educational value of 1PM3 and its potential to transform mathematics learning into an engaging and enjoyable experience. By leveraging the game's strengths and embracing opportunities for growth, educators and educational institutions can harness 1PM3 as a powerful tool to empower students, improve problem-solving abilities, and foster a lasting passion for mathematics.

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e ISBN 978-967-2948-56-8

