Proposed Strategic Management in Teaching Mathematics Using Game-Based Technique in Problem Solving

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ABSTRACT

This study focused on non-computer-based game called "Race to be Mathematicians". It aimed to compare traditional strategy and the game-based technique to be a basis for strategic management in teaching Mathematics. Descriptive comparative design was used to determine if there was a significant difference between the two variables being studied. Quizzes and questionnaire were distributed to respondents upon the approval of the College Administrator and the conduct of both strategies. The data gathered was described, analyzed and interpreted using descriptive statistics such as percentage and mean. Furthermore, to test the hypothesis of the study, T test for uncorrelated sample was used. The findings indicate that the use of game-based technique in teaching Problem Solving in terms of learning outcomes and motivation as perceived by the students were highly effective with overall mean of 91.94 and 4.70 respectively while the use of Traditional Strategy in teaching Problem Solving were effective with overall mean of 86.39 and 3.68 respectively. Moreover, there is a significant difference as revealed by the computed t-value of -2.69 and -8.63, which is less than to critical value -2.10. This simply means that though traditional strategy can produce the desired result effectively, game-based technique can produce it better and combining this two strategies must be considered to get better results.

Keywords- strategic management, teaching mathematics, game-based technique, problem solving

INTRODUCTION

One of the most important elements of the teaching-learning process in the 21st century as the teachers' instructional style, which serves as an example for academic progress. Despite the implementation of programs such as teacher professional development, students' performance on win or lose achievement assessments remains poor. As a result, learning teaching methods and techniques is important to becoming a teacher who can use a range of interesting ways and strategies to convey knowledge to their students. Teachers need to choose the most efficient technique for imparting knowledge to their learners.

Mathematics is prone to misconceptions and misunderstandings. Learners may develop incorrect or incomplete understandings of concepts, leading to persistent errors. These concerns about mathematics teaching and learning has long existed in the global educational system. The development of critical thinking and problem-solving skills is required for the implementation of the K–12 Curriculum basic education. Mathematics has a vital role in varied aspects of lives, both lifestyle and career. Thus, Mathematics education doesn't solely aim to teach learners, however, conjointly aims to cultivate learners with academic competency as a provision to hold out their roles in social life (SEAMEO RECSAM, 2017).

Given the significance of mathematical proficiency, educational institutions have a pressing necessity to turn out knowledgeable learners. Addressing these misconceptions and helping learners develop accurate conceptual frameworks requires targeted intervention and thoughtful pedagogical approaches. Enjoyment in learning Mathematics is often observed to be a positive and desired emotion in the learning process as gratification engage learners in their learning. If a learner will be able to perceive and acknowledge the various different perspectives by speaking and acting in the proper ways, math concepts can help them function in a global setting. Learners must learn to think logically and interpret what they have studied, however, conceptual thinking in math appears to be more challenging than other language, arts and social studies.

A global assessment, referred to as PISA, or the Program for International Student Assessment, is conducted by the Organization for Economic Cooperation and Development (OECD). This program intends to assess the levels of achievement in terms of skills and knowledge in mathematics, science, and reading of 15-year-old learners around the world every three years to enhance educational methods and outcomes. Findings showed several countries have a long way to go in terms of achieving the global goals for excellent education. As cited by Satiti, et.al, 2021 the score obtained by Saudi Arabia in mathematics is lower than the national standard. Some of the countries are even below national standards, such as the United States, Russia, and the United Arab Emirates (OECD, 2019).

However, in ASEAN countries, the mathematical mean scores of PISA 2018 showed that only Singapore exceeded the OECD average, while other countries got lower mean scores. The ranking results in 2018 showed that Indonesia's rank is lower than it was in 2015, placing them in seventh place

from the bottom among 79 countries. Whereas, Brunei, Malaysia, and Thailand are among the ASEAN countries that scored lower than the OECD average, ranking 51st, 47th, and 57th (OECD, 2019).

PISA 2018 revealed that Filipino students in both mathematical and scientific literacy ranked second to the lowest. Math performance has been a major source of concern both globally and domestically, as learners are perceived to be underperforming in this subject. Students' low performance in mathematics such as geometry and other mathematics disciplines has been shown by a number of research studies conducted in the Philippines. Thus, the improvement or progression of a student's mathematical literacy must be prioritized.

According to ED Tech RCE (2025) by incorporating interactive gaming components into the learning process, game-based learning is transforming education. Game-based learning is a teaching strategy that improves engagement and knowledge retention through the use of game dynamics, challenges, and rewards. To make learning more engaging and pleasurable, this teaching strategy is frequently utilized in corporate training, online education, and classrooms. Game-based learning improves critical thinking, problem-solving, and teamwork, according to studies.

In the same manner, (Grace, 2019) game-based learning is an educational technique that incorporates game mechanics to improve student engagement and knowledge retention. Unlike traditional learning methods that rely on passive instruction, game-based learning encourages active participation, problem-solving, and decision-making. This method is widely used across different educational settings, including schools, corporate training programs, and e-learning platforms

Another advantage of game-based learning is its ability to adapt to different learning styles. Visual learners benefit from animated graphics, while auditory learners can engage with narrated instructions and dialogues. Additionally, hands-on learners benefit from real-time decision-making within a game environment. These personalized learning experiences make game-based learning a powerful educational tool (Kula, 2021; Syafii, 2021). With the rise of digital technology, game-based learning has expanded beyond traditional classroom settings. Online learning platforms, mobile apps, and virtual reality (VR) simulations have transformed how education is delivered. Whether it's through math puzzles, language learning apps, or business simulations, game-based learning continues to shape the future of education.

However, Han (2015) state that adapting to society requires the ability to solve problems, and game-based learning has become the most effective approach to enhancing these abilities; for example, discovered that interactive sessions of instruction are beneficial. Students get more knowledge and enhance their cognitive problem-solving skills. Learning through games, by Integrating many skills into the educational process is also thought to have the potential to boost involvement of pupils.

Moreover, the goal of game-based learning is to strike a balance between learning through games and theoretical content. Students can investigate demanding learning environments, topics, and focused learning through based learning (Chen et al., 2018). (Hettiarachchi & Mozelius, 2017) stated that games should be designed to ensure that the students can repeat the cycles within the game context without becoming bored.

The researcher recognized an understated connection among the strategic management in teaching mathematics and game- based technique in problem solving.The researcher became eager to conduct a study on the related factors of proposed strategic management in teaching mathematics using game-based technique in problem solving

OBJECTIVES OF THE STUDY

The purpose of this study was to measure the effectiveness of game-based technique in teaching Problem Solving in terms of learning outcomes and motivation which would serve as a basis for strategic management in teaching Mathematics.

METHODOLOGY

Descriptive comparative design was used in this study 20 respondents were chosen by purposive sampling to fill out a research-made questionnaire. Two instruments were used to measure the effectiveness of game-based technique. Grade interpretation of the quizzes was used for the learning outcomes and self-made questionnaire using five-point numerical scale that was used for motivation. In order to describe the variables being studied, the study also employed descriptive statistics, namely the weighted mean.

After being briefed and given crucial information about the study's objective before it is carried out, the respondents freely decided to participate by giving their informed permission. In accordance with RA 10173, often referred to as the Data Privacy Act, all information was stored and managed with the utmost confidentiality in order to guarantee anonymity, confidentiality, and the prevention of possible harm.

RESULTS AND DISCUSSION

The effectiveness of game-based technique in teaching problem solving in terms of learning outcomes is shown in table 1.1 The weighted mean for the item mentioned were 91.94 which is highly effective. In addition, the result implied that the students tended to get a higher result in quiz if they are given a chance to experience and collaborate with their fellow students.

Table 1.1. Percentage quiz on the extent of effectiveness of game-based technique in teaching Problem Solving in terms of learning outcomes:

Grade %	Frequency	Description
90- Above	8	Highly Effective
85-89	2	Effective
80-84	0	Moderately Effective
75-79	0	Rarely Effective
Below - 74	0	Ineffective
Overall Mean: 91.94	**10**	**Highly Effective**

The effectiveness of game-based technique in teaching problem solving in terms of motivation is shown in table 1.2. The weighted mean for the item mentioned were 4.70 which is highly effective. However, the result implied that game-based technique brings enjoyment while learning, enables students to explain the answer and students become more motivated in the learning process as well.

Table 1.2 Mean Perception and Rank on the Extent of Effectiveness of Game-Based Technique in Teaching Problem Solving in terms of Motivation

Items	Mean	Rank	Description
1. Engages students in class discussion	4.90	2.5	Highly Effective
2. Makes the students eager to learn	4.80	4	Highly Effective
3. Brings enjoyment to students while learning	5.00	1	Highly Effective
4. Catches students' attention during class discussion	4.70	5.5	Highly Effective
5. Increases students' understanding in solving mathematical problems	4.60	8	Highly Effective
6. Provide opportunity to think critically	4.70	5.5	Highly Effective
7. Enhances active participation in solving mathematical problems	4.90	2.5	Highly Effective
8. Manages time to solve mathematical problems	4.60	8	Highly Effective
9. Develops collaboration among students	4.60	8	Highly Effective
10. Enables students to explain the answer	4.20	10	Highly Effective
Overall Mean:	**4.70**		**Highly Effective**

Table 2.1 presents the effectiveness of traditional strategy in teaching problem solving in terms of learning outcomes with overall mean of 86.39 which is highly effective with 3 out of the total number of respondents got a percentage of 90- above on the quiz. In the same manner, 1 respondent got a percentage of 75-79 (rarely effective). However, the result implied that traditional strategy is still effective in teachers and learners.

Table 2.1. Percentage quiz on the extent of effectiveness of traditional strategyin teaching problem solving in terms of learning outcomes.

Grade %	Frequency	Description
90 - Above	3	Highly Effective
85-89	4	Effective
80-84	2	Moderately Effective
75-79	1	Rarely Effective
Below - 74	0	Ineffective
Overall Mean: 86.39	**10**	**Effective**

Table 2.2 presents the extent of traditional strategy in teaching problem solving in terms of motivation with overall mean of 3.68 which is effective. The result suggest that

traditional strategy provide opportunity to think critically with mean of 4.20 and develops collaboration among students with mean of 3.20.

Table 2.2 Mean perception and rank on the extent of effectiveness of traditional strategy in teaching problem solving in terms of motivation.

Items	Mean	Rank	Description
1. Engages students in class discussion	3.70	5.5	Highly Effective
2. Makes the students eager to learn	3.80	4	Highly Effective
3. Brings enjoyment to students while learning	3.60	7	Highly Effective
4. Catches students' attention during class discussion	3.70	5.5	Highly Effective
5. Increases students' understanding in solving mathematical problems	3.90	2.5	Highly Effective
6. Provide opportunity to think critically	4.20	1	Highly Effective
7. Enhances active participation in solving mathematical problems	3.30	9	Highly Effective
8. Manages time to solve mathematical problems	3.90	2.5	Highly Effective
9.Develops collaboration among students	3.20	10	Highly Effective
10.Enables students to explain the answer	3.50	8	Highly Effective
Overall Mean:	**3.68**		**Effective**

Table 3 presents the data gathered of learning outcomes. The computed t-value is -2.69 while motivation computed t-value -8. 63 which is less than the critical value of 2.10 at 58% level of significance with 18 degrees of freedom, meaning the null hypothesis is rejected, therefore, there is significant difference between the extent of using game-based technique and traditional strategy in teaching problem solving.

The result implied that the teacher had the control on what instruction should be like in order for the students to learn. Moreover, this result supported by "Instructional Theory" by Robert M. Gagne. According to this theory, in promoting education, teachers must know how to construct different instructional models and methods.

Table 3. T-test result on the mean difference between the extent of effectiveness of using game-based technique and traditional strategy in teaching problem solving in terms of learning outcomes and motivation.

Variable	Critical Value	Computed t- value	Result
Learning Outcomes	$\pm$ 2.100922	- 2.694439	With Difference
Motivation	$\pm$ 2.100922	-8.634289	With Difference

CONCLUSIONS AND FUTURE DIRECTIONS

Based on the result of the study, game-based technique and traditional strategy was an effective strategy in teaching problem solving. However, game-based technique exhibited better outcomes. Moreover, there is a connection between the extent of effectiveness of using game-based technique and traditional strategy in teaching problem solving in terms of learning outcomes and motivation.

Furthermore, traditional strategy needs for improvement, thus other methods in teacching must be explored. Future studies may continue to examine this study using other unique non-technological games must be done to support this study.

References:

Balbuena, S.E., & Buayan,M.C. (2014). Mnemonics and Gaming: Scaffolding Learning of Integers. Asia Pacific Journal of Education, Arts and Science, Vol.2 No.1 P-ISSN 2362-8022 E-ISN 2362-80301 www.apjeas.apjmr.com

Chen, C., Liu, J., & Shou, W. (2018). How competition in a game-based science learning environment influences students' learning achievement, flow experience, and learning behavioral patterns. Journal of Educational Technology & Society, 21(2), 164-176.

Goodrum, D., Hackling, M., & Rennie, L. (2001). The status and quality of teaching and learning of science in Australian schools: A research report. Canberra: Department of Education, Training and Youth Affairs.

Grace, L. (2019). Doing things with games: Social impact through play. Routledge. Kula, S. S. (2021). Mind games with the views of classroom teachers. International Journal of Research in Education and Science (IJRES), 7(3), 747-766. https://doi.org/10.46328/ijres.1471

Mozelius, P., & Hettiarachchi, E. (2017). Critical factors for implementing blended learning in higher education. International Journal of Information and Communication Technologies in Education, 6(2), 37-51. https://doi.org/10.1515/ijicte-2017-0010

DISCLOSURE OF CONFLICT OF INTEREST

I, the corresponding author, hereby swear that the information included in this disclosure is accurate and complete to the best of our knowledge and belief on behalf of contributing author. We shall quickly tell the editor and fill out a new conflicts of interest disclosure form outlining any modifications to the information and declaration provided above. This covers any modifications made before our manuscript is published. Also affirm that we abide by the journal's conflict of interest policy