Enhancing Achievement and Interest in Mathematics Learning Through Innovative Pedagogical Approach

Rey R. Angel, Razil M. Gumanoy

Maharlika National High School, North Eastern Mindanao State University

ABSTRACT

This study aimed to evaluate the effectiveness of innovative pedagogical approach compared to conventional instructional method in enhancing students' academic performance in mathematics. The research involved pre-test and post-test assessments of students in both experimental and control groups. Findings revealed that the students in the controlled group had a mean score of 9.46 for the pre-test and 16.18 in the post-test. The result showed that the scores from pre-test to post-test increase a bit. While the students in the experimental group obtained a pre-test mean score of 9.31 and post-test mean score of 24.14. The result showed that the scores of the students from the pre-test almost doubled their scores in the post-test. The mean scores of pre-test and post-test in both methods have a p-value of 0.000 which is less than the significance level of 0.05. Thus, both methods rejected the null hypothesis. The significant improvement in post-test scores for the experimental group highlighted the effectiveness of the innovative pedagogical method. Additionally, the results indicated that the experimental method was more effective across different mathematical levels, with high-achieving students showing greater improvement. In this study, the researcher was employed the pretest – posttest non comparable quasi experimental design to determine the effectiveness of the innovative created game-based approach in teaching Mathematics 8 on the academic achievement of students. In this design, two groups of students were involved. This design is the same as the classic controlled experimental design except that the subjects cannot be randomly assigned to either the experimental or control group. In other words, participants do not have the same chance of being in the control or experimental group, or of receiving or not receiving the treatment. Design. Quasi-experimental design involves selecting groups, upon which a variable is tested, without any random pre-selection processes. The researcher used the mean scores of students in pre-test and post-test of the two methods. The researcher used the One-Way ANOVA to identify if there is a significant difference between the mean gain score of the students in the pre-test and post-test using the conventional and experimental methods.

Keywords: Innovative Pedagogical Approach, Academic achievement, Quasi-Experimental Approach

INTRODUCTION

Digital learning platform has emerged as a dynamic pedagogical approach that encourages and enhances students' learning through 4A's activities/games. Digital Platforms are engaging and interactive in nature have been found to impart knowledge and enhance skills. Digital platforms refer to incorporating Kahoot with new activities-like elements into teaching and learning. Kahoot learning incorporates actual activities into the learning experience and has received attention for its potential to transform education, particularly in Mathematics. Teaching mathematical concept has a reputation for being challenging for students. Studies show that both high school and university students struggle not just to produce concrete solution but even to understand what a mathematical concept is. Students frequently claim that while they can follow a teacher's explanation of a solution in class, they are unable to compose solution on their own when given homework assignments. The study is all about the application of digital platforms learning which defined as the use of the creative games aligned with the competency   to reinforce learning in which game elements used to motivate and engage the users to promote learning.

Kahoot and other digital platforms learning has received increased attention in health sciences education in the global north due to its effectiveness in achieving learning outcomes. The literature concurs that learning outcomes can be improved through appropriate pedagogical approaches. However, more studies need to focus on game-based learning in the health sciences and higher education field in South Africa. Learning about mathematics would entail much more than just attending lectures. According to Darlin (2021), many students entered high school with severe gaps in their mathematical concepts and skills. They frequently lack motivation when it comes to learning mathematics, which can affect their achievement. Rubin (2021) states that students can better attain conceptual understanding and procedural fluency when they engage in hands-on and minds-on activities. Students are more likely to learn when they are motivated and involved in the task at hand than when they are not.
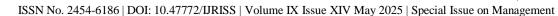
The researcher focused in implementing the created games/activities learning strategy in teaching math classes in Grade 8 level of Maharlika National High School because of its lower scores in their 1st periodical examination. In fact, they got 52.3 Mean Percentage Score (MPS) in the periodical exam which is low because of the lower scores of the students. Aside from that, lots of strategies can be associated in math classes and one of this is the digital platform learning approach. The researcher be wanted to give emphasis on this strategy because students learn mathematics by an active participation, and their active participation can be insured by good teaching strategies and by creating their interest in the classroom. The concept, process, and benefits of games have always been considered by researcher. Mathematics is especially difficult when students will be taught to follow rules and procedures in a very abstract manner without going through models for better conceptual understanding.

Students often find mathematics to be one of the more challenging courses. Some students find math lessons boring when teachers teach them directly, and they struggle to understand the material. However, learning will be more successful when a game is included with the instruction. According to the researcher's own observations, students are naturally lighthearted and fun. When games are used to break up a class rather of relying solely on traditional teaching methods, students are more likely to comprehend the material. It is the purpose of this study to examine on what innovative game-based activities could be developed to scaffold in the teaching and learning process, to help students improve their performance in mathematics.

Theoretical/Conceptual Framework

Student's performance is greatly affected as to how engaging teaching-learning process takes place. It is believed that fundamental mathematical concept created games may foster learning in the students which will further help them solve a more complex math problem. This study is anchored on Bruner's theory on constructivism which encompasses the idea of learning as an active process wherein those learning is able to form new ideas based on what their current knowledge is as well as their past knowledge. The teacher resources used should be focused on that of encouragement, aiding and allowing the student to uncover the main principles on their own. Independent learning within Created-Based Learning may reflect Piaget's (1936, cited in Martin, 2019) cognitive learning theory where learning occurs when children actively construct knowledge through interacting with their environment.

This study is also supported by the theory of individual differences of B.F. Skinner and Gagne's which explained that students comes from different environments in which their learning behavior has been shaped and reinforced in various ways. Therefore, what may be considered a positive reinforces for one student may not promote positive learning behavior for others (Alkin, B. 2020). Whereas, collaborative learning in Game-Based Learning may be similar to Vygotsky's (1978, cited in MacBlain, 2021) social learning theory in which children develop their understanding through talking and listening to others. Therefore, independently and actively constructing knowledge through games promotes students to communicate and collaborate with their peers and teachers, refining and developing the students' understanding, thus, promoting learning (Hennessey, Higley&Chesnut, 2020). The theories mentioned above plays a significance role in this study. It allows the researcher to create something that serve as alternative basis of foundation in this study. Subsequently, GBL within mathematics may promote effective and positive independent and collaborative learning, which is encouraged through the use of creative games that positively impact upon motivation and engagement of students.

RESEARCH METHODOLOGY

In this study, the researcher was used the pretest – posttest non comparable quasi experimental design to determine the effectiveness of the innovative created game-based approach in teaching Mathematics 8 on the academic achievement of students. In this design, two groups of students were involved. This design is the same as the classic controlled experimental design except that the subjects cannot be randomly assigned to either the experimental or control group. In other words, participants do not have the same chance of being in the control or experimental group, or of receiving or not receiving the treatment. Design. Quasi-experimental design involves selecting groups, upon which a variable is tested, without any random pre-selection processes (Shuttleworth, 2020). After this selection, the experiment proceeded in a very similar way to any other experiment, with a variable being compared between different groups, or over a period of time.

Pretest and Posttest were given to both groups, but the treatment will be only introduced to the experimental group which is the integration of innovative game-based mathematical approach. In the study of both groups, the pretest O_1 will be assessed the previous knowledge as a covariate. After the administration of the posttest O_2 of each group will be compared. The broken line between the two groups suggests that there has been no randomization done to the respondents. Moreover, this design involves two treatment group modeled.

The researcher was conducted the study at Maharlika National High School (MNHS) because they have a largest number of high school students' population in Bislig City. It also suited to the needs and level which the researcher found the necessity of conducting the study. Maharlika National High School (MNHS) is located at Bislig City, Surigao del Sur. The school was established last 1968 through a resolution passed by the provincial board headed by Governor Vicente L. Pimentel Sr. The respondents of this study consisted of 64 students from the Grade 8 under Basic Education Curriculum of Maharlika National High School (MNHS). The researcher was used two sections; one for conventional and the other one for experimental method. The researcher chose these sections since they are under her class. Also, Grade 8 students were chosen since they were fond of playing for their young ages and thought that the study suited for their ability as being playful and carefree learners. This study utilized adopted standardized questionnaire from DepEd, forty (40) items multiple choice Unit Test for both controlled and experimental group. The two groups were used the same questionnaire for pre-test which was based on their prior knowledge to the Unit, and for the post-test which was used the concept gained after conducting the lessons of Unit 9.

In the controlled group, the researcher was used the direct teaching while in the experimental group was used the Innovative created game-based learning activities through digital platform like kahoot and quizzes. Each lesson had a unique game title and the procedures were all based to the students' interest but suitable to the topic because the games had already the concept of the lesson. The researcher gave additional input to the students to further understand the topic. The games will be conducted by the researcher had also undergone a validation to the experts since it was validated by the experts.

To start the study, the researcher was asked permission for the conduct of the study to the principal of Maharlika National High School and to the Grade 8 Campus Chairman. Upon the approval of the request, the researcher started to conduct the research by applying the strategy to the lesson, on the first day of the formal conduct of the study, an orientation was given to both classes. It was followed by the administration of the 40-item pretest. On the second day, the researcher presented starting with the objectives of the lesson. The teacher asked the students about their previous lesson to find out how much knowledge they retained in their mind. This was done in order to motivate and enhance students. Secondly, in the development of lesson, in experimental group, the teacher discussed the lesson thoroughly with the use of the innovative mathematical activities to further enlighten the doubts in the lesson.

Meanwhile, in the control group, the teacher will use the conventional method without Innovative created game

-based activities in development of the lesson. After the discussion, the teacher provided activity with the same guidelines and procedures. However, in the experimental group, created game-based activities were provided by innovative mathematical activities. Afterwards, the students were given the generalization from the

presentation of outputs. The conclusion serves as a summary of the lesson. The teacher conducted a quiz to assess the knowledge learned from the lesson. Then, teacher gave homework or assignment to facilitate and further assist their difficulties in the lesson. The teacher proceeded to the next topic following the steps. When all the topics has been discussed for the duration of 26 sessions, posttest was administered to both experimental and control group. The same questionnaire in the pretest used during the said test.

RESULTS AND DISCUSSIONS

This section reveals the presentation and analysis of data gathered in the study. The sequence of the discussions was based on how problems were stated in chapter one.

The Mean Scores of the Students in the Pre-test and Post-test Results in the Conventional and Experimental Methods

Table 2.Students' Mean scores in the Pre-test and Post-test

	Experimental		Control	
	Pre-Test	Post Test	Pre-Test	Post Test
Mean Score	9.31	24.14	9.46	16.18

The table presents the mean scores of students in the pre-test and post-test for both the experimental and control groups. The experimental group, which was taught using digital platforms like Kahoot with a new procedure, showed a significant improvement in their mean scores from the pre-test (9.31) to the post-test (24.14). This indicates an increase of 15.01 points. On the other hand, the control group, which was taught using conventional methods (Original Kahoot), also showed an improvement in their mean scores from the pre-test (9.46) to the post-test (16.18), with an increase of 6.09 points. Initially, the pre-test mean scores for both groups were relatively close, with the experimental group scoring 9.31 and the control group scoring 9.46. This suggests that the baseline knowledge of students in both groups was similar before the intervention. After the instructional intervention, the post-test means scores revealed a more pronounced difference between the two groups. The experimental group achieved a higher mean compared to the control group's mean score. This indicates that the experimental instructional method was more effective in enhancing students' understanding and performance in the subject matter. According to Mogan (2019) as cited by Meliton (2020), delivery of learning experiences or scenarios ensured understanding. A rich setting, as well as educational technology integration, materials and equipment, were required for effective education. To make learning more meaningful, these materials and devices evaluated the learner's attention, imitated thinking, and encouraged understanding. According to Brook (2020), one advantage of integrating technology in discussion with complete procedures to the learners received quick feedback and could discuss issues as they emerge. He also mentioned that students could build on their past knowledge and made connections between the process of solving and their daily lives.

The Significance Difference between the Mean Scores of the Research Subjects

Table 3. Significant difference between the mean scores of the respondents

	GROUP	Mean	p-value	Decision	Conclusion
Pre-Test	Control Group Experimental Group	9.46 9.31	0.822	Failed to Reject Null Hypothesis	There is no significant difference

Post-Test	Control Group	16.18	0.000	Reject Null Hypothesis	There is a significant difference
	Experimental Group	24.14			

The table presents the mean scores and statistical analysis of the pre-test and post-test results for both the control and experimental groups. The analysis includes the mean scores, p-values, decisions, and conclusions regarding the significance of the differences between the groups. For the pre-test, the mean scores were 9.46 for the control group and 9.31 for the experimental group. The p-value for the pre-test comparison is 0.822, which is greater than the typical significance level of 0.05. Consequently, we fail to reject the null hypothesis, indicating that there is no significant difference between the pre-test scores of the control and experimental groups. This suggests that both groups had similar baseline knowledge before the intervention. In contrast, the post-test results show a mean score of 16.18 for the control group and 24.14 for the experimental group. The p-value for the post-test comparison is 0.000, which is less than the significance level of 0.05. Therefore, we reject the null hypothesis, indicating that there is a significant difference between the post-test scores of the control and experimental groups. This significant difference suggests that the instructional method used in the experimental group was more effective in improving student performance compared to the conventional method used in the control group. This finding aligns with the research by Chelao (2020), which emphasizes that creative and innovative instructional strategies, such as 4A's and activity-based learning, can significantly enhance student engagement and learning outcomes. One essential principle driving is the use of technology-based learning for educational purposes. According to Wariza (2018), that integrating Technology or CAI in a classroom setting students were more engaging and participative than traditional classroom exercises. He claimed that integrating technology strategies were intrinsically motivating, meaning that the source of motivation and enjoyment came from the process itself rather than anything external to the activity

CONCLUSION

Based on the results, the following conclusions were drawn: The experimental group learned better than the controlled group since their mean scores from pre-test to post-test has a greater increased than the controlled group. Both teaching strategies showed effectiveness to the both group of students. This means that the experimental method and conventional method suited to the ability and interest of the assigned group of students. It also concludes that the teaching strategy used by the teacher did not really affect the learning of the students in terms of their mathematical understanding. There is no such best teaching strategy to any level of students in a class. Any teaching strategy can be integrated to each other as long as it fits to the interest of the various kinds of students.

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