HOSTED BY unisel UNIVERSITI SELANGOR

Selangor Science &Technology Review
Vol 4 No 1 (2020): Special Issue: STEM Education

Enhancing Foundation Student Interest in Mathematics Through the Use of Mathematics Games

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Abstract: The aim of the study was to examine student's performance in understanding related topics in Mathematics subject and determines the effectiveness of Mathematic games towards students' attitude. Experimental research design with prequiz and postquiz was applied in this study. The participants, which included 50 foundation students which are from Foundation in Science, Foundation in Information Technology and Foundation in Management students. They were divided into several small groups and the games which are Number Race, Linear Equation Puzzle and Number Base Maze that are related to Real Number System, Linear Equation and Number Base respectively. There were also another three games which are Number Hunt, Math Dice and Fraction Race to enhance their basic algebra operations. Each group was given the quizes after finished lecture on related topics. These studies carried out two phases; a prequiz on a traditional teaching method and a postquiz on playing the games. For collecting data, the quiz marks of both phases were collected and together with the questionnaire Likert type attitudes towards mathematics game scale were used. As a result, the quiz achievement after play the games were positively increased. On the other hand, the students' attitudes towards mathematics subject also received a positive feedback.

Keywords: Mathematics; game-based learning; Mathematics games; education tools

1. Introduction

Game can be described as an activity that have characteristics such as fun or pleasure, has specific duration and place, governed by rules, non-productive and has sense of uncertainty and fictitious. Educational game is an integrated of game and educational concepts that used for teaching and learning purposes. In Malaysia, the number of students who took science stream in secondary school shows decline trend from year to year. Due to that, the government had take the issues seriously by implementing various initiatives to help students in mastering Mathematics subject and hence, encourage them to enter science stream class in secondary school.

The reasons student not interested with mathematics because of their belief that mathematics is a difficult and boring subject. They also feel not confidence to solve mathematical problem because they unable to memorize the rules, the laws and related formula. These bad attitutes towards mathematics remains unchanged until they continue their study in higher institution. In order to change the bad attitutes or perception towards mathematics among Foundation students, the lecturer should be more creative and innovative in term of their teaching method by change the environment of the class.

In this paper, the game based learning method was used by mathematics lecturer as teaching aided tools in teaching mathematics for the Foundation Year student in Unisel. The objective of this study is to compare the performance of students' comprehension about certain topics by using traditional learning method and game-based learning method through the pre and post test respectively. Other than that, this study also aims to evaluate the effectiveness of game-based learning towards students' attitutes.

2. Literature Review

Game can be described as an activity that have characteristics such as fun or pleasure, has specific duration and place, governed by rules, non-productive and has sense of uncertainty and fictitious (Rula, Fatma & Mazin, 2016). According to Kirikkaya, Iseri & Vurkaya (2010), games can be defines as a leisure activity that involve participation of one or more than one individual, specific rules, time and place, need communication and problem solving skill. Educational game is an integrated of game and educational concepts that used for teaching and learning purposes.

In recent year, there are many researchers that focus on the game based learning method as an alternative to the traditional learning method in their research. In Turkey, Kirikkaya, Iseri & Vurkaya (2010) report that the use of board game as teaching-aid learning in the class can increase the motivation of primary school student to learn the space and solar system more effectively. Liu & Chen (2013) reported that the use of educational card game, named Conveyance Go had give positive impact to students' attitutes and increase students' interest to learn science. Batdi (2014) also reported that activity based learning give positive impact to the interest and attitude of the students. Halil (2018) shows that activity based learning increase the academic achievement of Sixth grade students in Turkey but the attitudes towards activities of students has decreased. Although the game based learning has positive impact to students' attitude but the game itself should be fun and attractive in order to attract students' interest. If the game is not attractive and bored then the students will not shows positive impact to their attitutes towards mathematics.

Student did not love mathematics because they had bad experience in solving mathematics problem in primary school. They also feel not confidence to solve mathematical problem because they unable to memorize the rules, the laws and related formula. Beside that, the student did not know how to use mathematics in solving their real-life problems due to lack of guidance from their teacher. Due to that reason, lecturer should change the environment of the class and the method of teaching. The encouragement and never ending support from lecturers are needed by the student to increase motivation to them to learn mathematics.

3. Materials And Method

3.1 Research Design

An experimental research design with pretest and posttest for control group was used in this study. There are two phases for the each game whereby the first phase is students were given a quiz after finished each chapter. Meanwhile the second phase is by given a game to the students on the related topic. In order to determine the effect, student were need to fill up the pre and post questionnaire for each game and marks for each student for the two phases were collected and been compared.

3.2 Participants

The participants of the study consisted of 50 students (27 female, 23 male) in Foundation in Science, Foundation in Information Technology and Foundation in Management. They were students who take Elementary Mathematics I and Basic

Business Mathematics subject. These two subjects consist of four topics related to FLeMatics game which are Number System, Polynomials, Linear and Quadratic Equations, and Number Base.

3.3 Data Collection

The study was prepared to examine the students' comprehension on certain topics in mathematics and the data were collected with pre and post test. Meanwhile, a Likert scale attitutes' questionnaires were used to collect the attitutes data of the respondent. The experiment has divided into two phases; Phase 1 and Phase 2.

In Phase 1, the traditional teaching method was used in the class. After lecture session end, the respondents were given pre test questions that consist of several structured questions related to certain topics in mathematics to be answered within 20 to 30 minutes. Then, the pre test was collected and the marks of each respondent were recorded.

In Phase 2, the game based teaching method was used in the class on the other day. The students in the class were divided into five small groups. Each group plays the different game and then the group has to change the game with other group so that each group plays all the five game. The participants were given 1 hour and 30 minutes to play all the game. After the game session end, the participant has to answer the post test question that consists of the same several structured questions as the post test. The respondent also given the Likert scale attitutes' questionnaires. Then, the post test was collected together with the questionnaires and then the marks of each respondent were recorded.

In this experiment, an experimental research design with pre and post test and Likert's scale questionnaires were used. The survey data were analyzed with a paired samples t-test to compare the mean score for students' attitudes toward mathematics using traditional based learning method and games based learning method.

3.4 Process of Implementation

There are five games that were used in this experiment; The Number Race, Linear Equation Puzzle, Number Base Maze, Number Dice and Fraction Race. The Number Race is a board game that related to real number system topics consist of six subsets of real number such as natural number, prime number, whole number, integers, rational number and irrational number. This game can enhance the memory of student because in order to play the game the student should memorize the definition and also the elements for each subset of the real number.

Linear Equation Puzzle game consists of sixteen pieces of puzzle to be combined together, where each piece of puzzle contain two systems of linear equations to be solved. These games develop teamwork skills where each member in a group must sure that every member in a group understands how to solve linear equation problems. Number Base Maze is a game that contain number base problem to be solve by each group of two students. This game can develop logical thinking skills while they solve each number base problem. Meanwhile, Number Dice is a game that contains multiplication and division of numbers and Fraction Race contains addition of fractions operation. Both games consist of basic arithmetic topics which are ratio, fraction and multiplication. In other hands, by implement the games, it helps student to understand the basic arithmetic operation.

4. Results and Discussion

The effectiveness of Mathematics games was studied through the activities. Data on a total of 50 students was collected and it was found that 82% students agreed on that these games increased their level of motivation to study Mathematics. In addition, 81% students agreed that these games enhance their understanding towards Mathematics subject. Futhermore, prequiz and postquiz marks have a significant different. It shows that by using game-based learning in study Mathematics helped to increase students performance compared using traditional teaching method.

Table 1: Paired Samples Test between Gender and Interest of Fun Learning

		Correlation	Sig.
Pair 1	Gender & Interest in Study Mathematics	.509	.003
Pair 2	Gender & Game-Based Learning	.530	.002

Gender of the students was significantly related to the effectiveness of Mathematics Games because male and female have different view on it. Table 1 show that the correlation between gender and interest in study Mathematics together with gender and game-based learning. By using paired samples statistics, both *p*-values are less than 0.05; conclude that there was a significant difference in the gender of students who like a fun learning in study Mathematics.

Table 2: Paired Samples Test between Programs towards Performance in Mathematic Subject

		Sig. 2-tailed)	Mean Difference
Program	Foundation in Science	0.109	-.58333
	Foundation in Information technology	0.138	-.58333
	Foundation in Management	0.764	-.58333

Table 2 shows the paired sample test between foundation programs towards performance in Mathematics Subject. The *p*-value of each programs is greater than 0.05 which means that there is no significant different between students background and their performance in Mathematics. It is proved that background of the students' science, information technology or management does not affect the result of the study. They enjoyed studying this subject through mathematical games. Nevertheless, the students gave a positive feedback whereby they want have a mathematical games after finish each topic.

5. Conclusion and Recommendation

The study reported in this paper is one of efforts to increase interest of studying Mathematics among Foundation students. Although this was a small case study, it did reveal some illuminating data around the question of how game-based learning influenced students interest in learning Mathematics. Based on observation, through out the activities found that students create a good teamwork with their group

members by discuss and teach each other in completing the games. In other ways, it helps increasing their level of self-confident and motivation in learning this subject. Indirectly, the games also help lecturers develop more effective teaching techniques.

Through out this study, more games on other topics in Mathematics subject can be develop and it helps lecturers to improve teaching and learning proess by added entertainment in learning process in order to make students love this subject. It was seen that based learning activities helps to improve attititude towards subject by looking at the student's attendance. After change the learning process, their attendances were 100% full. However, the findings in the study were limited to the numbers of the student's foundation in UNISEL only. For further research, this study can be carried out in other university or high school. As overall, this game-based learning received a positive feedback from the students. They hope that this kind of games will be doing for each topic in Mathematics subject.

6. References

Willacy, H., & Calder, N. (2017). Making mathematics learning more engaging for students in health schools through the use of apps. *Education Sciences*, *7*(2), 48.

Çelik, H. C. (2018). The Effects of Activity Based Learning on Sixth Grade Students' Achievement and Attitudes towards Mathematics Activities. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*(5), 1963-1977.

Mahmoudi, H., Koushafar, M., Saribagloo, J. A., & Pashavi, G. (2015). The effect of computer games on speed, attention and consistency of learning mathematics among students. *Procedia-Social and Behavioral Sciences*, *176*, 419-424.

Ogochukwu, N. V. (2010). Enhancing students interest in mathematics via multimedia presentation. *African Journal of Mathematics and Computer Science Research*, *3*(7), 107-113.

Koay, P. L. (1996). The use of mathematical games in teaching primary mathematics.

Festus, A. B. (2013). Activity-based learning strategies in the mathematics classrooms. *Journal of Education and Practice*, *4*(13), 8-14.

Agyei, D. D., & Voogt, J. M. (2016). Pre-service mathematics teachers' learning and teaching of activity-based lessons supported with spreadsheets. *Technology, pedagogy and education*, *25*(1), 39-59.

Kaur, H., & Sankhian, A. (2017). Effect of Activity Based Method on Achievement Motivation and Academic Achievement in Mathematics at secondary Level. *Educational Quest-An International Journal of Education and Applied Social Sciences*, *8*(3), 475-480.

Karatas, I., & Baki, A. (2017). The effect of learning environments based on problem solving on students' achievements of problem solving. *International Electronic Journal of Elementary Education*, *5*(3), 249-268.