EFFECTS OF EDUCATIONAL GAMES AS INSTRUCTIONAL TOOLS INTEACHING COLLEGE ALGEBRA

John Paul Hablado, Ethel P. Junco, & Geraldo B. Cang

ABSTRACT

Educational games explicitly designed with educational purposes and help people learn about certain subjects, expand concepts, reinforce development, understand a historical event or culture or assist them in learning skills as they play games. The study aimed to determine the effectiveness of educational games as instructional tools in teaching College Algebra among first-year students. Mean scores were used to determine the performances of the two groups, while paired samples t-tests were used to determine the differences in their test results. Data were collected, organized, presented, analyzed, and interpreted using the Statistical Package for Social Sciences (SPSS) software program. Subjects in the experimental group had better performance than the control group. Based on their pre-test mean score and an increase in mean score on post-test shows the success and impact of the intervention. Likewise, there were significant differences between the pre-test and post-test results on the experimental group. These results revealed that educational games as instructional tools increase the performance of the learners. This finding is evidence that the educational game has the potential to facilitate students' learning of college algebra.

Keywords: *Mathematics, Educational Games, College Algebra, instructional tools*

INTRODUCTION

Background of the Study

Time and again, curriculum planners, policy makers, and researchers have been exploring the extent thru which numeracy among students develops and improves via Mathematics instruction. The quality of Mathematics education in the country is alarming. Some measures have been exhausted to address this discipline's status which attributed to multi-faceted reasons and causes. Commonly, students in the college experience the most challenging phase of learning Mathematics. College Algebra is a subject that deals with symbols that are easy to visualize. This course will enable the students to think critically by solving and graphing equalities and inequalities, applying algebraic expressions and linear equations in practical contexts, solving problems on combinatorial progression, and solving problems about exponential and logarithmic functions. This subject can also serve as a foundation for higher Mathematics that will help them consider that this subject can be of help to their daily existence. Learning mathematics presents various challenges for many students. Mathematics is often associated as a difficult and tedious subject to learn (Sedig, 2008).

According to students' achievements, we can assess by utilizing pre and post-tests if our students have improved and if the procedure is useful, effective or not. Educational games are one of the techniques and methods that the teacher may use in teaching a College Algebra. Games are often used as short warm-up activities or when there is some time left at the end of a lesson. Engagement in play that has implicit, internalized rules that can be negotiated among the players requires a higher level of cognitive, social and verbal functioning than following explicit, external and immutable rules (Saifer, 2010, p. 39).

The initiative of using games to employ students in the practice of active learning is not new. Over the past several years, educators have been increasingly incorporating various games into their teaching curriculum to create a fun and engaging learning environment for students. Instructors are no longer demonstrating basic Arithmetic at this level, but are asked to introduce difficult concepts. If taught correctly, College Algebra is accessible and provides the fundamentals in critical thinking and logic skills that have impacts outside the realm. Believing that everything exists with its hidden value, educational games may impose the greatest value in the field of Mathematics especially in College Algebra.

In current years, several well-made empirical studies investigating the effects of serious games on learning outcomes have been published. Sawyer (2012) refers serious games as those games produced by the video game industries that have a substantial connection to the acquisition of knowledge. Zyda (2005) expands Sawyer's definition, adding that serious games are games whose primary purpose is not entertainment, enjoyment or fun. Serious games, educational gaming, as well as virtual worlds developed for educational purposes reveal the potential of these technologies to engage and motivate beyond leisure activities (Anderson et al., 2009). At the same time, there is extensive literature exploring the potential learning benefits offered by game-based learning (GBL), which can be defined as the use of game-based technology to deliver, support, and enhance teaching, learning, assessment, and evaluation (Connolly, 2007).

There is sufficiently recent research on the effects on learning of electronic games, including video and computer games, as well as game-based simulations and quiz-type games (Afari, Aldridge & Fraser, 2012), but the games used in this research were not electronic and commonly available in books and teacher journals. The commercial board, card, and dice (and other) games with the potential to develop children's mathematical skills may be found in cupboards of many primary classrooms, and typically teachers have a mental stock of competitive games that they use purposefully (Bragg, 2003). The games in this study were selected to investigate their potential to lead to concept formation by expanding student's understanding of college algebra.

Thus, to help Math instructors and other stakeholders solve the difficulties that students encountered in College Algebra, the researchers came up with this study.

Statement of the Problem

This study aimed to determine whether educational games are useful instructional tools in teaching College Algebra among students of Guimaras State College-Salvador and Mosqueda Campuses for the first semester of AY 2015-2016.Specifically, it sought answers to the following questions: (1) What is the pre-test performance of the subjects between experimental and controlled groups? (2) What is the post-test performance of the subjects between experimental and controlled groups? (3) Is there a significant difference between the pre-test performance of the experimental and controlled groups? (4) Is there difference between the post-test performance of the experimental and controlled groups? (5) Is there a significant difference in the post-test and pre-test performance of the controlled group? and (6) Is there a notable difference between post-test and pre-test performance of the experimental group?

METHODOLOGY

This experimental research method utilized the pre-test- post-test design.The subjects of this study were freshman students who took College Algebra in the first semester of the academic year 2015-2016. Thirty students from Mosqueda Campus were subjected to educational games, and thirty students from Salvador Campus were not. A multiple-choice type of tests was used as the research instrument to gather the needed data duly validated by three experts from Guimaras State College. The instruments also underwent reliability testing by means of item analysis.

In the administration of the research instrument, letter of requests were prepared for approval of the College President including the letter to the subjects of the study with prior informed consent. Each group was composed of 30 students homogenized using sex, age and course as homogenizing factors. The experimental group was given an intervention of educational games on algebraic expressions, polynomials, geometry, angles, areas, decimals, volume, fractions, graphs, intercepts, integers, order of operations, percentages, Pythagorean Theorem. Algebra games include memory games, fling the teacher algebra games, grade or no grade algebra games, time challenge algebra games, and walk the plank algebra games, while the control group received a lecture method. Both groups were taught the same topic within the same time frame. Mean scores were used to determine the performances of the two groups, while paired samples t-tests were used to determine the differences in their test results. Results were collected, organized, analyzed, interpreted, and presented, using the appropriate statistical tools generated from the Statistical Package for Social Sciences (SPSS) software program. The level of significance was set at 0.05.

RESULTS AND DISCUSSIONS

Pre-test Performance of the Subjects between Experimental and Control Groups. Table 1 shows the pre-test performance of the subjects between experimental and control groups. Results revealed that pre-test achievement in the experimental group was M (4.93), SD (2.69) while the pre-test performance in the control group was M (3.56), SD (1.71). This means that the subjects before the intervention of educational mathematical games as instructional tools in the experimental group had more prior knowledge than control group based on their pre-test results in College Algebra which indicates better performance.

Table 1. Pre-test Performance of the Subjects between Experimental and Control Groups

	N	Mean	SD	Variance
Experimental Group	30	4.93	2.69	7.24
Control Group	30	3.57	1.71	2.94

Post-test Performance of the Subjects between Experimental and Control Groups. Table 2 shows the post-test performance of the subjects between experimental and control groups. Results revealed that the post-test results in the experimental group was (M=27.67). The increase in the mean of post-test from pre-test was (M=4.61). This shows that the intervention on experimental group was success.

The post-test performance in the control group was (M=21.33) compared to the pre-test result with M=3.57. There is also an increase in the mean in the control group with (M=4.97)

Moreover, it implies that the students after the intervention of educational games in experimental group performed better than those in the control group with a difference of 6.33 indicating that the intervention was successful in improving the performance of the students. This results is supported by the belief that everything exists with its hidden value, educational games may impose the greatest value in the field of Mathematics especially in College Algebra (Saifer, 2010).

Table 2.Post-test Performance of the Subjects between Experimental and Control Groups

	N	Mean	SD	Variance
Experimental Group	30	27.67	2.42	5.88
Control Group	30	21.33	2.56	6.57

Difference between the Performance of the Experimental and Control Groups

Table 3 shows the difference between the pre-test performance of the subjects in the experimental and control groups. Results revealed that there was a significant difference of t (2.177), p-value (0.038) between the groups. The results showed that the students in the experimental group performed differently even before the intervention of educational games in the experimental group despite the homogenization steps made by the researcher to homogenize the characteristics of the individual subjects.

Table 3.Difference between Pre-test Performance of the Experimental and Control Groups (Paired Samples Test)

	Paired Differences					T	df	p-value	Interpretation
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Diff					
				Lower	Upper				
Experimental Group & Control Group	1.37	3.43896	0.63	0.082	2.65	2.17	29	.038	Significant

** ∝<0.05 level of significance*

Difference between Post-test Performance of the Experimental and Control Groups

Table 4 shows the difference between the post-test performance of the subjects in the experimental and control groups. Results revealed that there was a significant difference of t(10.03), p-value= (0.000) between the two groups. It means that the subjects in the experimental group, after the intervention of using educational games as a tool in teaching Algebra, have higher performance than the controlled group, who did not received any intervention such as the use of educational games as a tool in teaching College Algebra.

Table 4.Difference between Post-test Performance of the Experimental and Control Groups

	Paired Differences					t	Df	p-value	Interpretation
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Experimental Group & Controlled Group	6.33	3.46	.631	5.04	7.62	10.03	29	.000	Significant

** ∝<0.05 level of significance*

Difference between Post-test and Pre-test Performance of the Control Group

Table 5 shows the difference between post-test and pre-test performance of the control group with no intervention of educational games. Results revealed that there was a significant difference t=(39.80), p-value=(0.000) between the pre-test and post-test results. It means that the subjects improved their performance even without the intervention of educational games in College Algebra. This is understandable despite having not received any intervention like the use of the educational games in teaching College Algebra because the teacher have introduced concepts on how to learn College Algebra.

Table 5. Difference between Post-test and Pre-test Performance of the Control Group (Paired Samples Test)

	Paired Differences					t	Df	p-value	Interpretation
	Mean	SD	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Post-test (Controlled Group)Pre-test (Controlled Group)	17.77	2.44	.446	16.85	18.68	39.80	29	.000	Significant

* *∝<0.05 level of significance*

Difference between Post-test and Pre-test Performance of the Experimental Group

Table 6 shows the difference between post-test and pre-test performance of the experimental group with the intervention of educational games. Results revealed that there was a significant difference between pre-test and post-test results t=(49.45), sig. p-value=(0.000). It implies that the subjects improved their performance with the intervention of educational games as tool in teaching College Algebra.

Table 6. Difference between Post-test and Pre-test Results/Performance of the Experimental Group (Paired Samples Test)

	Paired Differences								Interpretation
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	p-value	
				Lower	Upper				
Post-test (Experimental Group) – Pre-test (Experimental Group)	22.73	2.52	0.46	21.79	23.67	49.45	29	.000	Significant

∝<0.05 level of significance

CONCLUSIONS

A potential impact of properly designed educational games on learning was evident in learning college algebra. Educational games can help complement and reinforce taught material by promoting students' participation and engagement in an interactive, enjoyable, and motivational learning environment. This finding is evidence that the educational game has the potential to facilitate students' learning of college algebra.

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