EFFECT OF SIMULATION- GAME CARDS ON THE TEACHING AND LEARNING OF SIMPLE INTEREST, PROFIT AND LOSS IN ENUGU STATE JUNIOR SECONDARY SCHOOLS

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ABSTRACT

This paper examines the effect of Simulation- Game Cards (SGC) on the teaching and learning of simple interest, profit and loss in Enugu state junior secondary schools. Two research questions were formulated and answered using the mean. Mathematics Achievement Test (MAT) developed by the researchers was used to collect the relevant data for this study. The two hypotheses raised were tested using Analysis of Covariance (ANCOVA) at $P < 0.05$ level of significance. The results indicated that the researchers' developed simulation-game cards improved students' achievement in simple interest, profit and loss. Equally, female students benefited more than male students under the SGC. The researchers recommended among others that SGC should be adopted as one of the teaching method in mathematics for effective enhancement of simple interest, profit and loss instructions in junior secondary schools.

KEY WORDS: Simulation, Game Cards, Simple Interest, Profit, and Loss

INTRODUCTION

The two broad aims of secondary education programme are:
1. preparation for useful living within the society; and
2. preparation for higher education (Federal Republic of Nigeria (FRN), 2004).

Mathematics played an important role in achieving these aims because it helps to develop the potentiality of logical reasoning in students which will in turn help them in pursuance of their higher education. Equally, mathematics helps to equip students with potentiality of quantification and application which will then help them in their daily life activities for useful living within the society. However, despite the compulsory nature

Accorded mathematics at this level, it is unfortunate that most secondary schools' students still fear mathematics and achieve poorly in it. West Africa Examination Council (WAEC) (2006), in its annual report expressed the view that 'very poor achievement of students in mathematics in school examinations is a good pointer to poor interest in mathematics. If this ugly trend is not discourage in our schools system by providing adept mathematics teachers, skillful in expressing mathematical concepts using various strategies, mathematics at the secondary schools' level will be under-achieved in this 21st century in Nigeria'. The strategies mathematics teachers used in teaching mathematical concepts have been blamed for this resultant effect (poor interest). The common

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strategy in use is the expository. Expository method / strategy consist of the presentation of mathematical facts and principles by the teacher, while, the students are mainly asked to listen and take notes. These facts and principles are drawn from textbooks based on the stipulated contents and cognitive levels within the unit of instruction. The act of not asking too much questions and answering them in expository method has resulted to poor achievement in secondary schools mathematics examinations. Students need a change in teaching method to enhance good achievement in mathematics examinations. To enhance good achievement among secondary schools students in mathematics, the chief examiner of WAEC in 2007 advocated the use of effective and motivating method in teaching and learning of mathematical concepts; but this must be in tune with the modern scientific and technological dispensation as remedies to students' poor academic achievement in mathematics in both junior and senior secondary schools' examinations. The need for innovative method becomes necessary. These innovative methods are: target task; delayed formalization; and simulation – game. The researchers' interest is on simulation – game method.

Ogbu (2006) defined Simulation – Game (SG) as a working representation of central features of reality where competition is guaranteed with participants (students) acting some role bounds. Simulation – Game Card (SGC) according to Ogbu (2006) is a deck of square cards sorted out into forty- eight (48) problem cards and 48 value cards. The use of simulation – game cards is one of such interesting means of repeating the learning of mathematics associated with stimulus. Simulation – game cards provide fascinating challenges to learners (students) and add interest, activity and novel to the lesson (Anikweze, 1992). Simulation – game cards are important spurs to increase motivation in the classroom instructions (Ogbu, 2006). Thus, simulation – game cards when played recreate and refresh the mind of players; and by so doing making learning novel and non–monotonous. Mogbo (1995) brought into sharp focus a simulative American experience where a lesson in astronomy was so ingeniously arranged that the entire galaxy was vivified in authentic kaleidoscopic and spatial dimensions. This is role – simulation and involves a real life situation where a learning experience is simulated by

means of a model. The researchers' then want to find out whether the simulation – game method is better than the expository method in enhancing mathematics students' academic achievement at the junior secondary school level. Gender disparity has been observed in mathematics students' academic achievement, but then, which of the gender – males and females would benefit more in the simulation – game method?

Purpose of the study

The aims of this study are:
1. to determine the effect of simulation – game method on students' academic achievement in the selected topics of Junior Secondary School (JSS) 2 mathematics.
2. to determine the effect of simulation – game on male and female students' academic achievement in mathematics.

Significant of the study

The mathematics teachers, students and ministry of education will benefit from this study. The students will benefit from the study because if the students understand better through the use of simulation games, they will achieve highly in internal and external examinations. The mathematics teachers will benefit from the study because it will simplify their jobs of talking too much before students understand their teaching. The ministry of education will benefit from the study because the programme of mathematics education they oversee is yielding the desired result.

Research questions of the study

The study adopted the following research questions:
1. what are the mean achievement scores of JSS 2 mathematics students taught using simulation – game and expository methods?
2. what are the mean achievement scores of male and female JSS 2 mathematics students
   taught using simulation – game cards?

Hypotheses of the study

Two hypotheses (Ho_1 and Ho_2) were tested at $P < 0.05$ (level of significance). They are:

Ho$_1$ there is no significant difference in the mean achievement scores of JSS2 mathematics

students taught with simulation – games and expository methods.

Ho$_2$ there is no significant difference in the mean achievement scores of male and female JSS2 mathematics students taught using simulation – games.

Research method

The study employed quasi-experimental design. Quasi-experiment is defined as an experiment where random assignment of subjects to experimental and control groups is not possible (Nworgu, 2006). The reason for adopting this design was because the subjects used for the study could not be manipulated. This study was conducted in four single sex secondary schools in Enugu education zone of Enugu state. In each of the sampled schools, purposive simple random sampling was used to pick two intact classes of JSS2. The two JSS2 intact classes were randomly assigned to experimental and control groups by balloting. All together there were 145 students in the experimental group and 147 students in the control group. The two groups of students were made to respond to items on the Mathematics Achievement Test (MAT) before and after being taught by instructional method (SGC) mapped out for use in each case. The data collected were analyzed using mean to answer the two research questions and Analysis of Covariance (ANCOVA) to test the two hypotheses, at $P < 0.05$ level of significance. The instruments used for collection of data were face validated by three experts (two from mathematics education and one from measurement and evaluation). The content validity was established using table of specification as shown in appendix 1. Equally, the reliability estimate for stability of the instrument was determined using test-retest method. The correlation of scores from first and second administration of the test was calculated using Pearson's Product Moment Correlation Coefficient (r). The correlation coefficient (r) of the test was 0.83.

Description of Simple Interest, Profit and loss

Simple Interest is the added money put in a savings account either in the bank by you or dad. This extra money he gets is part of the profit the bank makes by using the money he paid in, in other business. If a bank decides to be paying her customers at the rate of 20% of whatever amount is deposited, what will be the interest for a customer who deposited #100 for 1year period? ie $20/100 \times 100 = $#20. This gives an in-depth understanding of the meaning of simple interest of students instead of depending on rote memory of the formula I=PRT/100. Simple interest depends on the amount deposited (P); on length of time (T) it is left in the bank and also depends on the rate (R) of interest specified by that particular bank.

Example: Find the simple interest (I) on #400 (P) for 3years (T) at5% (R) per annum.
Solution: Simple interest (I) on #400 (P) at 5% (R) per annum= $5/100 \times 400$
Simple interest (I) on #400 (P) at 5% (R) for 3years (T) =$5/100 \times 400 \times 3$= #60.

Calculating profit and profit percentage:
Example 1: A woman bought some baskets of oranges for #250 and sold them for #296. Find her percentage profit.
Solution: Cost price (C.P) = #250; Selling price (S.P) = #296
Profit = S.P. – C.P. = 296-250 = #46; Percentage profit = $46/250 \times 100$% = 18.4%
Example 2: A businessman bought 30 metal rods for #1300 and sold them at #60 each, what was his selling price and profit percent?
Solution: S.P for 30 metal rod = #60 $\times$ 30 = #1800; C.P. = #1300
Profit = #1800 - #1300 = #500; Profit percent = $500/1300 \times 100$% = 38.46%

Calculating loss and loss percentage:
Example 1: A bicycle was bought at #170 and was sold at #150.50. Find the loss percentage.
Solution: C.P. = #170; S.P. = #150.50
          Loss = C.P. – S.P. = #170 - #150.50 = #19.50
Example 2: A chief bought 9 beds at #155 each and sold all for #1,315. What is his gain or loss percent?
Solution: C.P. =155 × 9 = #1395; S.P. = #1315
          Loss = C.P. - S.P. = 1395 – 1315= #80; Percentage loss = 80/1395 × 100% = 5.73%

RESULTS

Research question 1: What are the mean achievement scores of students taught using simulation – game and expository methods?

Table 1: Mean achievements of JSS2 mathematics students taught using simulation – games and expository methods.

Methods	Groups	Pre-test mean	Post-test mean
Simulation- games	Experimental (145)	22.86	53.07
Expository	Control (147)	22.06	47.17

In table 1 above, the mean achievement in the post-test was 53.07 for the experimental group. The mean achievement for the control group was 47.17. The results in table 1 above apparently show that the experimental group achieved higher than the control group with mean difference of 5.90. It implies that JSS2 students exposed to simulation – games instruction achieved better than the control group with expository method.

Hypothesis (Ho$_1$): There is no significant difference in the mean achievement scores of JSS2 mathematics students taught with simulation-games and expository methods

Table 2: ANCOVA for JSS2 students mean achievement taught using simulation- games and expository methods.

Source of variation	Type 111 sum of square	Degree of freedom	Mean square	F	Significant off	Decision
Method	2698.077	1	2698.077	40.536	0.000	Significant
Interaction	11.464	1	11.464	0.172	0.678	Not significant
Residual	10126.312	4	2531.578	38.034		

Table 2 above indicates that null hypothesis one was not accepted since [F (40.536) = 0.000; P < 0.05]. So, the difference in the mean achievement of students taught with simulation – games and expository methods was statistically significant. This means that method of teaching mathematical concepts has effect on JSS2 students in mathematics achievement. Simulation – game method of teaching has effect on mathematics students' academic achievement better than the expository method.

Research question 2: What are the mean achievement scores of male and female JSS2 mathematics students taught using simulation- games

Table 3: What are the mean achievement scores of male and female JSS2 mathematics students taught using simulation –games?

Groups	Pre-test mean	Post- test mean
Male	24.31	52.64
Female	21.63	53.69

The table 3 above, the mean achievement scores in the post-test for the male and female mathematics students was 52.64 and 53.69 respectively. This apparently shows that female students benefited more than their male counterparts under the simulation –game with 1.05 mean differences.

Hypothesis (Ho$_2$): There is no significant difference in the mean achievement scores of male and female JSS2 mathematics students taught using simulation – games

Table 4: ANCOVA for JSS2 students mean achievement according to gender taught using simulation – games

Source of variation	Type 111 sum of square	Degree of freedom	Mean square	F	Significant off	Decision
Gender	29.815	1	29.815	0.448	0.504	Not significant
Interaction	11.464	1	11.464	0.172	0.678	Not significant
Residual	10126.312	4	2531.578	38.034		

From table 4 above, the null hypothesis which states that there is no significant difference in the mean achievement scores of gender (male and female) JSS2 mathematics students in Enugu state taught using simulation- game was accepted since [F (0.448) = 0.504; P < 0.05]. Hence, the difference in the mean achievement of male and female JSS2 mathematics students taught with simulation- games was not statistically significant. Simulation-game reduces abstraction in classroom mathematics lessons and boredom among students and mathematics teachers. Their energies are conserved. Nneji (2000) in her findings detected that videotaped and other games instructions have the potentials of enhancing qualities of good teaching and learning in science (mathematics).

Discussion of findings
In table 1, the mean achievement of the mathematics students in experimental group in post-test is apparently higher than those in the control group. This shows that the method applied produce positive differential effects on mathematics students' achievement in simple interest, profit and loss. From table 2, the ANCOVA statistics showed that hypothesis one was not accepted since significant of F < 0.05. Hence, the difference in the mean achievement of experimental group and control group of both methods (simulation –game and expository) was statistically significant at P < 0.05. The result is in line with the findings of Okeke (1999) and Onyegaegbu (1999), that instructional materials such as (videotaped, cards game etc) in teaching any mathematical concept are more effective than other methods of instruction including the traditional (expository) method. Dale in Gbodi and Laleye (2006) findings asserted that videotaped or other games instructions offer realities of experiences that simulates self-activities on the mathematics students and

develop their continuity of thought in mathematical concepts quick understanding.

Table 3 and 4, revealed that the mean achievement of female students in mathematics in the post-test is higher than that of male students in Enugu state. This finding agrees with Ozofor (2001) and Onoh (2005) who found that females achieved higher than males in mathematics academic achievement. Apparently, females gained more in the use of the researchers' self- made simulation- game cards. The ANCOVA statistics showed that hypothesis two was accepted since significant of F > 0.05. Hence, the difference in the mean achievement of male and female students in mathematics was not statistically significant at P < 0.05. These findings are also in consonance with Gbodi and Laleye (2006) finding that no significant main effect of sex (gender) on students' achievement when teaching any concept irrespective of the discipline. Alonge and Ojerinde in Gbodi and Laleye (2006) in their studies found that there was significant difference in the achievement of male and female students, with the male students performing better. However, this contradict this research finding that female students achieve better than their male counterparts using the simulation-game in the teaching and learning of mathematical concepts.

CONCLUSION

From the findings of this study, simulation- games contribute a lot in mathematics students' academic achievement in Enugu state junior secondary schools. Hence, this study concluded and advocated the use of simulation-games method in the teaching and learning of mathematical concepts in junior secondary schools. The implication of the findings is that simulation –games used by mathematics students will make real participation and active observers in the teaching and learning process. Mathematics teachers will also be satisfied in classroom instructions as simulation- games are novel and enjoyable.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made:

* students should be encouraged by mathematics teachers and school administrators to improve simulation – game cards.

* the serving mathematics teachers in secondary schools should adopt the use of well
structured simulation – games strategy in teaching mathematics lesson.

* ministry of education in conjunction with Mathematical Association of Nigeria (MAN) should organize workshops and seminars for mathematics teachers to enhance the need to teach mathematics using method that are characterized by simulation.

REFERENCES

Anikweze, C. M. 1992. Improving the study of geography in models, games and simulations. Journal of teacher education, 1(2): 105-110.

Federal Republic of Nigeria (FRN), 2004. National policy on education (4th Edition). Lagos: NERDC press.

Gbodi, E. and Laleye, A. M., 2006. Effect of videotaped instruction on learning of integrated science. Journal of research in curriculum and teaching, 1(1):10-19.

Mogbo, J. O., 1995. Assessing the effectiveness of improvisation as a learning model in chemistry. Paper presented at the department of science and technical education, faculty of education conference held at Enugu state university of science and technology, Enugu.

Nneji, L., 2000. Video -film as a science teaching tool. Journal of science teachers association of Nigeria, 1(1):143-145.

Nworgu, B. G., 2006. Educational research: Basic issues and methodology (Second Edition). Enugu, Nsukka: University trust publishers.

Obodo, G. C., 2004. Principles and practice of mathematics education in Nigeria. Abakpa Nike, Enugu: Floxtone press.

Ogbu, S., 2006. Effect of simulation –game on students' achievement and interest in mathematics. Unpublished MSc dissertation. Enugu: Enugu state university of science and technology.

Okeke, R., 1999. Improving adult- literacy programme through effective media utilization. Paper presented at NEERA conference in River state university of science and technology, Port- Harcourt.

Onoh, D. O., 2005. Effect of advance organization on students' achievement, interest and retention in algebra. Unpublished PhD thesis. Enugu: Enugu state university of science and technology.

Onyegaegbu, N., 1999. Effects of video and audio rolling graph among students in achievement and retention in the understanding of schistosomiasis. Unpublished PhD thesis. Nsukka: University of Nigeria.

Ozofor, N. M., 2001. Effects of two modes of computer instruction on students' achievement and interest in statistics and probability. Unpublished PhD thesis. Nsukka: University of Nigeria.

West Africa Examination Council (WAEC) (2006). Chief examiner's report, 35.

West Africa Examination Council (WAEC) (2007). Chief examiner's report, 42.

APPENDIX 1

TABLE OF SPECIFICATION OF CONTENT VALIDITY

Content	Weight	Knowledge(K)	Comprehension(C)	Application(A)	Total
Teaching simple interest	**1 week**	**1**	**1**	**1**	**3**
Teaching calculating profit and profit percentage	**1 week**	**2**	**2**	**3**	**7**
Teaching calculating loss and loss percentage	**1 week**	**2**	**3**	**3**	**8**
Total 3weeks		**5**	**6**	**7**	**18**

According to Obodo (2004:69) "cognitive level for Junior Secondary School students should end with application questions for lower order questions". The weightings for each topic with regards to length of time it took to cover each topic is indicated by the researchers. A total of 3weeks was spent in teaching all the topics. Since 18 items are to be constructed, it means that 18 ÷3= 6 items per week of each topic taught should be set. This means if a topic is taught for 2weeks, then, 12 items (6 ×2) should be set for the topic and so on. The researchers' decided how many items for each topic to be set for Knowledge (K), Comprehension (C); and Application (A) depending on the content presented and level of emphasis in the class. Hence, 5, 6, and 7 items were constructed respectively for knowledge, comprehension, and application levels of the students' cognitive domain.