THE EFFECT OF SIMULATION-GAMES ENVIRONMENT ON STUDENTS ACHIEVEMENT IN AND ATTITUDES TO MATHEMATICS IN SECONDARY SCHOOLS

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ABSTRACT
This study sought to determine the effect of simulation-games environment on students' achievement in attitudes to mathematics in secondary school. Data was collected from a sample of 147 students in senior secondary school in Osun-State, Nigeria. t-test and analysis of variance was used to analyze the data collected for the study. The finding reveals that students' poor academic achievement in mathematics is partly due to the method of teaching used. Also, the findings revealed that, the use of simulation-games environment led to improve achievement and positive attitude towards mathematics. The study conclude that teachers' use of stimulating teaching methods would go a long way in sustaining and motivating students interest in learning mathematics.
Keywords: Simulation-games environment, mathematics achievement, attitude to mathematics.
Key words: Simulation-games environment; achievement; attitudes; mathematics

INTRODUCTION

Research in mathematics education shows the difficulties students have in acquisition of mathematical concepts. Various studies (Akinsola, 1994, 1997), Popoola, 2002) have shown that an instructional strategy is crucial to the understanding of mathematical concepts. Effective instruction requires the teacher to step outside the realm of personal experience unto the world of the learners (Brown, 1997). It is the learners who must be engage for learning to occur, the learner is the one who must make the commitment to learn. Newman et al (1995) pointed out that for learning to be meaningful (authentic) it must be individually constructed. Learning takes place as student process, interpret and negotiate the meaning of new information. To Brown (1997), this is heavily influence by the prior knowledge, values, expectations, reward and sanctions that shape the learning environment.

What then can we use to shape the learning environment? How do we teach mathematics in a way that student can use it, apply it, in general, work with it? Which is appropriate didactic approach that will permit students to broaden their conceptions and become aware that mathematics is a dynamic instrument in solving real life problems? The questions above could not be answered without students engaging in authentic learning. Authentic learning requires the learner to communicate an in- depth understanding of a problem or issues rather than memorize sets of isolated facts and it must result in achievements that have relevance beyond school (Brown, Bettina and Lankard, 1997). Therefore, for authentic learning to take place in mathematics, method or style of teaching needs to be innovative. Adewuyi (2001) noted that the style of teaching employed by teacher is a potent factor in motivating learners to learn. According to him mathematics is a subject, which is very easy to make difficult and very difficult to make easy. The perennial methods of teaching mathematics through listening, looking and learning have not been successful. If anything, it has resulted in making students dislike mathematics (Akinsola, 2002). Coudron (1997) as stated in Akinsola, (2002) offers the following suggestions to teacher for targeting instructions to individuals.

- Focus on outcomes rather than technique.
- Make learning experiential
- Give students control over their own learning

- Respect learners ability to engage in parallel thinking
- Highlight key point
- Motivate learner
- Provide challenges

The suggestions above might not be possible using a single instructional strategy or style. So a combination of strategies might be required. Providing motivational environment, challenging and making learning experiential, demand active participation by students.

Simulation – game instructional strategy might be an antidote. Randel, Morris, Wetzel and Whitehill (1992) are of the opinion that since many students enjoys playing games; it is worthwhile to investigate whether this play aspect could be combined with instruction to enhance learning. It is further stressed that the observation had led educators to explore the feasibility of using a game format to supplement or even replace the teaching of a variety of subjects.

Considering the way many students learn mathematics, it is absolutely nothing to write home about. That is why Adeniran (1993) observes that teachers struggle to teach mathematics against the nature of children; hence the children end up learning to hate mathematics. He stressed further that the traditional learning method of memorization has done much harm to the learning of mathematics.

If a child is asked of what he learnt after one month he may not be able to recall the information. Students may be confused even when real object are made use of to solve mathematics problems not to talk of when only symbols are use to do this. It is hoped that when illustration with physical object coupled with dramatization is made use of in teaching different concepts in mathematics students' understanding might improve.

Thus according to Mills, Middleton and Moran (1974) experimentation with a realistic simulation gives the student insight that is very difficult to conceptualized by conventional teaching method.

Historically, the word game has been used to connote a pastime of trivial, if fun, endeavour. It is this connotation that today seems to cause some educators to flinch when they hear the word game and imagine frivolous time wasted play that serves only to entertain and certainly not educate to significant degree.

The use of games and simulation in education is well documented in history and recent literature. They have been used in preschool, K-12, the university, military, business, and by older adults. (Dempsey, Lucassen, Haynes, & Casey, 1997).
But what exactly, do we mean when we say simulation and gaming? First, though computers have certainly allowed the evolution of simulation gaming, a quantum leap forward, they are by no means the only type of simulation gaming done today (Seay, 1997)

Cruickshank (1980), is of the opinion that simulation are the products that result when one creates the appearance or effect of something else and considered games as contests in which both players and opponents operate under rules to gain a specified objective.

He further distinguishes between types of games types of games-academic and non-academic games. To him non – academic games such as table tennis or checkers are primarily for fun while academic games, such as anagrams or war games are primarily for or based upon learning. Cruickshank further distinguished between two types of academic games. These are simulation games and non-simulation games. Non- simulation games are those in which a player solves problems in a school subject such as spelling or mathematics by making use of principles of that subject or discipline. The other type of academic game is the simulation game in which participants are provided with a simulated environment in which to play.

So a game is a form of enjoyable play or sport which is bound by rules to achieve specified goals that depend on skill and often involve chance while simulation is a role- playing, which involve people adopting roles in a mock - up of a situation.

Generally, simulation employs selected aspects of a real – life situation. The usefulness of simulation and games in teaching cannot be undermined. Mere teaching the students topics in the class may not be enough to achieve the desire mastery of the subject matter. As Adelakun (1997) says, innovation like games played in the class and outside the classroom could improve the mastery of a topic. She says that teachers should not limit themselves to

the traditional method of teaching the students alone but they should accompany their teaching methods with innovative system such as playing of games during instructional delivery.

The fundamental problem in mathematics is how to persuade students to think mathematically outside the narrow classroom context. It is only when mathematical concepts are presented in a way to link it with everyday life activities that the benefit of mathematical knowledge be directly felt in improving understanding of scientific activities. This also suggests that the common student's complaint of the lack of utility and relevance of the mathematics taught to them stems partly from the students own mental block against using mathematical modes of thinking outside mathematics classes and their consequent failure to benefit from the mathematics taught.

Wensi – Puryear (1975) in Randel, Morris, Wetzel and White Hill (1992) pointed out that games significantly improved learning in a computerized drill and practice mathematics lesson for third to sixth graders over those who did not have the game opportunity, even though the game - playing students did fewer exercises because teachers who used the game to teach did not cover enough ground as teachers who did otherwise.

Aremu (1999) in her study observed that the use of games could be effective for the improvement of female pupil's achievement in mathematics. In conformity with the usefulness of games Plos and Sneider (1994) declare that for over a century, games have been used to teach mathematics and science. They further stress that games provide a unique opportunity for integrating the cognitive, affective and social aspects of learning. Consequently, they have been recommended for inclusion in the curriculum (Old Field, 1991). It is being said here that games appeal to almost all the senses.

The major purpose of the use for simulation as demonstrated by Morris (1974) in teaching is to test the behavior of simple theoretical models, which would otherwise involve tedious calculation, or high level of mathematical expertise. Simulation is shown to be useful not only because of it ability to provide believable numerical answers but also perhaps more importantly because successful simulation require a full understanding of the problem to be solved (Reinhardt and Loftsgadem, 1979). Problems are often unique or inaccessible to students. For such cases, students may be able to use interactive simulation as a supplement to or even a substitute for experiment.

Using games to teach may makes learning remain permanent. Supporting this view, Rendel, Morris, Wetzel, &Whitehill (1992) claim that the positive results obtained for retention over time favors the use of simulation / games. The war of the opinion that since games requires the active participation of students, the material has a greater chance of being integrated into the cognitive structures of the individuals and thus being retained.

According to some studies, games improve learning because practice with games instruction produced better test performance for the games group than the control group (Aremu, 1998, Adelakun, (1997). "D" Augustine, and Charks (1973), highlight some characteristics of games and simulation as follows.

(1) They promote high interest
(2) They may be more time consuming than other method; they may result in greater depth of understanding of a concept or better mastery of a skill.
(3) They are high noise level activities one could see that the interests of the students are likely to be aroused using simulation games to teach though it may consumes time but knowledge is likely to be imparted at a higher rate and retention longer than when traditional / conventional methods are used.

SIGNIFICANCE OF THE STUDY

By emphasizing the use of simulation - games to teach mathematics, it is hoped that the study will lead to the improvement of mathematics teaching and learning in our secondary schools. The general poor performance of students in mathematics and their attitudes towards some aspects of the subject are expected to be better.

With this study, the researcher aims at exposing the teachers and students to the importance of using simulation – games to improve the teaching and learning of mathematics.

HYPOTHESIS

(1) There will be no significant differences in mathematics achievement of students exposed to the simulation game environment and the control group.
(2) There will be no significant difference in the attitude of the students to mathematics between students exposed to the simulation – game environment and control group.

METHODOLOGY

SAMPLE: All the 147 available S.S. 11 students in two of the four secondary schools within Ila – Orangun township of the Local Government Area of Osun State were used for the study. They were all exposed to 3 consecutive weeks of teaching by one of the investigators with the assistance of the subject teacher in the respective schools. A 40 minutes duration representing a period was used per day for the consecutive weeks of teaching. To ascertain the student's level of achievement, a pretest was given to the student on the topics under focus. A pretest on attitude towards mathematics previously validated by one of the investigators was used.

The result of the co-efficient of reliability was 0.87 for the achievement test using test-retest reliability method. The pre-test on achievement in mathematics was subjected to analysis of variance and no significant difference was found between the control and experimental groups. This implies that the groups are equivalent in their entry behavior. The attitude instrument gave a reliability of 0.91 using Cronbach alpha.

METHODS OF INSTRUCTION/ ADMINISTRATION OF THE INSTRUMENT

The two groups were provided with similar text material on the topics treated during the investigation. In group one, after the teacher have introduced and discuss the lesson for between 10 to 15 minutes ,students then converged in their respective groups of 4 to 5 students and make use of the programmed materials supplied by the teacher. In this group there was no order as to who lead the discussion on the programmed text. It was a lazier-faire kind of group. They discussed the material as they deemed fit. After twenty minutes the groups were then dissolved and class exercise were given to be done individually. This was collected by the teacher for the periods of the research and used for analysis. Similarly, in group two (experimental group), after the teacher have discussed as in group one; the students converged into their respective groups of 4 to 5 students in a group. Here who lead the discussion is determined by the results of thrown tow die. Who ever has the highest score on the two die start the discussion. The remaining 3 or 4 students will now contest for the next discussant, until it comes to the turn of the last person in the group. After all the students have had the chance of leading, the process is repeated. Class test is then administered just like the case of group one. The exercise is collected and graded for analysis.

A school was used for the experimental group while the other one was used for the control group. Two arms in each school were used. One of the investigators thought the students personally for three weeks in each of the schools. Simulation – games was used to teach the student that constituted the experimental group while the other group constituted the control group.

The pre-test was done for both achievement and attitude the same day in each of the school with each of the investigators supervised the student with the assistance of the subject teacher(s) in each of the school. The posttest was also done the same way at the end of the experiment.

RESULTS

Analysis of variance was used since the pre-achievement and pre-attitude scores were not significant. The result in table 1 shows no significant difference between the experimental and the control groups.

TABLE 1

Analysis Of Variance For The Pre-Test Achievement Scores Between Experimental And Control Group.

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F – RATIO	**F- TABLE**
Between groups	1	8. 153105	8.153105	0.58	3.84
Within Groups	145	2021.724405	13.94292693		
TOTAL	146	2029.87751			

It may be concluded at this stage that the subjects has equivalent entry behavior in the experimental and the control groups since the table reveals no significant difference between the groups.

TABLE 2

Analysis Of Variance For The Class – Tests Achievement Scores Between Experimental And Control Group.

SOURCE OF VARIATION	DF	SUM OF SQUARE	MEAN SQUARE	F – RATIO	F – TABLE
Between Groups	1	47.4384382	4743.84382	232.63	3.84
Within Groups	145	2956.986112	20.39200767		
TOTAL	146	7700.829932			

Table 2 shows that the there was a significant difference on student's achievement in mathematics on class tests within the period of the research. Thus, hypothesis 1 is rejected. The reason for this may be due to the fact that the student in the experimental group has been exposed to the use of simulation game instead of the conventional teaching method has been used.

The mean score of the experimental group is 18.80 while that of the control group is 15.61 on the cumulative class tests.

TABLE 3
T-Test On Post Achievement Scores Between The Two Groups.

Group	N	X	SD	t- Cal.	t-critical
Simulation game	72	17.90	5.46	2.31*	1.96
Control	74	15.41	3.89		

*P<.005, df=145

The result in table 3 above also confirms that significant difference on post test achievement scores between the two groups , showing that the students in the simulation game environment perform better than there counterpart in the control group.

TABLE 4
Analysis Of Variance For The Pre – Test Attitude Scores Between Experimental And Control Group.

SOURCE OF VARIATION	DF	SUM OF SCORES	MEAN SQUARE	F – RATIO	F – TABLE
Between Groups	1	32.5075	32.5075	0.9585372	3.92
Within Groups	145	4917.48	33.913655		3.92
TOTAL	146	4949.9875			

The above table4 shows the analysis of variance of pre- attitude scores between the experimental and control groups. The result shows that the students' attitudes before the commencement of the treatment are not significant difference.

TABLE 5
Analysis Of Variance For The Post Test Attitude Scores Between Experimental And Control Group.

Source of variation	Df	Summary of Scores	Mean square	F ratio	F Table
Between Groups	1	276.6125	276.6125	7.9836208	3.92
Within Groups	145	5023.8875	34.6475		
TOTAL	146	5300.5			

Table 5 shows the analysis of variance of post attitude scores and it indicates that there is significant difference in the attitude of students towards mathematics at the end of the treatment. The hypothesis 2 is rejected. On examination of the mean post attitude scores, it was discovered that the group with simulation game environment was 28.61 and the other group mean was 21.98. This implies that the simulation game group has a better attitude development.

DISCUSSION

The major findings in the research work have shown that simulation game environment is an important method of teaching which affects students' achievement in and attitude towards mathematics.

In the case of hypothesis 1, there was no significant difference in achievement between the students in the control and in the experimental groups at the initial stage, that is, at the pre test level. But at the posttest level, there was a significant difference in achievement between the students in the control and in the experimental groups.

Simulation games environment were used to teach the students in the experimental group, while conventional method was for the control group. This result is in consonance with the finding of Randel, Morris, Wetzel and Whitehill (1992); Pulos and Sneider (1994).

It could be keenly observed that generally in hypothesis 2 that there is also significant difference in the attitude of students between the experimental and the control groups at the posttest level. The result of this work as shown that the teacher's role is not simply that of a facilitators whose task is to provide a suitable environment in

which students are presented with new opportunities for learning, but his task includes encouraging students ' motivation so that their academic performance could be improved.

The outcome of this research also indicates that students' attitude is positively affected by the use of simulation – game environment. The fact that the significant difference exists between the experimental and control groups in relation to their academic achievement encourage desirable changes in attitude of individuals and behavior towards mathematics.

The data collected in this research confirm that student' poor academic achievements are partly due to the method of teaching used in teaching them. Most of the teachers teaching in schools were not even ready to diversify their teaching methods and this will not help teaching / learning situations.

In the light of the finding from the data that the students have difficulties in learning mathematics and that only the traditional method of teaching is in vogue in schools, this study contends that the situation needs to be changed. Mathematics teachers in the secondary schools should channel students' towards positive attainable goals in learning mathematics by reducing their difficulties and making the teaching and learning of mathematics practical and meaningful through the use of simulation – game and other activities based strategies. Through simulation game generally requires extra time to develop concepts, students' getting a depth of understanding in the subjects and consequently developing a strong liking for it. Changing students' attitude from negative to positive through instructional methods is a must for teachers of mathematics. Teachers need to engage student in creating their own learning environment. By transferring classroom rules and management to students for their directions, teacher becomes facilitators of the learning, enabling students to determine the strategies that will motivate them to learn. Also, teachers should engage students in role playing and cooperative experiences. Knowing how to work cooperatively with one another, to build on the knowledge and experiences of diverge nature of the classroom, bringing different perspective to the thinking and reasoning process in the mathematics classroom, can help students to expand their thinking and explore new approaches to learning mathematics(Brown,1997).

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