EFFECT OF SIMULATION GAMES AND COMPUTER ASSISTED INSTRUCTION ON PERFORMANCE IN PRIMARY SCIENCE IN LAGOS STATE NIGERIA

Olubola Sowunmi and Francisca Aladejana
College of Education
Ikere-Ekiti, Nigeria.
faladejana@gmail.com; olubolasowunmi@yahoo.co.uk

ABSTRACT
This study examined the comparative effectiveness of Simulation Games and Computer Assisted Instruction for teaching basic science at the lower primary school. The study adopted a pre-test, post-test experimental control group design in which a total of 150 pupils participated. There were two experimental groups and one control group consisting of 50 pupils in each group. A research instrument "Science Achievement Test" (SAT) was also used for the pre-test and the post-test. The pre-test was carried out to determine the entry level of the pupils before they were exposed to the teaching strategies. The first experimental group was exposed to the "Game Tactics Skill Package" (GTSP) which involves pupils playing the Simulation Games. The second experimental group was exposed to the "Computer Interactive Skill Package" (CISP) which involved cluster teaching and individual interaction, while the control group was taught using the conventional teaching strategy. The post-test was conducted at the end of the pupils' exposure to the strategies. The data collected were analysed using t-test and analysis of variance (ANOVA). The hypothesis formulated was tested at 0.05 level of significance. The findings showed that there was no significant difference in the performance of pupils exposed to simulation games and computer assisted instruction. The study concluded that simulation games can be very useful in improving teaching and active learning or learning by doing especially where there are minimal facilities for computer assisted instruction.

Keywords
Simulation Games, Computer Assisted Instruction, Conventional method of teaching

INTRODUCTION

Globally, science and technology is changing the world at an unbelievable rate. According to Oden and Asim (2002) any nation that ignores scientific literacy may find it difficult to fit into the world affairs. Nigeria is not an exception; as a result, all effort must be put in place to meet up with challenges ahead. The concept of Computer Assisted Instruction is as a result of the advent of Information and Communication Technology (ICT). According to Yenice (2006), Computer Assisted Instruction (CAI) is an instruction or remediation presented on a computer to illustrate a concept through attractive animation, sound, and demonstration. CAI is a kind of instruction that exploit computer software to assist teachers teach information or skills related to a particular topic and students can interact directly with lessons programmed into the computer system, ((Roblyer, 2004)).

According to Aladejana (2013), in the year past, classrooms were a circle of memorization, repetition, and note copying and these agreed perfectly with the world at the period, but now, the world is increasingly shaped by ICT. Right from childhood, children in the 21st century glue endlessly to television watching cartoons, playing games and other ICT related past times. Technology has become an integral part of our everyday lives. At home, learners come in contact with mobile phones, television, computer, internet, games cash registers, bar-code scanners, traffic lights, automatic doors, security cameras, remote controls, fax machines, the list can go on and on. The conflict then arise when such students get to the classroom and are still expected to listen ,write and regurgitate learning materials (Aladejana and Idowu, 2006; Aladejana 2011). Thus, the 21st century classroom must be matched with 21st century education which should be flexible, creative, challenging and complex.

The present state of science teaching and learning in Nigeria is a concern to all. According to Aladejana (2007), science teaching at various levels still retains the old conservative approach with the teacher, in most cases, acting as the repertoire of knowledge and the students the dominant recipient. There is over-reliance on textbooks and only occasional demonstrations and experimental classes. In an average classroom, one finds a teacher at the blackboard putting important facts while students furiously copy all that is written and said and are expected to memorize the facts and spit them out in examinations.

Several researchers have identified the importance of CAI in education. It has been found that CAI allows learners to progress at their own pace and work individually or solve problem in a group, computers provide immediate feedback, letting students know whether selected answer is correct. If the answer is incorrect, the programme shows students how to correctly answer the question. Computers offer a different type of activity and could offer a change of pace from teacher-led or group instruction. CAI improves instruction for pupils to receive immediate feedback. Computer programmes can present instruction at the learner's pace and keep track of the learner's errors and progress. Computers capture the learners' attention because the programmes are interactive and engage the learners' spirit of competitiveness to increase their scores. Also, CAI moves at the learners' pace and usually does not move ahead until they have mastered the skill (Yenice, 2006). Others identified the importance to include assisting students' understanding of concepts, enhancing students' motivation in exploring, investigating, conjecturing, creating and discovering principles, and making generalization and connections. Also according to Guha (2003), CAI ensures student involvement in the learning process; and developing students' problem-solving abilities by allowing them to analyze and decompose a problem by using systematic trial and error to find solutions (Roblyer, 2004).

However, various barriers to ICT use in African schools have been identified to include: poor infrastructure; epileptic power supply; lack of electricity; lack of trained personnel; poverty; inadequate funding and limited or no internet access (Aladejane, 2007). Advocating a total shift to technology-assisted classroom might be unrealistic in most secondary schools. Blended learning can however be a better alternative, which is the combination of multiple approaches to learning. An alternative approach that can be explored is the simulation game.

The term simulation game has been used interchangeably e.g. "games with simulated environments," "teaching games," "learning games," "instructional games," and "educational games" (Duke and Greenblat 1979; Greenblat 1971).Simulation Game is a game based strategy that can be used for teaching and learning at any level of education. Simulation games in the classroom are used to copy what are found in a real life situation. According to Enciso (2001), simulation game is defined as an activity that works, fully or partially, on basis of players' decision. Academic games can be divided into two: simulation or non-simulation games. Cruickshank and Telfer (1980) distinguished between two types of academic games. There are two types of academic games: 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 or simulating activities in which to play. These games are intended to provide learners with insight into the process or event from the real world which is being simulated.

Simulation games are argued to be an excellent supplement to the standard lecture. As evidence, both computerized and non-computer based simulation and games are showing significant levels of growth in education (Lean, Moizer, Towler, and Abbey, 2006; Dobbins, Boehlje, Erickson and Taylor, 1995; Gentry, 1990) the key benefits of simulation games as teaching and learning tools/ game-based tools identified that simulation games: adapt to the level of the individual while providing support; games are learner-centered; built with multiple levels; ensuring user's skills are challenged; engage users for hours in pursuit of a goal; played with others; online communities provide engagement; provide immediate and contextualized feedback; and encourage creative expression, problem solving in complex situations, and experiential/active learning.

OBJECTIVE

The specific objective of the study is to determine the effectiveness of Simulation Games, and Computer Assisted Instruction on performance in Basic Science. Specifically the study examined the comparative effectiveness of Simulation Games and Computer Assisted Instruction for teaching basic science at the lower primary school with a view to recommending it in situations where facilities for CAI are greatly deficient.

Research Hypothesis

The following null hypothesis was tested at $p = 0.05$ level of significance.

There is no significant difference between the academic achievements of lower primary school pupils in basic science when taught using Computer Assisted Instruction and Simulation Games.

THEORETICAL FRAMEWORK

The study is predicated on the assumption that the use of computers and games affects the motivation of students in the learning of science. The study is underpinned by Bandura's theory of observational learning and theory of constructivism. Bandura's theory of observational learning lays emphasis on experimental methods, with variables that are observable, measurable and manipulative, and they avoids whatever is subjective, internal, and unavailable – i.e. mental. In the experimental method, the standard procedure is to manipulate one variable, and then measure its effects on another. Thus, learning methods that are observable, measurable and activity-based are some of the features of Bandura's theory. The study stresses that learning should be in such a way that learners are actively involved in the learning process.

The study is also predicated on the theoretical framework of constructivism, a philosophy of learning founded on the premise that by reflecting on our experiences, we construct our own understanding of the world we live in. According to the constructivist view, meaningful learning is a cognitive process in which individual make sense of the world in relation to the knowledge, which they already have construed, and this sense-making process involves active negotiation and consensus building (Wilson, 1996).

METHODOLOGY

The study adopted a pre-test post-test experimental control group design. All the 512 private nursery and primary schools in Lagos State Nigeria constituted the research population. Out of the number of schools mentioned, three schools were purposely selected from three local government areas in Lagos State for the study. A total number of 150 pupils were used for the study. Intact class of 50 pupils each were used from the selected schools in the experimental group A, experimental group B and the control group. The research instrument titled "Science Achievement Test" (SAT) designed by the researcher was used for pre-test to determine the entry performance of the pupils before they were exposed to the experiment. The construct and content validation of the research instrument were carried out by a Professor of Science Education and an expert in Tests and Measurement. Furthermore, the instrument was trial-test on 50 pupils from another school which was not part of the original study sample and hence its reliability index was computed to be 0.87 by using Alpha Cronbach technique.

The first experimental group consist of 50 pupils using the "Game Tactics Skill package" (GTSP) which involves pupils playing the Simulation Games. The second experimental group also consist of 50 pupils will use "Computer Interactive Package" (CIP) which involves cluster teaching and individual interaction with the software designed for CAI. The GTSP consisted of four simulation games that were designed and the CIP consisted of four computer based interactive activities for instructing basic science. The control group was taught using traditional lecture method (chalk and talk) and pupils copied notes at the end of the teaching. Four different topics were selected from the primary school curriculum of basic science and technology to design the instruments. The topics are living things and non-living things; exploring your environment; animals and where they live; and you and your environment. GTSP and CIP have instructional guides on how to play the games and explore the computer software. The experiment covered the period of six weeks in which four Simulation Games were played during the period and four Computer Assisted Instruction software were also be interacted with after which post-test was conducted with SAT. The data collected were analyzed using t-test and analysis of variance (ANOVA).

RESULTS AND DISCUSSION

The result showed that all the three groups were at the same entry level as the result of the pre-test showed no significant difference in the performance *F-value = 0.142, p> 0.05* (Table 1). The result of the pre-test and post-test of the simulation games and computer assisted instruction showed that there is a significant difference in the performance of each of the group after the treatment for the period of three weeks while there is no significant difference in the performance learners taught with the conventional method (Table 2). The result of the post-test showed that there is no significant difference in the performance of pupils in the two experimental groups, which were exposed to the simulation games and computer assisted instruction (Table 5). The scores of the two groups shows that the *t-value = -0.587* and the *p-value = 0.560*. The result showed that there is no significant difference in performance of the experimental group A and B. This implies that what CAI can achieve, SG can also achieve it.

Table 1: ANOVA Summary of Difference in the Pre-test Scores

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.012	10	.101	.142	0.999*

Within Groups	98.988	139	.712		

***Not significant**

Table 2: T-test Analysis of the Pre-test and Post-test of Simulation Games (SG), Computer Assisted Instruction (CAI) and Conventional Method (CM) Groups

	df	t	Significant
SG Pre-test SG Post-test	49	-18.254	0.000
CAI Pre-test CAI Post-test	49	-20.678	0.000
CM Pre-test CM Post-test	49	-0.483	0.630*

***Not significant**

Table 3: T-test Analysis of Post-test of Simulation Games (SG) and Conventional Method (CM) Group

Group	N	Df	t	p
SG post-test CM post-test	50 50	49	0.230	0.000

Table 4: T-test Analysis of Post-test of Computer Assisted Instruction (CAI) and Conventional Method (CM)

Group	N	Df	t	p
CAI post-test CM post-test	50 50	49	8.692	0.000

Table 5: T-test Analysis of Post-test of Simulation Games and Computer Assisted Instruction

Group	N	Df	t	p
SG post-test CAI post-test	50 50	49	-0.587	0.56*

Based on these findings, performance of learners in sciences can be enhanced using both simulation games and computer assisted instruction over the conventional method of instruction. These methods can help to arouse and sustain learners' interest right from the pre-primary and primary level. In other words, the classroom environment should be enriched with activity based materials that can help to sustain the interest of the learners' in scientific skills. Recognising the limitations of most Nigerian environment in terms of availability of facilities for CAI, it is recommended that simulation games be put to use where computer assisted instruction is minimal so as to promote active learning, or learning by doing. Moreover, these two strategies assist learners to believe that they are capable of accomplishing school tasks and hence develop a sense of self-efficacy. Teachers can promote such self-efficacy by having learners receive confidence-building messages, watch others be successful, and experience success on their own.

CONCLUSION

The study concluded that both Simulation Games and Computer Assisted Instruction were methods of improving the academic performance of lower primary school pupils in Basic Science. It was recommended that were CAI facilities were minimal; SG can be used because it can be easily constructed by teachers and it is also cheap to construct.

Brief Biography of Authors

Prof Francisca Aladejana has BSc Education/ Biology (First Class Honours), M.A. Science Education, PhD Botany (Ife). She is a Professor of Science Education; the Provost, College of Education, Ikere-Ekiti, Nigeria and a past Director, Institute of Education, Obafemi Awolowo University, Ile-Ife, Nigeria. She has won three distinguished academic awards and many honorary awards. Prof Aladejana's research interests include science education, genetics and gender studies. She has published about 65 published articles including six co-authored books and three co-edited books. She has supervised many undergraduate and postgraduate theses. She has wide range of academic, administrative and professional experiences and belongs to many professional organizations..

Olubola Sowunmi has BSc Education/ Biology, M.A. Early Childhood Education and is currently an Assistant Lecturer in the Department of Early Childhood Education, College of Education, Ikere-Ekiti, Nigeria. She is also pursuing her PhD in Early Childhood Education at the Obafemi Awolowo University, Ile-Ife, Nigeria. She has published four papers and has presented papers in national and international conferences. She belongs to some professional associations.

REFERENCES

Aladejana, F.O. and Idowu, L. (2006). ICT in Teaching and Learning. The Obafemi Awolowo University, Ile-Ife Experience Conference Proceedings, eLearning Africa, 1st International Conference on ICT for Development, Education and Training, UNCC, Addis Ababa Ethiopia, May 24-26; p. 25-28.

Aladejana, F.O. (2007). The Implication of ICT aand NKS for science Teaching. *Complex Systems,* Vol 17 pp 113-124.

Aladejana, F.O. (2011). The Child in the 21st Century, Can ICT Change the Face of Learning? 3rd International Conference of the Faculty of Arts and Socials Sciences, University of Lagos in collaboration with the Early Childhood Association of Nigeria, University Guest House, University of Lagos,23-24th November, 2011.

Aladejana, F.O. (2013). Best Educational Practice as a Panacea to Educational Conflicts in Nigeria, Keynote Address presented at the 4th Annual Conference of the Faculty of Education, Adeyemi College of Education, Ondo.

Cruickshank, D.R. & Telfer, R. (1980) Classroom games and simulations. *Theory into Practice*, 19(1), 75-80.

Dobbins, C. L., Boehlje, M., Erickson, S., and Taylor, R. (1995). Using Games to Teach Farm and Agribusiness Management, Retrieved June 25, 2010. *Review of Agricultural Economics*, 17(3), 247-255.

Duke, R. D. and Greenblat C. S. (1979). Game-generating games: A triology of games for community and classroom. Sage Publications, Beverly Hills, California.

Enciso, R.Z. (2001). Simulation games a learning tool. ISAGA 2001 proceedings Conference (International Simulation and Gaming Association). *http://www.traininggames.com/pdf/en/SimulationGames elearning Tool.pdf.*

Gentry, J. (1990) *Guide to Business Gaming and Experiential Learning,* ABSEL, Nichols/GP Publishing, East Brunswick.

Greenblat, C. (1971). 'Simulations, Games, and the Sociologist.' *The American Sociologist* 6(2): 161-164;

Guha, S. (2003). Are we all technically prepared? Teachers' perspective on the causes of comfort or discomfort in using computers at elementary grade teaching. *Information Technology in Childhood Education Annual*, 317-349.

Lean, J., Moizer, M., Towler, C. A. (2006). Active Learning in Higher Education, *Journal of Simulation and games,* 7(3), pp227-242.

Oblinger D. (2006). Simulations, Games, and Learning. Retrieved November 8, 2008. *http://net.educause.edu/ir/library/pdf/ELI3004.pdf*

Oden S.N & Asim A.E. (2002) *Towards Scientific Literacy: Motivating Primary School Children to learn Scientific Poems.* Universal Basic Education Forum 2 (2).

Roblyer, M. D. (2004). Educational technology in action: Problem-based exercises for technology integration. *www.utc.edu/Faculty/Margaret-Roblyer/index_files/Page590.htm*

Yenice N. (2006). The Effect of Computer Assisted Science Teaching on Students' Science and Computer Attitudes. *The Turkish Online Journal of Educational Technology,* 2(4), Article 12.