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

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Abstract
This study examined the effect of simulation games and computer assisted instruction on teaching basic science among lower primary school pupils. Presently in Nigeria, learners find science subjects difficult and this may not be unconnected with the methods employed in the teaching. Teachers still retain the conservative approach by acting as repertoire of knowledge while learners remain as dormant recipients. Literature had shown that the beneficial effects of Computer Assisted Instruction (CAI) that include motivation, transfer of knowledge, problem solving, and individualization of instruction are also inherent in Simulation Games. Studies are needed to validate this assertion in Nigeria where CAI facilities are minimal. The study is predicated on the theoretical framework of the Constructivist theory. This study therefore 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 number of 150 pupils were subjects of the study. There were two experimental groups and one control group consisting of 50 pupils each. The research instrument "Science Achievement Test" (SAT) was 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 involved 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. Post-test was conducted at the end of the pupils' exposure to the strategies. The data collected were analyzed using t-test and analysis of co-variance (ANOVA). The hypothesis formulated was tested at 0.05 level of significance. The findings showed that there is 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 when there are minimal facilities for computer assisted instruction.

Introduction
Globally, science and technology is changing the world around us 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 should not be an exception; as a result all efforts 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 exploits computer software to assist teachers to 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 years past, classrooms were a cycle of memorisation, repetition, and note copying and these agreed perfectly the world around the period, but now, the world is increasingly shaped by ICT. Right from childhood, children in the 21st Century have endless glue to the 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, computers, 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 arises when such students get to the classroom and are still expected to listen, write and regurgitate,

(Aladejana and Idowu, 2006; Aladejana, 2011). Thus, the 21st Century classroom must be matched with the 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 dormant recipient. There is over-reliance on textbooks with only occasional demonstrations and experimental classes. In an average classroom, one finds a teacher at the blackboard jotting down important facts, students furiously copying all that is written and said, expected to memorize the facts and spit them out in an examination.

Several researchers have identified the importance of CAI in education. It has been found that CAI allows learners to progress at their own paces and work individually or solve problem in a group, computers provide immediate feedback, letting students know whether selected answers are 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). Other identified importance of CAI 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 engages 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 Africa 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 (Aladejana, 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 Simulation game.

The term simulation game has been used interchangeably with "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 real life situations. 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 the two types of academic 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 the 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 have been showing significant levels of growth in education (Lean, Moizer, Towler, and Abbey, 2006; Dobbins, Boehlje, Erickson and Taylor, 1995; Gentry, 1990). Some of the key benefits of simulation games as teaching and learning tools/ game-based tools identified are that they can help to:

1. adapt to the level of the individual while providing support; games are learner-centered.
2. provide multiple levels; ensuring user's skills are challenged.
3. engage users for hours in pursuit of a goal.
4. learners to play with others; online communities provide engagement.
5. provide immediate and contextualized feedback.
6. encourage creative expression, problem solving in complex situations, and experiential/active learning.

Objective of the Study

The specific objective of the study is to compare the performance of learners exposed to the use of Simulation Games, and those exposed to Computer Assisted Instruction 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 and Theory of Constructivism. Bandura's theory lays emphasis on experimental methods, with variables that are observable, measurable and manipulative, and 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 individuals 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 these schools, three schools were purposively selected from three local government areas of the State for the study. A total number of 150 pupils were actually used for the study. Intact class of 50 pupils each was used from each of the three selected schools as 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 the pre-test to determine the entry performance of the pupils before they were exposed to the experiment and ensure all subjects were at the same level. 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-tested 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 A consists of 50 pupils taught 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 the 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 which 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 guide on how to play the games and explore the computer software. The experiment covered the period of six weeks where four Simulation Games was played during the period and four Computer Assisted Instruction software was also be interacted with after which post-test was conducted with SAT. The data were collected and analyzed using t-test and analysis of co-variance (ANOVA).

Results and Discussion
The result showed that all the three groups were at the same entry level as the results of the pre-test showed no significant difference in their performances (Table 1). The results 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 the computer assisted instruction for the period of three weeks, (Table 2). 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 the performance of the experimental groups A and B. This implies that what CAI can achieve, SG can also achieve it. The ANOVA analysis of the Difference in the Post-test Scores of CAI and SG Groups also confirms that there is no significant difference in the performance of pupils in the two groups with exposure to treatment (Table 5). It can thus be concluded that the beneficial effects of CAI such as motivation, transfer of knowledge, problem solving, and individualization of instruction are also inherent in simulation games and this agreed with earlier findings of Oblinger (2006). However significant differences were observed in the performance of the control group taught by lecture method and the experimental groups taught using CAI or SG (Tables 3 and 4), indicating the inherent advantages in the use of CAI and SG over the lecture chalk-talk method. This agrees with earlier findings of Lean et al (2006); Yenice (2006) and Aladejana and Idowu (2006).

Table 1: t-test Analysis of Pre-test of the three groups

Paired Groups	N	Df	t	p
SG / CAI PRE-test	50/50	49	-0.437	0.56*
SG/CM pre-test	50/50	49	-0.512	
CAI/CM pre-test	50/50	49	-0.234	

*Not significant

Table 2: t-test Analysis of the Post-test of Simulation Games (SG) and Computer Assisted Instruction (CAI) Groups

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

*Not significant

Table 3: t-test Analysis of the Post-test of Simulation Games (SG) and Conventional Method (CM) Groups

Group	N	df	t	p
SG post-test	50	49	9.230*	.000
CM post-test	50			

*Significant

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

Group	N	df	t	p
CAI post-test	50	49	8.692*	.000
CM post-test	50			

*Significant

Table 5: ANOVA Summary of Difference in the Post-test Scores of CAI and SG Groups

Source	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	1.012	10	.101	.142	.999	Not Significant
Within Groups	98.988	139	.712			

Based on these findings, performance of learners in sciences can be enhanced using both simulation games and computer assisted instruction over and above 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 the 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 thus recommended that where CAI facilities were minimal; SG can be used because it can be easily constructed by teachers and it is also cheap to construct.

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