EFFECT OF COMPUTER GAME, DRILL AND PRACTICE ON ACADEMIC PERFORMANCE IN BIOLOGY AMONG SENIOR SECONDARY SCHOOLS STUDENTS IN MAIDUGURI METROPOLIS, BORNO STATE, NIGERIA

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Abstract. This study examined the effect of Computer Game, Drill and Practice on students' academic performance in Biology in Maiduguri Metropolis, Borno State, Nigeria. Three research questions and three hypotheses were formulated guide this study. Related literatures were reviewed. A quasi experimental design specifically the non-randomized control group design involving two intact classes was used. The population of the study consisted of 719 public Senior Secondary Two Biology students in Maiduguri Metropolis, Borno State. The sample of the study consisted of 88 Senior Secondary class Two Biology Students from two Government Secondary schools drawn using purposive sampling techniques. An instrument, Biology Performance Test was adapted and used by the researcher. Before treatment commenced, the BPT was administered as pre-test to the sampled schools. The treatment lasted for six weeks. After treatment session, the same instrument which was retyped and the questions reshuffled was re –administered to the subjects to obtain post-test scores. Means and standard deviations were used to answer the research questions. Hypotheses

were tested using Analysis of Covariance, at 0.05 level of significance. The findings of the study revealed that there was no significant difference in the post-test performance scores of students taught Biology with the use of computer gam eand drill and practice ($p>0.05$); there was no significant difference in the performance of male and female students taught Biology with the use of computer Game ($p>0.05$) and there was no significance difference in the post-test performance scores of male and female students taught Biology using Drill and Practice ($p>0.05$). Based on the conclusion, the study recommended that computer game, drill and practice can both be used in teaching students since it enhances students' performance. Also the study recommended that both male and female students should be taught with computer game, drill and practice.

Keywords: computer game, drill and practice, academic performance and biology

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Introduction

The teaching and learning process has been revolutionized with the use of computers. Globally, schools are embracing the use of new technology in the teaching and learning process. The delivering of instruction is becoming more students centred with the use of information and communication technology (ICT). Different educational software's and packages have been developed over the years to enhance the way instruction is delivered in the classroom. National examination body like Joint Admission and Matriculation Board (JAMB) have completely introduced the use of computer in it examination and students are becoming more conversant with ICT. In the science classroom, computer games, drill and practice can present unique opportunities for teachers and students, as they involve activities of observation, interpretation, simulation, inference, prediction, hypothesis, classification, and communication. Indeed, computer games, drill and practice offer much potential to make the scientific inquiry process more engaging by providing a rich and interactive environment

that challenges students to solve a complex problem in a meaningful context and enables them to gather information and evidence from multiple sources using authentic tools (An, 2015).

The recognition of the value of computers in the teaching-learning process in the contemporary world introduced computer education into the Nigerian school curriculum in 1989 (Achuonye, 2011). This means that students can proceed at their own time, following a path through the curriculum suited for their interest and talent. The use of computer assisted instruction (CAI) as a supplement to conventional method produced higher achievements by the learners than using conventional method alone. Computer assisted instruction is a user friendly learning technique, usually involving interaction of students with programmed instructional materials (Yusuf & Afolabi, 2010).

Drill and practice involves a sequence of tasks, exercises, or words repeated over and over until they can be performed faultlessly. In a CAI drill and practice design, the computer screen presents the student with questions to respond to or problems to solve, the student responds, the computer informs the student whether the answer is correct and if the student is right, he/she is given another problem to solve, but if the student responds with a wrong answer, he or she is corrected by the computer. Drill and practice are interactive and help students remember the concepts they have been taught previously (Yusuf & Afolabe, 2010).

Computer games work as rapid changes of a picture on the computer screen. There are three main features of games, and they are picture, indication of certain movements, and simulation. The flexibility of learning through games, allows for a wider range of stimuli, thus increasing students' engagement in learning. This can be one way of bringing about a change of emphasis in teaching from a teacher-directed approach to a teacher-facilitated approach. With this, both teachers and students may control the pace of lessons according to their abilities (Akpinar & Ergin, 2007).

The issue of poor academic performance has been a concern to all and sundry. Poor performance in science subjects especially Biology is not a problem in Nigeria alone. In most countries, learners perform below average in science subjects. The problem is so much that it has led to the widely acclaimed fallen standards of education in many countries (Akiri & Ugborugbo, 2009). This poor performance in science subjects is attributed to: Poor quality of science teachers whose methods of teaching such as excessive talking, writing of notes and rote learning of text books materials tend to inhibit interest, the prevalent exposition method of instruction rather than inquiry, with very little involvement of learners in experimentation and shortage of laboratory facilities and equipment necessary for practical work. It was stated that in Kenya there was a public outcry and concern by parents, teachers and educationists about poor performance in science subjects (especially Biology) and Mathematics in the national examinations (Akiri & Ugborugbo, 2009). They explain: Biology as a science subject requires an integration of both theoretical and practical work to make it easily understood by students. The largest proportion of teachers still use the conventional lecture method while teaching Biology and the teacher expectation have a bearing on the attitude and science anxiety levels of the learners particularly when learners are aware of the levels of expectation the teacher has of them. This research will therefore examine the effect of computer game drill and practice on students' performance.

Statement of the problem

The persistence decline in senior secondary school students' performance in Biology in West Africa Examination council (WAEC) is disheartening. The fact was asserted by WAEC chief examiner's report. The report of the chief examiner, West African Examination Council 2013-2015 revealed that candidates' performance was poor. For the years 2013 to 2015 the report was that there was no improvement in the performance of candidates who sat for Secondary School Certificate Examination (SSCE) in Biology. Furthermore, a

critical look at the statistics of candidates' enrolment and performance in Biology in Borno State shows that the performance of the candidates was poor. The percentage of failure of students in Biology in thesenior secondary school certificate examination (SSCE) for the years 2013, 2014, and 2015 are: In 2013, 14% (180) passed and 83% (1,073) failed out of a total of 1, 285 students. In 2014, 38%, passed and 62% failed out of a total of 2183 students. In 2015 38%, passed and 62% failed out of a total of 2460. The problem of mass failure in the ordinary level examination generally then becomes an area for concern and concerted efforts must be made to address it.

As a result of the poor performance in Biology, educators are faced with the challenges of improving students' performance in the subject area. In their search for more innovative instructional pedagogy, the use of computer and other forms of technology are being analysed for their impact on students' academic performance. Computer game drill and practice therefore, might provide students with the opportunities to actively explore Biology as an experimental subject instead of a descriptive one. This active participation in their learning might improve their performance in the subject area. Therefore, as a result of this evident poor performance the study seeks to determine the effects of computer games, drill and practice on students' performance in Biology.

Research questions

The following research questions were ruled to guide the study: (1) what is the difference between the mean performance scores of senior secondary school students taught Biology using drill and practice and those taught using computer game; (2) what is the difference between the mean performance scores of male and female senior secondary school students taught Biology using computer game.

The following null hypotheses will guide this study: (i) there is no significant difference between the mean performance scores of senior secondary school students taught Biology using drill and practice and those taught using

computer game; (ii) there is no significant difference between the mean performance scores of male and female senior secondary school students taught Biology using computer games.

Review of literature

Game is a "system in which players engage in artificial conflict, defined by rules that results in a quantifiable outcome" (Salen & Zimmerman, 2004). A digital game, then, further refines the definition by requiring the game system to incorporate technology. Simulations, augmented reality, and traditional video games all fall within this definition.

Heinich et al. (2002) described "game" as an activity in which players follow prescribed rules for attaining some challenging goals. He highlighted that the rules in games are different from those in real life and thus make gaming fantastic and entertaining. Although Heinich, (2002) argument is applicable to some non-computer games and also some computer games it has yet to be comprehensive enough to cover all games in the past and today.

Different games, no matter non-computer-based or computer-based, can have a very different "technical" design therein. Some games have scoring, but some do not. Some games have real win and lose stages, but some do not. Some games are in a purely competitive manner, but some require players to work collaboratively. Some games focus on providing players with fantasy experience, but some advocate for offering players authentic experience. Instead of proposing a universal definition of "game," Mayer (2011) generalized four key structural characteristics of games that make a game a "game;" they are (1) rule-based, (2) responsive, (3) challenging, and (4) cumulative. Rules in games enable players to play. Responses of games make players feel their actions are reacted. Challenges in games pose goals for players to achieve. Cumulative features of games aggregate players' past gaming successes.

Methodology

The design that was used in this study is the experimental design. The type of experimental design used quasi-experimental design. (Creswell, 1994). It is a design used for comparing the achievements of two groups in the pre-test and post-test and also to determine how effective a treatment was. The specific type of quasi- experimental design will be the non-equivalent (pre-test and post-test) control group design. The pre-test- post-test designs will be used to evaluate the effects of some changes in the environment on subsequent performance hence can be employed to find out the effect of changes in an educational environment (Bordens & Abbot, 2002). The design can be depicted in the visual mode in the way (Fig. 1).

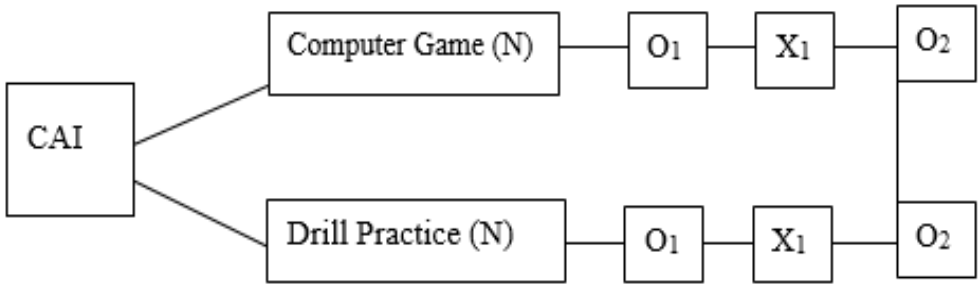

Figure 1. Research design: **N** = Non-equivalent; **O_1** = Pre-test measure; X_1= Treatment, O_2 = Post-test measure

It is a design used most often in educational research where random assignment of subjects in a school or classroom is impracticable (Cohen & Manion, 2004). In a typical school situation, schedules cannot be disrupted nor classes reorganized in order to accommodate the researcher's study and in such a case it is necessary to use groups that are already organized into classes or intact groups (Ary et al., 2009). The main weakness of this design is that it is inferior to randomized experiments in terms of internal validity (Trochim, 2008).

The population of the study was 719 senior secondary school Biology students in their second year (SSS2) in Maiduguri Metropolis. The sample was 88 students in Shehu Garbai Secondary School and Government Day Secondary School Maiduguri. The study used purposeful sampling technique to sample out school with ICT facilities, ICT teachers, power supply and adequate security due to the nature of the study.

The instrument that was used in collecting data in this study was Biology Performance Test (BPT). The BPT consisted of 20 multiple choice items adapted from past examination questions of West African Examination Council (WAEC) and National Examination Council (NECO). Biology Performance Test is based on SSII curriculum on the concepts of Adaptation and tolerance.

Pre-test was administered on both students using the BPT before the commencement of the experiment. The researchers trained two research assistants that helped to carry out the experiment by teaching the groups. At the onset of the treatment the experimental group (group 1) was taught the biology topics using computer game by one research assistant while the experimental group (group 2) was taught by the other research assistant using drill and practice. The two groups were taught in different schools far away from each other in order to avoid contamination of treatment if the groups were taught at nearby schools at the same time or on different days. The experiment lasted for four weeks and post-test was administered on the groups.

Both descriptive and inferential statistics were used in the analysis of data. The descriptive statistics of mean and standard deviation were used to answer the research questions earlier stated in chapter one of this study, followed by detailed interpretation. For the null hypotheses, inferential statistics of ANCOVA was used to test each of them at 0.05 alpha level of significance. Hence, hypothesis that is greater than 5% or P= >0.05 was rejected and hypothesis that is less than 5% that is P=<0.05% was retained.

Results

Research question one: What is the difference in academic performance of senior secondary school students taught Biology using drill and practice and those taught using computer game?

In answering research question one, mean scores of students were analyzed using mean and standard deviation and the result is as shown on Table 1.

Table 1. Pre-test and post-test mean gain scores of students taught biology with drill and practice and computer game

Group	N	Pretest		Post-test		Mean Gain
		Mean	SD	Mean	SD	
Drill and Practice	26	18.5	3.4	57.9	6.8	39.4
Computer Game	62	20.5	7..3	62.4	9.7	41.9

Table 1 shows the mean and standard deviation of the pre-test and post-test scores of the students taught with drill and practice and those taught with computer game. The result revealed that the mean and standard deviation of the pretest and post-test scores of the students in drill and practice has a mean score of 18.5, standard deviation of 3.4 for pre-test and mean score of 57.9, standard deviation of 6.8 for pos-test. This gives a mean gain of 39.4 for the drill and practice. Similarly, the results also revealed that the mean and standard deviation of the pretest and post-test scores of the students in computer game are 20.5 for the mean, 7.3 as the standard deviation for the pre-test and 62.4 for the mean and 9.7 for the standard deviation of the post-test. This gives a mean gain of 41.9 for the computer game. From the result, it can be deduced that there is difference between the pre-test and post-test mean scores which accounted for mean gain scores for the two groups in favour of the post-test. This implies that students in all the groups performed better at post-test than pre-test, however, students had higher scores in game than drill and practice.

Research question two: What is the difference between the mean performance scores of male and female senior secondary school students taught Biology using drill and practice?

Table 2. Pre-test and post-test mean Gain scores of male and female students taught biology using computer game

Group	N	Pretest		Posttest		Mean Gain
		Mean	SD	Mean	SD	
Male	15	18.0	3.2	58.0	8.2	40.0
Female	11	19.1	3.8	57.7	4.7	38.6

Table 2 shows the mean and standard deviation of the pre-test and post-test scores of male and female students taught with drill and practice. The result revealed that the mean and standard deviation of the pre-test and post-test scores of the male students has a mean score of 18.0, standard deviation of 3.2 for pre-test and mean score of 58.0, standard deviation of 8.2 for post-test. This gives a mean gain of 40.0 for the male students. Similarly, the results also revealed that the mean and standard deviation of the pre-test and post-test scores of the female students are 19.1 for the mean, 3.8 as the standard deviation for the pre-test and 57.7 for the mean and 4.7 for the standard deviation of the post-test. This gives a mean gain of 38.6. From the result, it can be deduced that both male and female students perform in favour of the post-test. This implies that students in all the groups performed better at post-test than pre-test, however, male students had higher post-test mean gain than their female counterparts.

Null hypotheses testing

Hypothesis One: There is no significant difference between the mean performance scores of senior secondary school students taught Biology using drill and practice and those taught using computer game.

In testing hypothesis three, the mean achievement scores of male and female students taught Biology using Drill and Practice (D&P) and Computer Game (CG) groups were analysed using ANCOVA as shown in Table 3.

Table 3. ANCOVA results of the mean performance scores

Source	Type III Sum of Squares	Df	Mean Square	F	p-value
Corrected Model	1228.788	2	614.394	8.713	.000
Intercept	21013.656	1	21013.656	298.009	.000
Pretest	852.096	1	852.096	12.084	.001
Treatment	223.540	1	223.540	3.170	.079
Error	5993.655	85	70.514		
Total	335525.00	88			
Corrected Total	7222.443	87			

*: Significant at $p < 0.05$

Table 3 shows the ANCOVA results of the mean performance scores of students taught Biology using Drill and Practice and those taught using computer Game. From the table, there is no significant difference in the mean achievement scores of the students at 0.05 level of significance $F(1, 85) = 3.170$, $p > 0.05$. Hypothesis one states that there is no significant difference between the mean performance scores of senior secondary school students taught Biology using drill and practice and those taught using computer game. On this basis, hypothesis one is therefore retained. This implies that students performed equally well in both Drill and Practice and Computer Game.

Hypothesis two: There is no significant difference between the mean performance scores of male and female senior secondary school students taught Biology using computer game.

Table 4. ANCOVA results of the mean scores of male and female students in drill and practice

Source	Type III Sum of Squares	Df	Mean Square	F	p-value
Corrected Model	30.782[a]	2	15.391	.314	.734
Intercept	2120.922	1	2120.922	43.21	.000
Posttest	30.310	1	30.310	.618	.440
Gender	2.461	1	2.461	.050	.825
Error	1127.872	23	49.038		
Total	88275.00	26			
Corrected Total	1158.654	25			

Ns: not significant at $p > 0.05$

Table 4 shows the ANCOVA results of the mean performance scores of male and female students taught Biology using Drill and practice. From the table, there is no significant difference in the mean achievement scores of the male and female students at 0.05 level of significance $F(1,23) = 050$, $p > 0.05$. The results of the analysis indicate that the hypothesis one that state that there is no significant difference between the mean performance scores of male and female senior secondary school students taught Biology using computer games. On this basis, hypothesis two is therefore retained. This implies that male and female students performed equally well when taught using drill and practice

Discussion

The result of this study showed that the use of computer game, drill and practice had no significant effect on students' performance in Biology; this is also in line with the study carried out by Sedega et al. (2014) effect of computer assisted instruction (Drill and Practice) on senior high School students' achievement at pie chart and histogram in Core mathematics. The results revealed that the drill and practice was effective for the students in the experimental group because it helped students to develop Mathematical concepts adequately with

limited teacher's guidance. The result of this study showed that the use of computer game, drill and practice had no significant effect on students' performance in Biology.

This result agreed with findings of Abubakar & Kamar, (2018) the result revealed that computer simulation was more effective in enhancing students' achievement in chemistry than lecture method. The result of this study showed that the use of computer game, drill and practice had no significant effect on students' performance in Biology; this finding is similar to the findings of Mahmoudi et al. (2015) on the effect of computer games on speed, attention and consistency of learning mathematics among students. The results revealed that computer games had a significant effect on increasing the speed and attention of the experimental group in mathematical calculations compared to the control group. The result of this study showed that the use of computer game, drill and practice had no significant effect on students' performance in Biology; this finding is similar to the findings of Gambari et al. (2014) the results found out that the students taught geometry using computer animation performed significantly better in post-test and retention test than their counterparts taught geometry using instructional model and conventional method respectively. The result of this study showed that the use of computer game, drill and practice had no significant effect on students' performance in Biology; this finding is similar to the findings of Salami (2016) on the Effect of Computer Games on Students' Performance in Mathematics.

The results of the study revealed that the experimental group performed better in the post-test than the control group. The result of this study showed that the use of computer game had no significant effect on male and female students' performance in Biology; this finding agreed with the findings of Suheir (2016) on the Impact of Educational Games on the Academic Achievement of Fifth Grade Students in Science. The results of the study showed that statistically there is no significant difference in the post-test score for male and female students, due to the close level of achievement. The result of this study also

showed that the use of drill and practice had no significant effect on male and female students' performance in Biology; thesefindings agreed with the findings of Gee & Umar (2014) the effects of Drill and Practice Courseware on Students' Achievement and Motivation in Learning English. The findings revealed that there was no significant difference in the achievement score between male and female students after using the courseware.

Conclusion

Findings from the research provided the bases for the researcher to draw the conclusion that the use of Computer Game in teaching of Biology in senior secondary schools enhances students' performance and they tend to score higher in post-test administered to them using Computer Game and Drill and practice.

Recommendations

Based on the major findings of this study, the following were recommended: (i) that computer game, drill and practice should be used interchangeably to teach students since they performed well in the post-test; (ii) that computer game should be used in teaching male and female students since both of them performed well in the post-test.

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