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IMPACT OF DIGITAL GRAPHICS ON SECONDARY SCHOOL BIOLOGY STUDENTS' ACHIEVEMENT ON THE CONCEPT OF POLLUTION IN AGAIE METROPOLIS OF NIGER STATE

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Abstract
This study examined the impact of digital graphics (charts showing land, water and air pollution) on secondary school Biology students' achievement in the concept of pollution in Agaie Metropolis of Niger State. Quasi experimental design was adopted for the study. A total of 120 Secondary School I (SSI) Biology students of from two senior secondary schools formed the sample of the study. The schools were randomly assigned to experimental and control groups and intact classes were used in each of the schools. The instrument used for data collection was the Biology Achievement Test (BAT) which was developed by the researchers and validated by Biology lecturers in the Department of Biological Science, Federal University of Technology, Minna. The instrument was also pilot tested and reliability coefficient of 0.86 was obtained using Pearson product moment correlation coefficient formula. Two research questions were raised and answered using mean and standard deviation. Also, two null hypotheses were formulated and tested using t-test analysis. The result revealed a significant difference in the mean achievement score of students taught using digital graphics and those taught using conventional lecture method. It also revealed no significant difference in the mean achievement score of male and female students taught using digital graphics. Based on these findings, it was concluded that the use of digital graphics is more effective in improving students' achievement in Biology than the conventional lecture method. It is therefore recommended among others that Government should provide adequate and relevant digital graphics for the meaningful teaching and learning to take place at secondary school level of our educational system.

Key words: achievement, biology, chart, digital graphic, students and pollution.

Introduction

Science is a methodical approach of acquiring, understanding and interpreting knowledge for growth and development of both individual and the nation as a whole (Abakkor, 2012, & Awofobaju, 2006). The National Policy on Education stated that science subjects constitute part of the core subjects at the Secondary School Level. Study of science is important as knowledge of science is used for improving and changing attitudes and skills, improving the process of storing knowledge about an individual and its environment. Science has always been seen as the backbone of technological advancement therefore, its role in the modern world cannot be overemphasized (Lorence, 2006). Other importance of the knowledge of science include manufacturing and production of medicine, computer, mobile phones, air craft, space satellite, television to mention a few. The major branches of science comprise Biology, Physics, Chemistry and Mathematics (Abakkor, 2012).

Biology, as a core science subject, is basically concerned with the study of living organisms. It deals with the study of life, evolution of living organisms, the study of the structures and functions of living organisms and the processes by which they interacts with each other as well as with their environment. Biology studies how the world is structured, how it functions and what these functions are all about, how it develops, how living things came into existence, and how they react to one another and with their environment (Malshinkafa, 2010). It is central to many science related courses like medicine, pharmacy, biochemistry, nursing, agriculture etc.

This is why researchers and curriculum planners pays much attention to biology as an important science subject in the school curriculum (Maishinkafa 2010, Abdullahi, 2003).

Despite the importance of biology to individual and national development, study of biology especially at secondary school level is faced with numerous problems as a result of which the students' performance in biology has been bellow expectation. Abdullahi (2003) reported that, one of the major factors hindering effective teaching and learning of science (especially Biology) in Nigeria is lack of human and material resources. Other problems include lack of teacher training and retraining facilities, the curriculum content, curriculum implementation and evaluation, lack of relevant instructional materials, too large classroom sizes and lack of adequate laboratory equipment. Other researchers revealed that teachers' instructional strategies are unproductive and as such, students find many topics difficult to understand (Koroka & Ezenwa, 2009; WAEC, 2013). Many biology teachers employed several methods in teaching to achieve meaningful learning and understanding by the students (Zenbari & Blume, 2009). For instance, Ifeakor (2005) emphasized the use of commercially produced computer assisted instructional package to teach biology.

Others ascertain that, students' poor achievement in biology can be attributed to lack of qualified teachers to handle biology (Abakkor, 2012; Thesaurus, 2013; Maishinkafa, 2010). According to them, most teachers employs the use of conventional lecture method which is a classroom-based method characterised by lectures and instructions by the teacher which make it to be a teacher-centred method of instruction. This teacher-centred method of instruction emphasizes on learning through the teacher's guidance whereby the teacher always talk to the students instead of encouraging them to interact and actively participate in teaching and learning process. In most classes, students are subjected to rote learning, where they depend on memorization without understanding the subject. This method makes students to become passive rather than active learners (Lawal, 2006; Maishinkafa, 2010; Udousoro, 2011 & Abdullahi, 2003).

However, various efforts have been made by researchers and science educators to come up with instructional strategies that will promote effective teaching, learning and understanding of biology concepts as well as improved students' achievement but all proved unsatisfactory as is shown in table 1.1

Table1: Performance of Nigerian Biology Students at WASSCE, 2008-2013

YEAR	TOTAL	(A1-C6)PASS	(D7-E8)PASS	FAILURE
2008	1005894	298555(29.68)	326092(32.41)	348890(34.68)
2009	1051557	375850(35.74)	313827(29.84)	338491(32.18)
2010	1137131	559854(49.23)	292317(25.70)	284960(72.96)
2011	1238163	413211(33.27)	397353(32.09)	402148(32.47)
2012	418423	185949(44.44)	114697(27.41)	110417(26.38)
2013	468546	204725(43.69)	114020(24.33)	119260(25.45)

Source: *WAEC, 2013*

Table 1 shows the percentage of students that passed biology at the Senior School Certificate Examination (SSCE) conducted by the West African Examination Council (WAEC). As the table indicates, the number of students that passed biology at credit level (A1-C6) was consistently less than 50% for a period of six years (2008 - 2013).

Therefore, it is necessary to look into current methods of teaching biology in order to get a suitable strategy that would lead to effective teaching and learning of biology. This study

therefore, aimed at investigating the impact of digital graphics (charts showing land, water and air pollution) on secondary school biology students' achievement on the concept of pollution. The study also investigated the impact of digital graphic on gender achievement among the students.

Aim and Objectives of the Study

The aim of this study was to investigate the impact of digital graphics (charts showing land, water and air pollution) on secondary school biology students' achievement on the concept of pollution. Specifically, the study attempted to achieve the following objectives:

i. Determine the impact of digital graphics (charts showing land, water and air pollution) on secondary school biology students' achievement on the concept of pollution
ii. Determine the gender influence of digital graphics (charts showing land, water and air pollution) on secondary school biology students' achievement on the concept of pollution.

Research Questions

The following research questions were raised to justify the study:

i. Will there be differences between the mean achievement scores of students taught the concept of Pollution in biology using digital graphics and those taught with conventional method?
ii. Will there be differences between the mean achievement scores of male and female students taught the concept of Pollution in biology using digital graphics?

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 significant level

HO_1 : There is no significant difference in the achievement mean scores of secondary school biology students taught the concept of Pollution using digital graphics and those taught without digital graphics.

HO_2: There is no significant difference in the achievement mean scores of male and female students taught the concept of Pollution using digital graphics.

Methodology

The research design adopted for this research was a quasi-experimental design (Non-equivalent, Non-randomized, and Experimental - Control group design). The experimental group students were taught the concept of pollution in biology using digital graphics (chart showing land, water and air pollution) while the control group students were taught the same concept without digital graphics but a conventional lecture method was used on them.

Table 2: Research Design Format

Group	Pretest	Treatment	Posttest
Experimental Group	O_1	X	O_2
Control Group	O_3	C	O_4

Where: O_1 & O_3 =Pretest, O_2 & O_4= Posttest, X – Treatment and C – Conventional method

The target population comprises of 495 (male = 231 and female = 264) Senior Secondary School One (SSI) Biology students in two Niger State government owned co-educational secondary schools in Agaie metropolis while the sample population comprises of 120 Senior Secondary School One (SSI) Biology students.

Two schools were purposively selected for the study. This is because there are only two

government owned co-educational schools in Agaie metropolis. The selected schools were randomly assigned into experimental and control groups. From the selected schools, two intact classes were also randomly selected for the study.

The instruments used for the study were the treatment and test instruments.
Treatment Instrument: This was the digital graphics (charts showing land, water and air pollution). The concept of pollution was drawn as chart in form of concept map by the researchers in collaboration with an expert in instructional development. The charts were drawn by strictly following the SSI curriculum.

Test Instrument: This was Biology Achievement Test (BAT) test items on pollution. It consists of (20) multiple choice test items on pollution with four options (A - D) but only one of them is correct. The test items used covered all the topical areas of pollution in accordance with the SSI syllabus and they were drawn from the West African Examination Council (WAEC) past question papers. The above instruments were both validated by three biology teachers to determine their appropriateness before being used for the study.

Reliability of the instrument was determined at Day secondary school Lapai using 20 students (male = 10 and female = 10). Day secondary school Lapai was used because there are only two co-educational secondary schools in Agaie and Lapai is not too far from Agaie. Test-retest method was use to collect two sets of data during pilot test. The two set scores were analyzed using Pearson product moment correlation coefficient formula and r = 0.85 was obtained.

After the researchers were granted permission to use the selected schools and also introduced to both biology teachers and students of the schools, they administered the Pretest question on both groups to determine their entry behaviour. The experimental group students were taught the concept of pollution in biology using digital graphics (charts showing land, water and air pollution) while the control group students were taught the same concept without digital graphics but a conventional lecture method was used on them. After the treatment which lasted for three weeks, a week revision was held after which the posttest was administered on them. The research lasted for six weeks.

The pretest and posttest scores collected were analyzed using mean, standard deviation and t-test statistics. Statistical Package for Social Sciences (SPSS) 20.0 version was used to analyze the data obtained. Data analyzed were used to answer the research questions and also test the hypotheses.

Results and Discussion

Analysis of Pretest and Posttest scores

Table 3: t-test Analysis of Pretest Scores of Experimental and Control Groups

Group	N	Df	Mean	SD	t-cal	P-value
Experimental Group	67	118	8.43(42.15%)	3.09	0.918^{NS}	0.360
Control Group	53		7.93(39.65%)	2.99		

NS: Not significant at p >0.05

Table 3 shows summary of t-test comparisons between the mean achievement scores of control group and the mean achievement scores of the experimental group in the pre-test. This indicated that there was no significant difference in the mean achievement of the two group (t = 0.918, df = 120, p >0.05). Hence it was observed that the scores of both experimental and control groups where at equal level before the treatment.

Ho_1 . There is no significant difference in the achievement mean scores of secondary school biology students taught the concept of pollution using digital graphics and those taught without digital graphics.

Table 4: t-test Analysis of Posttest Scores of Experimental and Control Groups

Group	N	Df	Mean	SD	t-cal	P-value
Experimental. Group	67	118	13.45(67.25%)	2.44	8.630	0.000
Control Group	53		9.67(48.35%)	2.42		

Significant at $p < 0.05$ alpha level

Table 4 Show the mean scores and standard deviation of the experimental and control group students taught the concept of pollution using instructional materials and conventional method. The mean scores and standard deviation of experimental group are 13.45 and 2.44 and that of control group are 9.67 and 2.42 respectively. This result indicated that there was a significant difference in the achievement mean score of the experimental group and control group ($t = 8.630, df = 120, p$ □0.05). Hence the null hypothesis that there is no significant difference in the achievement mean scores of secondary school biology students taught the concept of Pollution using digital graphics (charts showing land, water and air pollution) and those taught with conventional lecture method was therefore rejected.

HO_2. There is no significant difference in the achievement mean scores of male and female students taught the concept of Pollution using digital graphics.

Table 5: t-Test Analysis of Posttest Scores of Male and Female Students in the Experimental Group

Group	N	Df	X	SD	t-cal	P-value
Male	29	65	13.83(69.15%)	2.39	1.12^{NS}	0.269
Female	38		13.16(65.85%)	2.47		

NS= Not significant at $P > 0.05$ alpha level

Table 5 shows the achievement mean scores of male students of the experimental group The mean score and standard deviation of the male students are 13.83 and 2.39 respectively while that of the female students are 13.16 and 2.47.The result indicates that there is no significant difference in the mean achievement score of male and female students taught the concept of pollution using digital graphics ($t = 1.116, df = 65, p$ □0.269). Hence the null hypothesis two which states that there is no significant difference in the achievement mean scores of male and female students taught the concept of Pollution using digital graphics is thereby accepted, this implies that there is no significant difference between the two groups on their respective achievement.

Findings of the Study

The following were the major findings of the study:

(i) Digital graphics used has significantly improved biology students' achievement on the concept of pollution. This is because the experimental group students exposed to digital graphics achieved better than the control group students.

(ii) Male and female students exposed to digital graphics achieved equivalently on the concept of pollution. This implies that the digital graphics (charts showing land, water and air pollution) improved the achievement of both male and female students equally.

Results

The pretest scores in table 3 shows that the control group (mean of 7.93 and standard deviation of 2.99) and experimental group (mean of 8.43and standard deviation of 3.09) are equivalent because the p-value is greater than the alpha level of significance (p = 0.918 greater than 0.05 alpha level), this means the experimental and the control group are equal in terms of their previous knowledge before the application of the treatment.

The result of the t-test as shown in table 4 shows that the computed t-value at (120) = 8.630 while the p-value (0.000) is less than the 0.05 alpha level of significance. The results show that the experimental group performed better than the control group. This means that the use of instructional material can enhance student performance in Biology at the senior secondary school level. This result was in line with the findings of previous studies (Aiyede, 2008; Akubulo, 2004), which provided evidence attesting to the efficacy of instructional material in facilitating meaningful learning. Koroka, Ezenwa, Wushishi & Omalu (2015) also found that the impact of concept mapping techniques on students' achievement was significant in Ecology and Genetics in Nigeria. Alice (2007) came into conclusion that those who utilize instructional material promote learning.

The results of the t-test as shown in table 5 shows that the computed t-value at t (65) = 1.116 while the p-value (0.269) is greater than the 0.05 alpha level of significance. Therefore, there is no significant difference in the mean achievement scores of male and female Biology students exposed taught with instructional material. This means that instructional material can be used to enhance both the male and female academic performance in senior secondary schools in Nigeria. This finding is in line with that of Eze (2008), who found no significant difference in the performance of male and female students.

Conclusions

The results revealed that students exposed to instructional materials in Biology achieved higher than those not exposed to instructional materials. The results also revealed that instructional materials are gender friendly. This implies that exposing students to Instructional Material will enhance their higher achievement.

Recommendations

In view of the findings of this research work, the following recommendations were made:

(i) Teachers especially in Biology should be sent on in- service training on how to effectively use instructional materials during teaching.

(ii) School administrators should support and give necessary encouragement to teachers for effective utilization of instructional materials during teaching.

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