Effect of Multimedia on Junior Secondary School Students' Achievement, Interest, and Retention in Basic Science and Technology in Niger State

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Abstract
This study was designed to determine the effect of multimedia on junior secondary school students achievement and interest in Basic science and Technology in Niger State. The study adopted a pre-test, post-test, non-equivalent control group, quasi-experimental research design which involved groups of students in their intact class assigned to experimental group and control group. The sample size for this study was 117 JSS II basic science and technology students which comprised 84 boys and 33 girls. Two research questions and two null hypotheses tested at 0.05 level of significance, guided the study. The instrument used for data collection wereBasic science and Technology Achievement Test (BSTAT) and Basic science and Technology Interest Inventory (BSTII). The trial test for determining the coefficient of stability of the BSTAT was carried out using test re-test reliability technique. Pearson product moment correlation coefficient of the instrument was found to be 0.72 while the use of KR20 in assessing the test of internal consistency yielded a reliability index of 0.85. Mean was used to answer the research questions, while ANCOVA was employed to test the null hypotheses. The study found out that the use multimedia is more effective in improving students' achievement and interest in basic science and technology than conventional method. Consequently, it was recommended that attention should be accorded multimedia literacy and schools should be equipped with necessary ICT facilities to leverage the potentials of ICT in Nigerian schools.

Introduction

Science and technology have contributed in no small measure to development and comfort of the modern world. Science has come to be recognized as the foundation upon which the bulk of the present day technology break through is built. It is no longer in dispute that the prestige and political power of any nation relies on its level of science and technology as a requirement for the development of any country. (Cepri, 2006; Dennen, 2003; Jaivis, 1998; Knoll, 2004; Kotrilik, 2004 & Preciado, 2004). Technology the world over is dynamic. With advancement in technology, electronic gadgets and other products that are imported or assembled in Nigeria are coming with new devices to such an extent that technological development is in a constant state of flux and change. The influence of technological development in ICT industries has rendered traditional skills inadequate for work while creating the need for new and often sophisticated skills. Capri, Ozseevgec, Sayilkan and Emre (2004) noted that because most students get information via visual content sources like computer which are used in daily life very much, it is more difficult to teach students by conventional means. If principles of how students learn are taken into account, richness of the visual content makes instruction more lasting and effective Mudasiru and Adedeji, (2010). One possible solution to these challenges is the use of multimedia instructional teaching approach.Multimedia, is the combination of various digital media types such as text, images, audio and video, into an integrated multi-sensory interactive application or presentation to convey information to an audience. Traditional educational approaches have resulted in a mismatch between what is taught to the students and what the industry needs. As such, many institutions are moving towards problem based learning as a solution to producing graduates who are creative; think critically and analytically, to solve problems. In this paper, the researchers focus on using multimedia technology as an innovative teaching and learning strategy in a problem-based learning environment by giving the students a multimedia project to train them in this skill set.

Students' achievement refers to performance in a school subject as designated by a score or mark obtained in an achievement test. According to Anene (2005) achievement is quantified by a measure of the student's academic standing in relation to those of other students of his age. Interest is a persisting tendency to pay attention and enjoy some activities. Interest has been viewed as emotionally oriented

behavioural trait which determines a student's vim and vigour in tackling educational programmes or other activities (Chukwu, 2002). The increasing effects of globalization and the rapid rate of technological changes on work places have informed the recommendation by United Nations, Educational, Scientific and Cultural Organization (UNESCO) and International Labour Organization (ILO) (2002) that all technical and vocational education system in the 21st century should be geared towards lifelong learning. This requires that schools should in addition to academic skills; inculcate workplace basic skills such as learning to learn, creativity, problem solving skills, collaborative skills and higher order thinking skills in order to increase the students' flexibility and job mobility which will make them adaptable to the present and envisaged changes (Hallak & Poisson, 2000; & Paris, 1998). In this context, Rojewski (2002) noted that a shift from teacher-centred instruction to learner-centred instruction is needed to enable students acquire the new 21st century knowledge and skills. In order to attain to students centered method of teaching Basic science and technology, multimedia was to be used.

Purpose of the Study

1. Determine the achievement scores of students taught Basic Science and Technology with multimedia and those taught using the conventional teaching methods.
2. Determine the interest of students taught Basic Science and Technology with multimediaand those taught using the conventional teaching methods.

Research Questions

The following research questions were formulated to guide this study:

1. What are the mean achievement scores of students taught Basic Science and Technology with multimedia and those taught using the conventional teaching methods?
2. What are the mean interest scores of students taught Basic Science and Technology with multimediaand those taught using the conventional teaching methods?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

Ho_1: There is no significant difference between the mean achievement scores of students taught Basic Science and Technology with multimediaand those taught using conventional teaching methods.

Ho_2: There is no significant interaction effect of treatments given to students by gender with respect to their mean scores in the basic science and technology achievement test.

Methodology

The study was conducted using quasi–experimental design. Specifically, the pre - test post – test non-equivalent control group design was used. This study was carried out in Niger State. The population for the study comprised all the 161 JSSII basic science and technology students from the nine junior secondary schools offering basic science and technology at BECE level. This is made up of 120 boys and 41 girls.The sample size for this study was 117 JSS II basic science and technology students which comprised 84 boys and 33 girls. Purposive sampling technique was used to select six out of the nine Junior secondary schools that offer basic science and technology in Niger State. The reason for the selection was that those six schools are of the same equivalent example; they have adequate computer sets, qualified basic science and technology teachers with ICTknowledge and conducive ICT laboratories needed for the research work.

Simple random sampling by balloting was used to select 3 intact schools as experimental group and 3 intact schools as control group. Three schools were labeled experimental group and 3 schools also labeled control group. The 6 schools were mixed in a sack and were selected randomly. The populations of the 6 schools were used as sample size since the schools were purposively selected for the study. The Basic Science and Technology Achievement Test was a 45 item multiple choice type which was developed by the researchers from the eight content areas used for the study. The multiple choice items were drawn using the table of specification. The Basic Science and Technology Achievement Test was face and content validated by 3 experts in industrial and technology education department all from Federal University of Technology, Minna.The reliability of the Basic Science and Technology Achievement Test was found using the test retest reliability technique and the Kuder Richardson 20 (K-R20) approach. The test retest reliability coefficient of the BSTAT was found to be 0.72 using Pearson Product Moment

Correlation Coefficient while the use of KR20 in assessing the test of internal consistency yielded a reliability index of 0.85. The test scores generated from the pre-test and post-test were collected using Basic Science and Technology Achievement Test (BSTAT) and Basic science and technology Interest Inventory (BSTII). Mean was used to answer the research questions while the analysis of covariance (ANCOVA) was used for testing the hypotheses at 0.05 level of significance.

Result

Research Question 1

What are the mean achievement scores of students taught basic Science and Technology with multimedia and those taught using the conventional teaching methods?

Table 1

Mean of Pre - test and Post - test Scores of Experimental and Control Groups in the Achievement Test

Group	N	Pre – test $\overline{X}$	Post - test $\overline{X}$	Mean Difference
Experimental	68	5.22	40.51	35.29
Control	49	5.28	20.16	14.88

The data presented in Table 1 show that the experimental group taught Basic Science and Technology with multimedia had a mean achievement score of 5.22 in the pre - test and a mean achievement score of 40.51 in the post - test making a pre-test, post-test mean gain in experimental group to be 35.29. The control group taught basic Science and Technology with conventional teaching method had a mean achievement score of 5.28 in the pre - test and a post - test mean achievement score of 20.16 with a pre-test, post-test mean gain of 14.88. With this result, the students in the experimental group performed better in the achievement test than the students in the control group.

Research Question 2

What are the mean interest scores of students taught basic Science and Technology with multimedia and those taught using the conventional teaching methods?

Table 2

Mean of Pre - test and Post - test Scores of Experimental and ControlGroups in the Interest Inventory Items

Group	N	Pre – test $\overline{X}$	Post - test $\overline{X}$	Mean Difference
Experimental	68	122.56	143.29	20.73
Control	49	122.10	133.33	11.23

Table 2 shows that the experimental group taught basic Science and Technology with multimedia had a mean interest score of 122.56 in the pre - test and a mean interest score of 143.29 in the post - test making a pre - test, post - test mean gain in experimental group to be 20.73. The control group taught basic Science and Technology with conventional teaching methods had a mean interest score of 122.10 in the pre - test and a post - test mean interest score of 133.33 with a pre - test, post - test mean gain of 11.23. This result indicates that interest of students in the experimental group is higher than the interest of the students in the control group

Hypotheses

Ho_1: There is no significant difference between the mean achievement scores of students taught basic science and technologywith multimedia and those taught using conventional teaching methods.

Ho_2: There is no significant interaction effect of treatments given to students and their gender with respect to their mean scores in the basic science and technology achievement test.

Table 3s
Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean Scores of Experimental and Control Groups and Interaction Effect of Treatment given to Students and their Gender with Respect to their Mean Scores in the Basic Science and *TechnologyAchievement Test*

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11860.455	4	2965.114	554.841	.000
Intercept	2686.001	1	2686.001	502.613	.000
- - -	17.395	1	17.395	3.255	.074
Groups	9925.597	1	9925.597	1857.000*	.000
Gender	34.999	1	34.999	6.549	.012
Groups * Gender	20.171	1	20.171	3.774	.055
Error	598.536	112	5.344		
Total	132203.000	117			
Corrected Total	12458.991	116			

***Significant at sig of F<.05**

The data presented in Table 3 shows F-calculated values for test of significance between the mean scores of experimental and control groups and interaction effect of treatment given to students by their gender with respect to their mean scores in the basic science and technology achievement test. F-value for groups is 1857.000 with significance of F at .000, which is less than .05. The null-hypothesis is therefore rejected at .05 level of significance. With this result, there is a significance difference between the mean scores of students taught basic science and technology with multimedia and those taught using conventional teaching methods in the achievement test. The F value for interaction effect (Group Gender) is 3.774 with significance of F .055 which is greater than .05. Therefore, the null hypothesis is accepted. This indicates that there is no significant interaction effect of treatment given to students and their gender with respect to their mean scores in the Achievement Test.

Discussion

The data presented in Table 1 provided answer to research question one. Finding revealed that students taught basic science and technology with multimedia had a higher mean achievement score than those students taught using the conventional teaching method in the achievement test. In the same vein, analysis of covariance was used to test the first hypotheses, Table 3, at the calculated F-value (1857.000), significance of F (.000) and significance level of .05. There was a statistically significant difference between the mean scores of the group taught with multimedia and those students taught using the conventional teaching methods in the achievement test. The implication of this finding therefore is that multimedia is more effective than conventional teaching methods in enhancing students' achievement in basic science and technology. This finding is similar to the finding of Odogwu (2002) who found that there was a significant difference in the mathematics achievement of experimental group taught with CTD and control group taught with conventional teaching methods in favour of the experimental group.Kulik, Bangert and Williams (1983) in their study on "Effects of Computer – Based Teaching on secondary school students" also found out that the use of CTD in teaching electronics students improved their achievement in the subject than the students taught electronics with traditional instructional methods. The findings is also in line with the assertion of Cotton (2001) who pointed out that the use of computer based learning produces achievement effects superior to those obtained with traditional instruction. Cotton explained further that student learning rate is faster with computer based learning than with conventional instruction. This finding is also in line with the finding of Audu (2007) who carried out a study on effect of constructivist approach on students' performance in building construction trade and found experimental group had higher mean scores that the control group in the pre-test and post-test.This is an indication that treatment has positive effects on students' achievement which is also in agreement with the finding of this study. The difference in the academic achievement of the students in basic science and technology is similar with the studies carried out in other fields of learning on students' academic achievement by Demen (2003), Olson and Pratt (2000) Coitman (2002) and Kotrlik (2004) who in their separate studies

found that the adoption of any treatment as an instructional framework greatly imploies students' academic achievement. The result could be explained by the fact that teachers' adoption of various instructional techniques appeal to the students' various intelligence address their diverse learning styles and consequently increase their motivation to learning and improve their academic achievement.This support the view of Jarvis (1998) students learn best when multimedia is used for instruction delivery. The research explained further that students learn better and retain more of what is taught in the class.

Analysis of Covariance was used to test hypothesis two Table 3. At the calculated F-value (3.774), significance of F (.055) and confidence level of 0.05 there was no significant interaction effect of treatment given to students and their gender with respect to their mean scores in the Achievement Test. This result showed that the effectiveness of treatments on students' achievement in basic science and technology does not depend on the level of gender. Hence, there were no differential effects of treatments over levels of gender (male and female), which implies that multimedia is more effective than conventional teaching methods in improving students' achievement in basic science and technology regardless of Gender. It has been established that the learner's own feeling toward the subject matter will largely determine how much of the material will be learned and how thoroughly it will be learned. According to Ogwo and Oranu (2006) to facilitate learning, the teacher must secure and sustain the attention and interest of the learner. They emphasized that unless attention is maintained and interest sustained, learning can hardly be accomplished. A state of sustained interest is shown by continued and determined readiness to learn on the part of the student as evidenced by a state of readiness to learn. Multimedia enhances how students learn by supporting four fundamental characteristics of learning: active engagement, participation in groups, connections to real-world contexts, frequent interaction/feedback (Basham, 2007). Owing to the dominance of the teacher in the traditional teaching approaches. Opara (2002) observed that the method hardly increased students' enthusiasm and interest. Teaching methods such as use of multimedia technology provides students' interaction with the learning environment which invariably provides meaningful learning activities. Meaningful learning activities built on prior knowledge motivate students and foster their interest in their effort to executively control their own cognitive process.

Conclusions

Application of multimedia technology to all aspects of human endeavour coupled with the need to create student-centred classroom to engage learners in their leaning tasks, improve learners' interest and consequently achievement in the school subjects has necessitated the use of multimedia in teaching. This study has found out that multimediaimproved students' achievement and interest in basic science and technology than the conventional teaching methods. Also, the study found out no significant interaction effect of treatments given to students and their gender in the basic science and technology achievement and interest. This simply means that the effectiveness of multimedia on students' achievement and interest in basic science and technology does not depend on gender. Hence, irrespective of gender, students studying basic science and technology will record improved performance in their achievement and interest in basic science and technology when multimedia is used for teaching. These results therefore revealed that multimedia is a viable alternative to the conventional teaching methods in teaching basic science and technology. Moreover, science and technology provides powerful tools to support the shift to student-centred learning and is capable of creating a more interactive and engaging learning environment for teachers and learners.

Recommendations

Based on the findings of this study, the following recommendations are made;
More attention should be accorded multimedia literacy and operation in the schools and relevant multimedia should be developed for use within the Nigerian school systems. In addition, Nigerian public schools should be equipped with necessary ICT facilities to leverage the potentials of ICT in Nigerian schools. Basic Science and technology teachers in Niger State should adopt the use of the multimedia to teach. Further empirical studies should be carried out on the use of multimedia for instructional purposes, on different subjects and at different levels to provide sound basis for the integration of ICT in Nigerian schools. Curriculum planners such as Nigerian Educational Research and Development Council (NERDC) should consider review of curriculum for basic science and technology for secondary schools with a view to incorporating the multimedia. Since the findings of this study showed that students who worked on the multimedia performed better than those who worked on the conventional teaching method, students should be encouraged to develop interest in the use of multimedia.

Niger State Government should provide relevant equipment for teaching basic science and technologyin all the secondary schools. Niger State Ministry of Education and principals of Niger State Junior Secondary Schools should organize seminars, conferences and workshops to sensitize technical teachers on the use of multimedia.

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