

Impact of Multimedia Instructional Strategies on Students' Achievement and Retention in Basic Science and Technology in Minna, Niger State

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Abstract: This study compared the impact of multimedia instructional strategies on students' achievement and retention in basic science and technology in junior secondary schools in Niger State. This study was conducted in Minna, Niger State. A sample of one hundred and two (102) JSSII students was involved in the study. The design of this study was quasi-experimental research design as there was no randomization of subjects into classes. Intact classes were used. Four research questions and four research hypotheses guided the study. Research questions were answered using mean and standard deviation while Analysis of Covariance (ANCOVA) was used in testing the hypotheses at 0.05 level of significant. Results from the study revealed that students who were taught basic science and technology using multimedia instructional strategies achieved and retained higher than those taught without instructional strategies. Also students who were taught basic science and technology using multimedia instructional strategies as tool achieved and retained higher than those taught without multimedia as tutor. The study equally revealed no significant difference in the mean achievement and retention scores of male and female students. Some of the recommendations made include; that teachers should pay more attention to using multimedia instruction as tool instead of using it as lecture method for effective teaching and learning of basic science and technology.

Keywords: multimedia, students, basic science and technology, achievement, retention

I. INTRODUCTION

Junior Secondary School education is both pre-vocational and academic, universal and compulsory for all Nigerian children. The goal of Junior Secondary School is to enable students to acquire knowledge and skills which will prepare them for useful living within the society. In specific term, Junior Secondary School Education should give learners opportunity to discover and develop their potentials. The three main objectives of Basic science and technology as stated in the national policy of Education are: to Provide pre-vocational orientation for further training in Technology; to provide Basic science and technology literacy for everyday living, and to stimulate creativity (Ajani, 2009; FRN, 2013).

Basic science and technology is a subject borne out of the desire of educationists of Nigeria origin to have an education that will fit into the culture and development trend of the

nation. This is the kind of education that will prepare students towards acquiring manipulative skills for effective participation in nation building. This subject in addition to the above introduces a child into the world of technology. The knowledge of which can help the Nigerian child to acquire technical skills in relevant fields. But in Nigeria society today the reverse is the case. Most of these aspirations are not met and these can be traced to a number of problems which include:

Curriculum inadequacy; Problem of Funding; Problem of Equipment installation; Shortage of Trained Technical Teachers; Wrong Method of Education and Educational Policy; Inadequate Facilities and Instructional Media; and Poor Methods of Instructional Delivery (Uwaifo & Edigin, 2011).

Presently, the common method of instruction applied by teachers in junior secondary schools in Nigeria is lecture method which involves verbal presentation of subject matter/content. Lecture method as conventional method, is didactic, stereotype and non-result oriented. It is often described as "talk and chalk" method because its presents information to the students who merely listen. Teacher do all the talk while students listening and copy note on the chalkboard after the lesson (Akpoghol *et al.*, 2016). This teacher-centered approach dominate the educational system in Nigeria except few private schools that are well equipped with modern Information and Communication Technology (ICT) facilities such as computer laboratories with computers and internet facilities, interactive whiteboards, learning software, multimedia and many others.

Multimedia is the combination of instructional methods that encourage learners to engage in active learning by mentally representing materials in words and pictures making connections between the pictorial and verbal representations (Krishnasamy, 2007). Kumar (2013) asserted that multimedia are instructional materials and interactive application that integrate text, color, graphic images, audio, animation, audio sound, and full motion video in a single application. According to Oshinaike and Adekunmisi (2012) opined that multimedia could be interpreted as a combination

of data carriers, such as video, CD-ROM, floppy disks, Internet and software in which the possibility for an interactive approach is offered. Salisu (2015) opined that multimedia approach can be used in teaching subjects like Geography, Biology, Chemistry, Physics, and Mathematics among others.

A multimedia aided instruction engaged students' interest, and encouraged them to collaborate, to inquire and to explore effectively, far beyond the bounds of the school (Galope, 2013). Research has shown that people remember 20% of what they see, 40% of what they see and hear, but about 75% of what they see and hear and do simultaneously (Krishnasamy, 2016). With multimedia, the communication of information can be done in a more effective manner and it can be an effective instructional medium for delivering information. According to Chapman (2013), the use of multimedia in teaching and learning processes has the potential to improve instruction by creating a technology-based, student-centered learning environment that allows students to take charge of their own learning. Using multimedia in classroom provides students with suitable learning resources according to their learning

Lecture method which is one of the teaching methods of science has been criticized heavily by many researchers as having the tendency to render the learner passive in the learning process and it does not help students construct their own understanding (Ebira, 2010; Okwilagwe, 2002; Oke, 2015). They also asserted that the uninspiring teaching methods adopted by science teachers for students' achievement.

Achievement according to Adeyemi (2008) is the scholastic standing of a student at a given moment. It has to do with the successful accomplishment of goal(s). The purpose of testing an achievement is to help the teacher and the students evaluate and estimate the degree of success attained in learning a given concept. It is also useful in testing the retention of information and skill. It is equally appropriate in determining the efficiency of instruction. One of the issues at stake in education today is students' achievement measure in relation to teaching and the overall success of learning outcome. Use of place-based learning teaching method in teaching simple machine by basic science and technology teachers may make Basic science and technology lesson objective stimulating and interesting to the students

Retention which is an ability to remember or recognize the content that has been learned or experienced is an importance issue in teaching and learning.

Learning is complete when knowledge can be transferred into a new situation. The need to have varied practice tools is to facilitate transfer and enhance retention process. Studies on types of learning tools that promote students' retention is yet to be concluded. For instance, Shieh & Yu (2016) revealed that guided discovery instruction influenced learning retention.

Statement of the Problem

Students' achievement in basic science and technology has been quite unsatisfactory over the years. Consequently, most students could not pass the "NABTEB/NECO" Examination which serves as a ticket to wage-employment, self-employment or transiting to tertiary institutions. When students could not obtain the ticket (certificate) after graduation as a result of poor achievement, they become easy prey to social menace such as stealing, thuggery, advance-fee-fraud, political extremism and even some resort to "Okada" riding. There is need to make frantic efforts of improving pedagogical styles in order to enhance better understanding of difficult concepts in Basic science and technology now that achievement in the subject is alarming. Some researchers have attributed students' poor achievement to poor teaching/instructional method arising from mismatch between the students and the teachers/instructors. The method employed by the instructors are not symmetrically aligned with modern ways of teaching new generations, when teachers are teaching in the class, students are also busy browsing with their phones or iPads.

Nowadays, it is obvious that technological developments have resulted into new ways by which students collect educative information/material especially via multimedia package. Therefore, it is highly necessary to introduce the new technological tool into teaching and learning Basic science and technology. Therefore, the problem of the study put in question form; what is the impact of multimedia instructional strategies on students' achievement and retention in basic science and technology in Minna, Niger State?

Purpose of the Study

1. Examine the impact of multimedia instructional strategies on students' achievement in Basic science and technology.
2. Examine the impact of multimedia instructional strategies on students' retention of learning in Basic science and technology.

Research Questions

1. What is the impact of multimedia instructional strategies on students' mean achievement scores in basic science and technology?
2. What is the impact of multimedia instructional strategies on students' mean retention of learning scores in basic science and technology?

Hypotheses

The following null hypothesis were tested at .05 level of significance

HO₁: There is no significant difference between the mean achievement score of students taught basic science and technology with multimedia instructional strategies and those taught with conventional learning method.

HO₂: There is no significant difference between the mean retention scores of students taught basic science and technology with multimedia instructional strategies and those taught with conventional learning method.

II. METHODOLOGY

Quasi-Experimental design was used for this study. The study was carried out in Minna, Niger State. The population for this study comprised of all third year junior secondary school students in Minna, Niger State. Stratified random sampling was used to select 102 JSS III students from two junior secondary schools in Minna, Niger State. The following two instruments were developed and used for the purpose of data collection by the researcher; Basic science and technology Achievement Test (BSTAT). The BSTAT was subject to face validation. The face validation was done by two experts in Industrial and Technology Education Department, Federal University of Technology, Minna. A trial test was conducted to determine the reliability of the test instrument (BSTAT) in Government Secondary School, Chanchaga which is not part of the selected schools. The 40 items were administered on a sample of forty (40) second year students in the school. The

reliability coefficient of the test was calculated to be 0.81 using Kuder-Richardson 21 (K-R 21) method. The scores obtained in the administration of the two tests were correlated using Pearson’s Product Correlation technique. The coefficient of stability computed was 0.96. The data generated from this study was analysed using the statistical package for Social Sciences (SPSS). The data collected from the administration of pre-test, post-test, retention test (lead post-test) was analysed using mean and standard deviation to answer the research questions. The pre-test post-test mean gain of each of the treatment group was computed to determine the effects of multimedia instructional strategies and conventional method on students’ achievement and retention in basic science and technology. Meanwhile, analysis of covariance (ANCOVA) was used to test the Hypotheses formulated at 0.05 level of significance.

III. RESULTS

Research question 1

What is the impact of multimedia instructional strategies on students’ mean achievement scores in basic science and technology?

Table 1 Mean and standard deviation of pretest and post test scores of Experimental and control Groups in the Basic science and technology Achievement Test.

| Group | No of Sample | Pretest | | Post test | | Mean Loss |
|--------------|--------------|---------|------|-----------|-------|-----------|
| | | X | S.D | X | S. D | |
| Experimental | 49 | 18.13 | 9.81 | 64.95 | 7.98 | 46.82 |
| Control | 53 | 19.63 | 6.77 | 43.23 | 10.06 | 23.61 |

The data presented in Table 1 shows that the experimental group had a mean score of 18.13 in the pre-test and a mean score of 64.95 in the post-test making a pre-test, post-test mean gain in experimental group to be 46.82. The control group had a mean score of 19.63 in the pre-test and a post-test mean of 43.23 with a pre-test, post-test mean gain of 23.61. With this result, the students in the experimental group taught basic science and technology using multimedia instructional strategies improved more than the control group taught using

conventional learning strategy. Hence, multimedia instructional strategies are more effective than the conventional teaching method on students’ achievement in basic science and technology.

Research Question 2

What is the impact of multimedia instructional strategies on students’ mean retention of learning scores in basic science and technology?

Table 2 Mean and Standard Deviation of the posttest and retention scores of experimental and control groups in basic science and technology

| Group | No of Sample | Posttest | | Retention test Mean | | |
|--------------|--------------|----------|--------------|---------------------|------|------|
| | | Mean | Standard Dev | Mean | S. D | Loss |
| Experimental | 49 | 64.95 | 9.87 | 59.13 | 7.26 | 5.82 |
| Control | 53 | 43.23 | 8.77 | 36.21 | 7.58 | 7.02 |

Table 2 shows that the experimental group had a mean score of 64.95 in the post-test and a mean score of 59.13 in the retention test with mean loss score of 5.82. The control group had a mean score of 43.23 in the post-test and retention mean score of 36.21 with a post-test, retention mean loss of 7.02. With this result, the experimental group retention of learning is higher than the retention of learning of the student in the control group. The results therefore indicate that students taught basic science and technology with web-based

instructional techniques retained their learning better than those taught with the conventional learning strategy.

Hypotheses

HO₁: There is no significant difference between the mean achievement score of students taught basic science and technology with multimedia instructional strategies and those taught with conventional learning Method.

Table 3: Summary of Analysis of covariance (ANCOVA) for Test of Significance of effect of treatment on students’ achievement in Basic science and technology.

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|-----------------|-------------------------|-----|-------------|---------|------|
| Corrected Model | 1410.617 ^a | 2 | 705.309 | 8.460 | .000 |
| Intercept | 27465.914 | 1 | 27465.914 | 329.443 | .000 |
| Pretest | 59.831 | 1 | 59.831 | .718 | .399 |
| Treatment | 1086.101 | 1 | 1086.101 | 13.027 | .000 |
| Error | 8253.696 | 99 | 83.371 | | |
| Total | 534408.000 | 102 | | | |
| Corrected Total | 9664.314 | 101 | | | |

a. R Squared = .146 (Adjusted R Squared = .129)

The data presented in Table 3 shows F-calculated values for mean scores of experimental and control groups in basic science and technology achievement test. The F-calculated value for group is 13.027 with a 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 significance between the mean achievement scores of students

taught basic science and technology with multimedia instructional strategies and those taught with Conventional Learning Method (CLM).

HO₂: There is no significant difference between the mean retention scores of students taught basic science and technology with web based instructional package and those taught with conventional learning method.

Table 4: Summary of Analysis of covariance (ANCOVA) for Test of Significance of effect of treatment on students’ retention in Basic science and technology

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|-----------------|-------------------------|-----|-------------|----------|------|
| Corrected Model | 11358.872 ^a | 2 | 5679.436 | 3192.545 | .000 |
| Intercept | 110.766 | 1 | 110.766 | 62.264 | .000 |
| Posttest | 8096.941 | 1 | 8096.941 | 4551.482 | .000 |
| Treatment | 373.681 | 1 | 373.681 | 210.055 | .000 |
| Error | 176.118 | 99 | 1.779 | | |
| Total | 407975.000 | 102 | | | |
| Corrected Total | 11534.990 | 101 | | | |

a. R Squared = .985 (Adjusted R Squared = .984)

The data presented in Table 4 shows that F-calculated value for the group is 210.055 with a significance of F at .000 which is less than .05. Hence, the null-hypothesis was rejected at .05 level of significance. The result means that there was a significant difference between the mean scores of student taught basic science and technology (BT) with multimedia instructional strategies and those taught with Conventional Learning Method in the test for retention of learning. This shows that the experimental group taught basic science and technology using web based instructional package retained more than the control group taught using Conventional learning method.

IV. DISCUSSION OF RESULTS

The findings of this study are discussed in this section under different aspects dealing with effects of a web based instructional package on basic science and technology students in science and technical colleges. The data presented in Table 1 shows that the mean score for experimental group

was 64.95 and that of the control group was 43.23. From the result, the students in experimental group performed better than those in control group in basic science and technology achievement test. At the same time, Analysis of covariance was used to test the first hypothesis, Table 3, at the calculated F-Value (13.02), significance of F(.000) and confidence level of .05, there was a significant difference between mean achievement scores of students taught Basic science and technology with WEBIP and those taught with CLM. This confirmed that the mean difference was statistically significant. The implication of this finding is that WEBIP is more effective than CLM in enhancing students’ achievement in studying Basic science and technology. This finding compared favourably with the finding of Daramola *et al.* (2016), who studied the effect of computer Assisted Instruction (CAI) in teaching Introductory Technology. The study revealed that the students who were taught with CAI made statistically significant improvements in their test scores. It can be therefore be concluded that the use of

multimedia instructional strategies to teach Basic science and technology contents in technical college curricula helped students to visualize processes that seem abstract and complex more than when the use of CLM is employed.

The data presented in Table 2 revealed the finding that students taught Basic science and technology with multimedia instructional strategies had higher mean score in the test for retention of learning than those taught with CLM. Analysis of covariance was employed to test the seventh hypothesis, Table 4, at the calculated F-value 210.055 with a significance of F at .000 with confidence of .005, there was a significant difference between the mean scores of students taught Basic science and technology with multimedia instructional strategies and those taught with CLM in the test for retention of learning. This finding indicates that Web based instructional package is more effective for improving students retention of learning in Basic science and technology than CLM. According to Abimbade, et al (2011), computer technology, provides powerful tools to support the shift to students-centred learning and is capable of creating a more interactive and engaging learning environment for teachers and learners. The use of computer technology for teaching also helps in inculcating in the students' workplace basic skills such as learning to learn, creativity, problem solving skills, and higher order thinking skills which increases the students' flexibility (Heinichi *et al.*, 2014). Chi *et al.* (2014) was of the opinion that by teaching students to think, they will gradually begin to realise that conscious reflection secretes understanding which helps in transfer of learning and improves students' retention of learning.

V. CONCLUSION

The need to find the best method to assist basic science and technology student in learning and improve their performance at junior secondary schools cannot be over emphasized. The study determined the impact of multimedia instructional strategies on achievement and retention of basic science and technology in Minna, Niger State. This study has found out that multimedia instructional strategies is more effective in improving student's achievement and retention in basic science and technology than conventional method. It is hoped therefore, that if multimedia instructional strategies is taken into consideration in the teaching of basic science and technology in Minna.

VI. RECOMMENDATIONS

Based on the findings of this study, the following recommendations were proffered;

1. Government at all levels should give more attention to the adoption of modern and interactive packages like multimedia instructional strategies in teaching of Basic science and technology. Teachers of basic science and technology should prepare their lessons in such a way that the students are given ample

opportunity to interact freely. This will go a long way to improve their academic achievement.

2. Workshops, seminars and conferences should be organized by Federal and State Ministries of Education and School Administrators to enlighten teachers and improve their knowledge and skills on the use of computer in order to utilize it for improving students' achievement and retention in basic science and technology.

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