UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.16 (4);
https://unijerps.org
2023 Impact Factor:* 6.834;** 2022 ***Impact Factor: 5.156; ***2021 Impact Factor: 5.641; 2020 Impact Factor: 5.355.***
Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363
July-December, 2023

EFFECT OF USING MULTIMEDIA IN TEACHING ON ACHIEVEMENT OF UPPER BASIC EDUCATION STUDENTS IN BASIC SCIENCE IN ANAMBRA STATE

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ABSTRACT
The study investigated the effect of using multimedia in teaching on the achievement of upper basic education students in Basic Science in secondary schools in Anambra state. The purpose of the study was to determine the effect of Multimedia Instruction on upper basic 9 students' academic interest and achievement in Basic science in Anambra State. The study was guided by two research questions and three null hypotheses. The study adopted a quasi-experimental research design specifically, the non-equivalent control group design. The population of the study comprised all 7,943 upper basic 9 students (3,300 males and 4,643 females) in the 19 co-educational public secondary schools in Awka South Education Zone. Seventy-nine (37 control and 42 experimental) upper basic 9 students from the 19 co-educational schools in Awka Education Zone were sampled using a multistage sampling procedure. The instrument used to collect data for the study was the Basic Science Achievement Test (BSAT). BSAT contains 40 multiple choice questions with options lettered A-D. The instruments were validated by relevant experts in the departments of Science Education and Educational Foundations from Nnamdi Azikiwe University, Awka. The reliability of BSAT was established using K-R 20 which yielded a reliability index of 0.81. Mean and standard deviation were used to answer the research questions, while Analysis of covariance was used to test the hypotheses at a 0.05 level of significance. The findings revealed that MI significantly enhanced the achievement of students in Basic Science. There was also no significant gender difference in the effect of MI on students' academic achievement in Basic Science. Based on the findings of the study, it was recommended among others that Basic science teachers should employ MI when planning their lessons to enhance students' achievement.

Keywords*:* Use of Multimedia; Multimedia Instructional Strategy; Conventional Lecture Method; Academic Achievement; Secondary School Students; Basic Science.

Introduction

Basic Science as a subject plays a significant and far-reaching role in the lives of an individual and a nation at large. For individuals, the knowledge of Basic Science is required for the acquisition of Basic Science literacy and process skills essential for human survival. For a nation, Basic

Science contributes to the advancement of scientific knowledge, development of technology, and wealth creation. However, regardless of the aforementioned benefits of Basic Science to individuals and the nation at large, students' academic achievement in this subject area in Anambra State as observed from the Basic Education Certificate Examination (BECE) result has not been consistently progressive. Although different research efforts have been made to identify the probable causes and solutions to this recurring fluctuating academic achievement of students in Basic Science, the situation has persisted. Thus, the present research attempts to remedy the situation by using an innovative teaching strategy – Multimedia Instructional Strategy (MIS) to improve students' academic achievement in Basic Science.

Multimedia instructional strategy (MIS) is the type of instruction that involves the combination and usage of various media tools for achieving meaningful teaching and learning. Mayer (2005) defined this teaching strategy as the type of instructional strategy that involves the presentation of words (e.g., printed or spoken text) and pictures (i.e., static graphics such as illustrations, diagrams, charts, maps, and photos, or dynamic graphics such as animation and video) on paper (e.g., as printed text and figures), a computer (e.g., as narrated animation or annotated graphics), a handheld device (e.g., as a game involving printed words and graphics), or face-to-face (e.g., as a narrated slide presentation) to achieve meaningful teaching and learning. Shah and Khan (2015) described MIS as an interactive and multi-sensory instructional approach that enables teachers to control the information flow and to keep the attention of their students. MIS helps to attract and keep students' attention to the classroom lessons, makes the lesson contents easily understandable and helps students to recall and retain information in their memory. This assertion is supported by literature (Erdemir, 2009; Savoy, Proctor and Salvendy, 2009; Wofford, 2009) which is explicit in the role multimedia instruction plays in enabling students to follow classroom lessons easily, interpret and retain the information and knowledge received during teaching for a long time.

There are several rationales identified by research for the use of MIS for classroom teaching and learning over other teaching methods like the conventional lecture method (CLM). For example, Gilakjani (2012) identified the enhancement of students' understanding, memorizing ability, and interest level as the rationales for the use of MIS. Also, Mayer (2009) identified the ability of people to learn more deeply from words and pictures than from words alone as the rationale for MIS. The researcher concluded from empirical evidence that learning is improved when corresponding graphics are added to words. To corroborate Mayer's assertion, Oshinaike and Adekunmisi (2012) posited that MIS has changed the narrative of learning and shifted emphasis gradually from the teacher to the students. This teaching strategy, unlike the CLM, changes the role of the teachers from being the custodians of knowledge to being facilitators of learning, while students' roles are changed from being passive learners to active participants in the learning process. Furthermore, to give credence to the

aforementioned assertion about multimedia instruction, Zhen (2016) posited that among all the teaching methods, only multimedia instruction can stimulate students' multiple sensory organs.

Regardless of the enormous advantages of MIS over CLM as highlighted by Khan et al. (2020) which includes the facilitation of practical learning through practical examples and the bringing of real-life scenarios of the world into the classroom to help students learn through practical and real-life situations, the following were identified by the researchers to be the barriers bedeviling the full deployment and implementation of this teaching approach in our educational system; lack of adequate power supply and load shedding problem, lack of ICT based trained teachers, lack of interest and confidence among teachers and students, lack of IT awareness among the teachers, students and the school authorities as a whole. All these barriers can impede the propensity of MIS to improve students' academic achievement.

Academic achievement is an important parameter in measuring students' learning outcomes in various school subjects/content areas. It is defined as the learning outcome of a student over a given period denoted usually with scores from continuous assessments or examinations. Academic achievement is the academic or scholastic standing of a student at any point in time (Nwune, Anidi and Okwuduba, 2021). It is a psychological construct that measures the level of knowledge acquired and skills developed in school subjects and it is usually depicted by marks obtained in tests in a term or annual examination (Ayibatonye and Ikechi, 2018). Over the years in Anambra State, literature (Nwune et al., 2022) has shown that the academic achievement of upper basic 9 students in Basic Science has been fluctuating. This assertion is made in consideration of the basic science achievement of these students in BECE.

In considering these recurring students' fluctuating achievements in Basic Science, researchers have conducted studies in a bid to determine probable causes and proffer solutions to the situation. For example, literature (Christian-Ike and Okoli, 2021; Nwune et al., 2022; Okigbo and Nwune, 2021) attributed this fluctuating performance of the upper basic 9 students in Anambra State to several psychological and socio-cultural variables such as students' gender, locus of control and perceptions of Basic Science teachers' communication behaviors and academic self-concept. On the other hand, Oguezue and Osuafor (2021) attributed the situation to the non-usage of innovative teaching strategies for communicating Basic Science curriculum contents to the students. This forms the fulcrum for this present study which seeks to determine the effect of innovative teaching strategy such as multimedia instructional strategy.

This assertion by Oguezue and Osuafor (2021) corroborates with the findings of Shan and Khan (2015) who conducted a study on the impact of multimedia-aided teaching on students' academic achievement and found out that multimedia aided teaching is more effective than the traditional one. Similarly, Ilhan and Oruç (2016) observed that out of those students who were taught using multimedia

instructional strategy achieved significantly higher than those taught using conventional lecture method. The preceding researches were conducted outside the area of the present research conditions. Thus, the present study seeks to find out whether multimedia instructional strategy exact any effect on students' academic achievement in Basic Science in Anambra State.

Purpose of the Study

The purpose of this study is to determine the effect of MIS on students' academic achievement in Basic Science in Anambra State. Specifically, the study seeks to determine the;

1. mean achievement scores of students taught Basic Science using multimedia and those taught using conventional lecture method.
2. mean achievement scores of male and female students taught basic science using multimedia and those taught using conventional lecture method.
3. Interaction effect of gender and teaching methods (multimedia and conventional lecture method) on academic achievement of students in Basic Science

Research Questions

The study will be guided by the following research questions;

1. What are the mean achievement scores of students taught Basic Science using multimedia and that of those taught using the conventional lecture method?
2. What are the mean achievement scores of male and female students taught Basic Science using multimedia and of those taught using conventional lecture method?

Hypotheses

The following null hypotheses were tested at 0.05 alpha levels.

1. There is no significant difference between the mean achievement scores of students taught Basic Science using multimedia and that of those taught using conventional methods.
2. There is no significant difference between the mean achievement scores of male and female students taught basic science using multimedia and those taught using conventional lecture method.
3. There is no interaction effect of gender and teaching methods (multimedia and conventional lecture method) on students' academic achievement in Basic Science.

Research Method

The study adopted a quasi-experimental research design. Specifically, the pretest-posttest non-equivalent control group of 2x2 factorial design was used. Nworgu (2015) stated that quasi-experimental research design is usually adopted where random assignment of subjects to experimental and control groups is not possible, hence intact class groups were randomly to treatment. The sample of the study consisted of 79 (36 males & 43 females) upper basic 9 students offering Basic science, drawn from two schools out of the 19 co-educational public secondary schools in Awka Education Zone. The

subjects were sampled using a multistage sampling procedure. The instrument used for data collection was the Basic Science Achievement Test (BSAT). BSAT questions were constructed based on the concepts of resources from the environment, living things, resources from animals, economic importance of plant resources, ethical issues in science and development, and resources from non-living things: Solid minerals and resources from non-living things: Solid minerals. The research questions were answered using mean and standard deviation, while the hypotheses were tested at 0.05 level of significance using analysis of covariance (ANCOVA).

Presentation of Results

Research Question 1: What is the difference between the mean achievement scores of students taught Basic Science using multimedia instruction and those taught using conventional lecture method (CLM)?

Table 1: Pre-test and Post-test Mean Achievement Scores of Students taught Basic Science using Multimedia Instruction and Conventional Lecture method (CLM)

Group	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gained Mean
Experimental	42	53.01	9.61	75.65	9.87	22.64
Control	37	49.59	12.32	61.08	11.04	11.49
Mean Diff.		3.42		19.9		11.15

Table 1 reveals that the students taught Basic Science using multimedia instruction had a pretest mean score of 53.01 with an SD of 9.61, a posttest mean score of 75.65 with an SD of 9.87 and a mean gain of 22.64 in Basic Science. In contrast, those in the control group taught with the conventional lecture method had a pretest mean score of 49.59 with SD 12.32, a posttest mean score of 61.08 with SD 11.04 and a gained mean of 11.49. Students' scores in the multimedia group were less spread in the posttest (9.87) than those in the conventional group (11.04).

Research Question 2: What is the difference between the mean achievement scores of Male and Female Students taught Basic Science Multimedia Instruction and Conventional Lecture Method (CLM)?

Table 2: Pretest and Posttest Mean Achievement Scores of Male and Female Students' taught Basic Science using Multimedia Instruction

Gender	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gained Mean
Male	10	50.90	10.54	66.04	13.17	15.14
Female	32	51.83	11.53	71.16	11.93	19.33
Mean Diff.		-0.93		- 5.12		-4.19

Table 2 shows that with a higher gained mean of 19.33, multimedia instruction is more effective in enhancing the achievement of female students in Basic Science. There was also lesser score variation among the female students (11.93) than among the male students (13.17), with a gained mean difference of 4.19.

Testing of Null Hypotheses

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught Basic Science using multimedia instruction and those taught using conventional lecture methods.

Table 3: ANCOVA Test of Significance of Difference in the Mean Achievement Scores of Students Taught Basic Science using Multimedia Instruction and those taught using Conventional Lecture Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	4239.017[a]	2	2119.508	19.329	.000	
Intercept	13884.852	1	13884.852	126.621	.000	
Pretest	61.075	1	61.075	.557	.458	
Method	3923.064	1	3923.064	35.776	.000	Sig.
Error	8333.926	76	109.657			
Total	386831.250	79				
Corrected Total	12572.943	78				

Table 3 shows a significant effect of the treatment on students' achievement in Basic Science F (2, 76) = 35.776, P = 0.000 < 0.05. Therefore, the null hypothesis was rejected, meaning that there is a significant difference between the mean achievement scores of students taught Basic Science using multimedia instruction and those taught using conventional lecture methods in favour of multimedia instruction. The result indicates that using multimedia instruction in teaching Basic Science enhanced the students' achievement.

Hypothesis 2: There is no significant difference between the mean achievement scores of male and female students taught Basic Science using multimedia instruction

Table 4: ANCOVA Test of Significance of Difference in the Mean Achievement Scores of Male and Female Students Taught Basic Science using Multimedia Instruction

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	797.070[a]	2	398.535	2.572	.083	
Intercept	12245.684	1	12245.684	79.032	.000	
Pretest	283.175	1	283.175	1.828	.180	
Gender	481.117	1	481.117	3.105	.082	Not Sig.
Error	11775.873	76	154.946			
Total	386831.250	79				
Corrected Total	12572.943	78				

Table 4 shows no significant influence of gender on students' achievement in Basic Science F(2, 76) = 3.105, P = 0.082> 0.05. Therefore, the null hypothesis was not rejected, meaning there is no significant difference between the mean achievement scores of male and female students taught Basic Science using multimedia instruction. The result indicates that using multimedia instruction to enhance students' achievement in Basic Science is not gender-biased.

Hypothesis 5: There is no interaction effect of gender and teaching methods (multimedia instruction and conventional lecture method) on students' achievement in Basic Science.

Table 5: ANCOVA Test of Interaction Effect of Gender and Teaching Methods on Students' Achievement in Basic Science

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	4308.841[a]	4	1077.210	9.646	.000	
Intercept	13942.862	1	13942.862	124.850	.000	
Pretest	59.414	1	59.414	.532	.468	
Method	3511.316	1	3511.316	31.442	.000	
Gender	66.046	1	66.046	.591	.444	
Method * Gender	3.884	1	3.884	.035	.853	Not Sig.
Error	8264.102	74	111.677			
Total	386831.250	79				
Corrected Total	12572.943	78				

Table 5 shows no significant interaction of teaching methods and gender on students' achievement in Basic Science F (4, 74) = 0.035, P = 0.853> 0.05. Therefore, the null hypothesis was not rejected, meaning there is no significant interaction effect of teaching methods and gender on students' achievement in Basic Science.

Discussion

The finding of the study revealed that the students taught Basic science with MIS gained in achievement more than the students taught Basic science with lecture method (CLM). This difference in achievement is confirmed by the test of hypothesis which showed that there was a significant difference in the mean achievement scores of students taught Basic science using MIS and those taught using (CLM) in favour of those in the experimental group (MIS). This implies that MIS was found to be effective. This finding is line with the finding of Ilhan and Oruç (2016) who found out those students who were taught using multimedia instructional strategy achieved significantly higher than those taught using conventional lecture method. The study is also consistent with findings of Shan and Khan (2015) who conducted a study on the impact of multimedia-aided teaching on students' academic achievement and found out that multimedia aided teaching (MIS) is more effective than the traditional one.

The positive effect of multimedia instructional strategy can be adduced to so many factors. For example, the use of multimedia instructional strategy simplifies abstract and difficult concepts for the students to comprehend. Also, it provides meaning to experience; then it turns the experience into a practice. Multimedia instructional strategy creates a lot of experiences for the students making them to rightly understand the concepts taught, thus enhancing students' achievement in Basic Science.

Recommendations

The following recommendations were made in the light of the findings of this study:

1. Basic science teachers should employ multimedia instruction to reduce the use of the conventional lecture method which has been found not effective in improving the achievement of basic science student
2. Curriculum planners should employ multimedia instruction as an innovative teaching strategy in planning Basic science curriculum.
3. The Science Teachers Association of Nigeria in collaboration with the government should organize in-service and pre-service training programs in the form of seminars, symposia, conferences and workshops to train teachers on how to use multimedia in teaching and learning Basic science and other science subjects.

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