



**Effects of Application of Multimedia Instructional Materials on Senior Secondary School
Students' Achievement in Geography in Plateau State**

Dakur, Dickson Sura¹

dakurdickson@gmail.com

Ariyo Opeyemi Glory¹

gloryhero2@gmail.com

¹Department of Science and Technology Education, University of Jos

Abstract

The study investigated effects of multimedia instructional materials on Geography achievement of senior secondary two students in the study area. A quasi – experimental, non –equivalent control group design was used for the study. A sample of 94 students was drawn from intact classes of four randomly selected public and private secondary schools in the study area, while Geography Achievement Test (GAT) was used for data collection. Three research questions and four hypotheses were answered and tested respectively. The mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) were used in testing the hypotheses at $p < 0.05$ level of significance. The study revealed that multimedia materials improve students' achievement in geography. It further revealed that there was no difference in the achievement of male and female students. Thus, students who were taught with multimedia materials understood Geography better than those taught without. It was consequently recommended that multimedia instructional materials should be used by teachers to teach Geography in senior secondary schools.

Keywords: Achievement, Multimedia Instructional Materials, Geography.

Introduction

Geography is defined as the study of spatial distribution of phenomena on the earth surface and their relationships. Thus, Geography is a spatial science, dealing with earth's space, use of space, and variation in space, how the observable spatial pattern evolved overtime, human behavior and decision, relationship and interactions on the earth surface. This means that Geography is physical and social science since the earth space contains both physical and cultural aspects (Gusen, Dakur & Shamle, 2017).

Geography is essentially endowed with enormous knowledge and skills in which potential geographers are trained and by which they can contribute to national growth and development. In the light of this, Damar (2004) posits that the teaching of geography can serve as vehicle for implementing and achieving the national educational objectives because it: (a) equip her student to live effectively in the modern and complex age of science and technology by effectively providing them with a body of geographical knowledge, which is interesting, useful and rewarding



in everyday life. (b) raise a generation of people who can think reflectively for themselves by considering both sides of a problem. (c) foster national unity.

Multimedia materials are those materials that can motivate students and serve as effective ways to explain and illustrate subject content by combining multiple technical resources for the purpose of presenting information in multiple formats. The use of multimedia materials was introduced in school system to promote instructional effectiveness in teaching and learning. It is common knowledge among educators that students who have the advantage of being taught with well selected and wisely utilized instructional media learn more effectively than those who are only provided with verbal instruction. Proponents of multimedia claim that it has the ability to change the way we understand, think, learn and work, and have heralded the end of printed books and static graphics.

The significance of multimedia materials as stated by Crosby and Stelvosky (1995) is that it permits the demonstration of complicated processes in a highly interactive, animated fashion such that instructional materials are interconnected with other related topics in a more natural and intuitive way. Despite the acclaimed efficiency and effectiveness of multimedia materials in the teaching – learning process, it has been discovered that most geography teachers do not like using it (Samuel, 2008) hence the motivation for this study as it could motivate the students and in turn result to high academic achievement.

Academic achievement is the outcome of education, the extent to which the student or institution has achieved their educational goals. Academic achievement has always been the center of educational aim and objectives. Thus, academic development of the child continues to be the primary and most important goal of education as it acts as an emotional tonic. Reports have shown that the academic achievement of geography students in West Africa Examination Council (WAEC) in recent time fell below expectation which is quite worrisome for geography teachers (Muhammed, 2014). The author stressed that poor achievement leads to low interest in the subject which result in low enrolment of students for the subject in Nigeria. An analysis of geography students' achievement of West Africa Examination Council (WAEC) from 2011 to 2017 by WAEC test development division reveals that percentage credit and above pass ranges from 54.15% to 71.12%. This is not an optimal achievement because about 30% to 50% of the students who wrote WASCE between 2011 and 2017 could not pass at credit level and could not gain admission to Read Geography at the higher level of learning.

Academic achievement varies among learners on the basis of different factors such as gender, school type, socioeconomic background, just to mention but a few. Gender has generated much argument in the academia, and no agreement has been reached as to which gender performs better. For instance, research reports (Okebukola, 2002; Yoloye, 2006; Eziirim, 2006) showed that gender have an impact on physics students' academic achievement while Dakur(2017) stated that test scores of boys in geography show greater variability with about 48.2 percent reaching or exceeding the median score of the girls. This indicates that there is absolute consensus about the equality of male and females' intelligence and their test scores. Traditionally, science and technology has assumed a certain stereotypical image as masculine discipline (Birke, 2006;



Manthorpe, 2002) at the exclusion of the female counterpart who are believed to be better in the art and social science subjects. This belief presumes science and technology then domain of men at the exclusion of women which may not be true. With this association, science is given a masculine image. Hence, the need for investigating the effect of multimedia materials on academic achievement of geography students' base on genders.

In Nigeria, schools are classified into public and private. Adebayo (2009) noted that a careful observation of the current trends in Nigeria in terms of parents' preferred choice of schools for their children would reveal preference for private school as opposed to public schools. The author attributed the development to the deterioration in academic achievement and wide – spread of loss of confidence in public schools. Research reports show a divergent and conflicting position on the superiority of private and public school geography achievement. Akiri and Ugbomgbo (2009) noted that consequent upon the observed deterioration in academic achievement, attitude and values of secondary school student in public schools, one wonder if the high failure rates particularly in geography and poor quality of the students are not the reflection of the instructional quality in schools. In this regards one may attempt to ask this questions, is there really any significant difference in the achievement of geography student from both the public and private school? Hence, Geography achievement based on school type was investigated in the study.

Aim and Objectives

The aim of the study was to determine the effects of multimedia instructional materials on Geography academic achievement of senior secondary II students in Geography in Jos North Local Government Area, Plateau State. The specific objectives included determining the Geography achievement of:

1. The experimental and control groups before and after application of multimedia materials.
2. Male and Female students in the experimental group before and after application of multimedia materials.
3. Public and Private school students in experimental group before and after application of multimedia materials.

Research Questions

The following research questions guided study:

1. What are Geography achievement mean scores of the experimental and control groups before and after application of multimedia materials?
2. What are the Geography achievement mean scores of male and female students in the experimental group before and after application of multimedia materials?
3. What are the Geography achievement mean scores of public and private school students in the experimental group before and after application of multimedia materials?

Hypotheses

Four hypotheses were tested at 0.05 significance.

1. There is no significant difference between the experimental and control groups on posttest Geography achievement mean scores.



2. The posttest Geography achievement mean scores of the experimental group will not significantly differ from the control group after controlling for gender effect.
3. The posttest geography achievement mean scores of the experimental group will not significantly differ from the control group after controlling for the effect of school type.
4. There is no significant interactive effect of school type and treatment on students' Geography achievement.

Method and Procedures

The study adopted Quasi-experimental research design, specifically, the study adopted the non-equivalent pretest – posttest control group research design in which intact classes were assigned to the experimental and control groups. The use of control group according to Awotunde and Ugodulunwa (2004) is beneficial in checking internal invalidity that might arise during the study.

The population of this study comprised all SSII geography students of public and private senior secondary schools in plateau state that have presented candidates for external examinations for at least two years. There were 31980 SSII geography students in in plateau state as at the time of the study, consisting of 17030 boys, 149550 girls, made up of 18837 and 13143 in public and private schools respectively. These students were distributed across 391 public schools and 774 private schools, making a sum total 1165 schools in plateau. SSII Geography students were used because they had studied Geography for one full year and were not in their final year in that the experiment could interfere with their preparation for final examination.

The sample for the study was made up of 94 students from four senior secondary schools. This was made up of 56 boys and 38 girls. 60 of whom was from public school, and 34 from private school. Students in two intact classes, one each from private and public school served as the control group. While students in two intact classes, one each from private and public school served as the experimental group.

The stratified sampling method was used to select four schools (2 public and 2 private schools) from the population of 109 senior secondary schools in plateau state. The choice of stratified sampling technique was to ensure that the different school types are duly represented (public and private) and also because it fit into the design of the study: non – equivalent control group design which does not involve random assignment of participating students.

Geography Achievement Test (GAT) was used to collect data for the study. GAT was used to collect the needed data which assessed the students on Geography topics that were taught during the study which included: Transportation in Nigeria, Population, Environmental resources, Manufacturing industries and factors affecting its location. The test contained 24 items adapted from Geography WAEC and NECO examination (2015 and 2014).

GAT was subjected to both face and content validity. Three experts, two from Geography Education and one from Test and Measurement validated the instrument. The experts were given content, the research questions, hypotheses, GAT, the topic covered, objectives of study and the test blueprint for scrutiny. Amendment of GAT items were made by the researcher based on the experts' judgment.

Kuder Richardson modified formula K-R21 was used to calculate reliability coefficient alpha of GAT. Kuder – Richardson was adopted because of its suitability for determining the reliability of a test with items of dichotomous responses such as objective test. A pilot study was conducted on 40 students that were not part of the sample of the study to generate data for testing the reliability of the instrument. The reliability index stood at 0.83.

The Geography achievement test (GAT) was administered to the experimental and control before the commencement of the experiment within two and half hours. Thereafter, two lessons of 80 minutes per week were taught to the experimental and control groups for six weeks. The experimental group was taught using multimedia instructional material while the control group was taught with traditional teaching aids. However, the content and the objectives of the lessons for the experimental and control groups were the same. At the end of the six weeks treatment, GAT was administered to both the experimental and control groups within two and half hours to conclude the study.

Descriptive statistical tools of mean and standard deviation were used to answer the research questions, while analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

Results

Three research questions and four hypotheses were answered and tested as follows:

Research Questions One

Table 1: Summary of pretest and posttest Geography achievement of the experimental and control groups.

Group	Test	N	$\bar{X}$	SD
Experimental	Pretest	50	42.72	11.82
	Posttest	50	65.10	14.60
Control	Pretest	44	46.59	10.74
	Posttest	44	44.00	9.42

Note: N=94.

Table 1 shows that pretest mean scores of the experimental group (M= 42.72) and the control groups (M= 46.59) had mean difference of 3.87 in favour of the control group. While, the posttest score of the experimental group (M = 65.10) is greater than that of the control group (M = 44.00) with a mean difference of 21.1. Thus, shows that multimedia materials enhanced Geography achievement of SS students.

Research Questions Two:

Table 2: Summary of pretest and posttest Geography achievement of male and female students in the experimental group.

Group	Test	N	$\bar{X}$	SD
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Male	Pretest	56	43.93	10.37
	Posttest	56	50.16	13.08
Female	Pretest	38	45.42	12.94
	Posttest	38	50.84	14.95

Note: N=94.

Table 2 indicates that the pretest mean scores of male students ($M = 43.93$) slightly less than that of the female students ($M = 45.42$). At the posttest, male students had mean score ($M = 50.16$), while their female counterpart had a mean score ($M = 50.84$) indicating near equality of posttest mean scores between the two groups.

Research Question Three

Table 3: Summary of pretest and posttest Geography achievement of public and private school students.

Group	Test	N	$\bar{X}$	SD
Public	Pretest	60	44.75	11.55
	Posttest	60	50.97	14.91
Private	Pretest	34	44.15	11.39
	Posttest	34	49.50	11.70

Note: N=94.

Results in table 3 shows that public school students had pretest mean scores ($M = 44.75$), compared to their private school counterpart who had a mean of ($M = 44.15$). More so, the result shows that during the posttest both groups improved in their achievement. The public school students had an achievement mean score ($N = 50.97$), while the private school students had achievement mean score (49.50). These showed slight difference between public and private school students on pretest and posttest Geography achievement mean scores.

Hypothesis One

Table 4: Summary of ANCOVA analysis of posttest Geography achievement mean scores between the Experimental and Control Groups.

Source	Type III Sum of Squares	Df	Mean Square	F	P
Corrected Model	3441.451 ^a	2	1720.73	10.99	0.000
Intercept	14852.495	1	14852.49	94.86	0.000
Pretest Achievement	14.834	1	14.83	0.10	0.759
Group (EXP. & Cont.)	3252.799	1	3252.80	20.78	0.000
Error	14247.666	91	156.57		

Total	256807.000	94
Corrected Total	17689.117	93

Table 4 indicates that the post-test comparison between the experimental and control group based on SPSS analysis output had $F(1,93) = 20.78$, $p = 0.000$. Since the p-value is less than 0.05, it means that the difference between the experimental and control groups on posttest Geography achievement was significant. There was therefore a strong basis to reject the null hypothesis and concluded that there is a significant difference between the experimental and control groups on posttest Geography achievement mean scores.

Hypothesis Two

Table 5: Summary of ANCOVA analysis of Posttest Academic Achievement Mean Scores between the Experimental and Control Groups after Controlling for Gender

Source	Type III Sum of Squares	Df	Mean Square	F	P
Corrected Model	3440.930 ^a	2	1720.465	10.99	.000
Intercept	24475.304	1	24475.304	156.32	.000
GENDER	14.313	1	14.313	.09	.763
GROUP	3430.419	1	3430.419	21.91	.000
Error	14248.187	91	156.573		
Total	256807.000	94			
Corrected Total	17689.117	93			

R Squared = .195 (Adjusted R Squared = .177)

Table 5 results shows no gender difference in the posttest achievement mean scores, $F(1, 91) = 0.09$, $p > 0.05$. After controlling for gender, the posttest p-value is less at 5% level of significance. This suggest that there is sufficient claims to reject the null hypotheses and inferred that there is significant difference in the posttest achievement mean scores between the experimental ($M=56.10$, $SD= 14.60$) and control groups ($M= 44.00$, $SD= 9.42$), $F(1, 91) = 21.91$, $p < 0.05$. This signifies that gender has no significant effects on the geography achievement mean scores of secondary school students after exposing to multimedia materials.

Hypothesis Three: The posttest geography achievement mean scores of experimental group is not significantly differ from the control group after controlling for the effect of school type.

Table 6: Summary of ANCOVA analysis of Posttest Academic Achievement Mean Scores of the Experimental and Control Groups after Controlling for School Type

Source	Type III Sum of Squares	Df	Mean Square	F	P
Corrected Model	3470.329 ^a	2	1735.165	11.11	.000
Intercept	28107.646	1	28107.646	179.88	.000
School type	43.712	1	43.712	.28	.598
GROUP	3423.646	1	3423.646	21.91	.000
Error	14218.788	91	156.250		
Total	256807.000	94			
Corrected Total	17689.117	93			

R Squared = .196 (Adjusted R Squared = .179)

Table 6 indicates that there is no significant difference in the posttest achievement mean scores based on school type, $F(1, 91) = 0.28, p > 0.05$. When the school type is being controlled, significant difference in the posttest achievement mean scores between the experimental ($M=56.10, SD= 14.60$) and control groups ($M= 44.00, SD= 9.42$) is recorded, [$F(1, 91) = 21.91, p < 0.05$]. This signifies that school type has no significant effects on the posttest geography achievement mean scores of secondary school students.

Hypothesis Four

Table 7: Interactive Effect of School Type and Treatment on Students' Academic Achievement in Geography

Source	Type III Sum of Squares	df	Mean Square	F	P
Corrected Model	3803.742 ^a	3	1267.91	8.22	0.000
Intercept	215158.346	1	215158.35	1394.58	0.000
Group (Exp. & Cont.)	2620.892	1	2620.89	16.99	0.000
School Type	29.954	1	29.95	0.19	0.661
School type & Treatment	333.413	1	333.41	2.16	0.145
Error	13885.375	90	154.28		
Total	256807.000	94			
Corrected Total	17689.117	93			

a. R Squared = 0.215 (Adjusted R Squared = 0.189)

Result seen in table 7 indicates that the probability value for school type and treatment interaction is higher than the 0.05 level of significance ($p = 0.145$). This implies that school type and treatment interaction have no significant effects on the students' academic achievement scores



in Geography after exposure to multimedia materials, $F(1, 90) = 2.16, p > 0.05$. It means that, the academic achievement of students in Geography is not significantly influenced due to school type and multimedia interaction.

Discussion

The result of the study revealed that the use of multimedia had significant positive impact on the senior secondary students' achievement in Geography. This outcome does not discriminate between students on the basis of gender and school type. Thus, male and female students in both public and private schools equally showed improvement in their achievement in Geography as a result of exposure to the use of multimedia materials in teaching and learning. This outcome of the study supported Crosby and Stelvosky (1995), Olatoye (2008) and Ariyo and Ibeagha (2011). Crosby and Stelvosky acclaimed the significance of multimedia materials in teaching and learning. While Olatoye and Ariyo and Ibeagha found no difference between school types on the effects of multimedia materials in the academic achievement of students. However, the result of the study contradicted the study of Agbatogun (2009) who found differential effects of multimedia materials between public and private school students, in the favour of the private.

The implication of the result of the study is that if teacher would use multimedia materials in the teaching of Geography, it is most likely that persistent failure rate of students in public examination will be ameliorated. Therefore, Geography teachers, curriculum planners, educational administrators, higher institutions, author and publishers of Geography textbooks, ministry of education and government at all levels should emphasized the use of multimedia materials. Since there was a significant improvement in the achievement of students taught Geography using multimedia materials. This could translate to optimal performance in Geography examination which can lead to the rapid production of a better workforce which can lead country to the path of science and technological development.

Conclusion

The study concluded as follows:

1. Multimedia instructional material enhanced the Geography achievement of senior secondary two student.
2. The gender of students did not significantly interact and influence the achievement of the students in Geography.
3. School type did not significantly interact and influence the achievement of the syudents in Geography

Recommendations

The following recommendations were made based on the result of the study:

1. Geography teachers should adapt the use of multimedia materials in their teaching of Geography.
2. Geography curriculum planners should consider multimedia materials very essential component of the curriculum.



3. Government at all levels should increase budgetary allocation to education to enable school administrators provide the enabling environment for the application of multimedia materials for teaching and learning.
4. Workshops should be organized for secondary school teachers on how to effectively apply various multimedia materials in their teaching.

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