

Impact of Multimedia and Hypermedia Instruction on Teaching Basic Electricity Technology: Case Study of Government Technical Colleges in Oyo State, Nigeria

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Abstract

This research was carried out to ascertain the impact of Multimedia and Hypermedia on teaching Basic electricity technology subjects in Government Technical Colleges in Oyo State, Nigeria. Quasi experimental design involving pretest, posttest, non-randomized comparison group was used for the study. Two research questions and two hypotheses were raised to guide the study. A total of one hundred (100) final year students of Electrical/Electronics Department from the five Technical Colleges in Oyo State constitute the population of the study. Achievement test with 40 test items involving application of multimedia and hypermedia resources was used as the instrument for data collection. The instrument was subjected to face and content validity by ICT experts in Industrial and Technology Education. The reliability of the instrument was determined using the Pearson Product Moment Correlation and the Correlation Coefficient was found to be 0.85, while the Kuder-Richardson (KR20) formula was used to determine the internal consistency and the result obtained was 0.78. Mean and Standard Deviation were used to answer the research questions while the Analysis of Covariance (ANCOVA) was employed to test the hypotheses that guided the study. The findings from the study revealed that multimedia and hypermedia instructions were effective in enhancing students' achievement in Basic Electricity Technology. The study also found out that there was a significant difference between the main effects of gender (male and female) on students' achievement in Basic Electricity. The study recommends for the adoption of multimedia and hypermedia instructional resources and also advocate for training and retraining of the teachers and students on effective utilization of multimedia and hypermedia instructions resources.

Keywords: Multimedia Instruction, Hypermedia Instruction, Basic Electricity, Technical Colleges, Nigeria

1 Introduction

Globally, the advent of information and communication technology (ICT) has been acknowledged as one of the most remarkable and transformative technology experienced in different spheres of human development, education inclusive. In the same vein, advancement in the present twenty-first century has introduced diverse ICT tools which are responsible for the monumental and radical transformation in the teaching and learning environment. This transformation is responsible for the paradigm shift from the conventional talk and chalk method of learning to a more advanced

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method of instruction which involves the use of a wide range of ICT tools. One of the most popular form of ICT tools presently used in the school system involves the use of instructional multimedia. Instructional multimedia is the combination of two or more forms of media to enhance teaching and learning effectively in the classroom [1]. Multimedia instruction has been defined as the use of radio, tape recorder, slide, teaching machine, forms trips, firms, chart, maps, graphics, video tapes recorders, slide protector, opaque, projector, overhead projector, still pictures, programmed instruction, television, computer and many more [2]. These instructional multimedia resources assist in great measures in disseminating information and communication towards teaching and learning process both at home and in the school especially in a class with large number of students. Instructional multimedia are vehicles through which instructions are disseminated to the learners for the purpose of appealing to their senses of touching, seeing, hearing and feeling so that the desired behavioural changes are achieved [3].

Consequently, instructional multimedia can be inferred as information carrier employed in the classroom to teach the students and to display information relating to teaching and learning. The above multimedia has been described as powerful possibilities for improving the learning process which makes a difference in learners [4]. Further advancement in ICT lead to the development and use of “superior” multimedia tools such as the hypermedia. In the teaching and learning environment, hypermedia instructional resources includes online internet browsing, interactive online transaction, email, e-payment, Facebook, Whatsapp, Twitter, Instagram, Website, YouTube, Skype, Imo and many more [5]. They are channel of passing and receiving information which can be effectively adopted for teaching and learning in classroom situation. Thus, the use of both the multimedia and hypermedia as innovative instructional approaches may permit learners to dwell on the knowledge they have acquired while displaying their capacity in the educational platform. At the end of the day, this innovative approach can improve the overall performance of the students of Basic electricity in Nigeria Technical Colleges.

Basic electricity is one of the technology subjects offered at technical college in Nigeria. Basic electricity curriculum content in technical college is designed to provide students with the knowledge of the key concepts in basic electricity, to promote their understanding of the world around them. The curriculum also aims at developing broad applicable of technical skills such as problem solving, communication, critical thinking and objective reasoning abilities, to enable them prepare for work place and self-sustainability in the world economy [6]. With these objectives of the curriculum in mind, students are expected to be useful and productive members of the society. Unfortunately, technical colleges’ students tend to fall short of these expectations due to improper ways of teaching the subject at technical college. This trend has been attributed to basic electricity teachers who solely rely on the traditional chalk and talk method of instruction at the expense of the use of flexible innovative methods of instructions such the use of multimedia and hypermedia instructions [7]. Thus, it is against this backdrop that this research attempts to investigate the impact of using multimedia and hypermedia as a means of instructional delivery for basic electricity students in technical colleges in Nigeria using Oyo State as a case study.

2 Statement of the Problem

The conventional method of instruction used in technical colleges in Nigeria remains the chalk and talk method of instruction. This assertion is in line with the recent findings of [8], [9], [10] and

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[11]. The studies revealed that the lecture method has been criticized for its weaknesses which includes the fact that it is not only teacher-centred but also lacks flexibility in terms of when, where and how teaching and learning takes place beyond the confines of the classrooms and schools' days. Thus, the present lecture method of instruction used in training the students of basic electricity is not adequate in preparing them to contribute meaningfully to the technological advancement of the nation. In addition to this sordid state of affairs, the performance of the students at the end of their terminal examination is also alarming and discouraging as confirmed by National Board for Technical and Business Examination Board. This dismal performance has been a major source of concern for the country because of its severe consequences which is the non-attainment of the much desired objective of training and producing competent technicians from technical colleges in Nigeria.

However, in the light of the numerous flexible alternative means of teaching and learning using ICT, it therefore becomes paramount for the teachers of basic electricity to exploit innovative modern e-learning techniques such as the use of multimedia and hypermedia instructions. It is anticipated that the use of innovative method of instruction such as that of multimedia and hypermedia is not only capable of improving the students' performance but it is also likely to enhance the acquisition of adequate knowledge and skills in technology especially in basic electricity.

Consequently, it is hoped that the use of multimedia and hypermedia instructional strategies in teaching and learning basic electricity will bring about the required result. Hence, the problem of this study posed as a question is: can multimedia and hypermedia instructions strategy produce significant effect on the academic achievement of basic electricity students in technical colleges in Nigeria?

3 Purpose of the Study

The purpose of the study is to determine the impact of multimedia and hypermedia instructional resources on teaching basic electricity in Oyo state government technical colleges. Specifically, the study determined:

The impact of multimedia and hypermedia instructional resources on students' academic achievement in basic electricity.

The impact of gender on academic achievement of students when taught basic electricity with multimedia and hypermedia instructional resources.

4 Research Questions

Two research questions were raised for the study:

- a. What is the impact of multimedia and hypermedia instructional resources on students' academic achievement in basic electricity?

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- b. What is the impact of gender on academic achievement of students when taught basic electricity with multimedia and hypermedia instructional resources?

5 Hypotheses

The following null hypotheses were formulated and tested at .05 level of significance:

HO1: There is no significant difference in the mean achievement scores of students taught basic electricity with multimedia and hypermedia instructional resources and those taught with conventional method.

HO2: There is no significant mean difference between the effect of gender on students achievement when taught basic electricity with multimedia and hypermedia instructional resources.

6 Scope of the Study

The scope of the study will cover the Basic electricity technology contents which include diagnosing and trouble shooting in the electronics gadget, electrical installation and maintenance, appliance repairs, rewinding of transformer, assembling of electronics products such as radio, television and many more. It will also cover all five (5) Oyo state government technical colleges in the state namely Ibadan, Oyo, Ogbomosho, Iseyin and Saki where basic electricity technology subjects are offered.

7 Methodology

The researchers adopted quasi-experimental research design for the study. The pre-test, post-test non-equivalent control group design was used. The students were assigned into two groups namely: experimental and control groups. The researchers randomly assigned intact classes to treatment and control groups. This was necessary in order not to disrupt the normal classes of the students and the school time-table. The use of intact class in a quasi-experimental design and this kind of procedure could be utilized if it is not feasible for the researcher to randomly sample the experimental subjects and allocate them to instructional teams without disruption of the normally existing instructional schedule of the students and institutions [12].

The population of the study comprises one hundred (100) year three students offering electronics technology subject in all the five Oyo state government technical colleges. Stratified random sampling technique was used for the selection of seventy (70) males and thirty (30) females students of Electrical/Electronics technology subject from year three students in order to have a balance gender of inequality; the reason for choosing year three students was because of the students interest in Electrical/Electronics technology subject as career option, their level of seriousness and commitment to the subject. The population was proportionally selected, that is fifty (50) students were used as experimental group while the remaining half of the population were equally used as the control group. The instrument for data collection was an achievement test titled impact of multimedia and hypermedia instruction test. The reliability of the instrument was determined using the Pearson Product Moment Correlation and the Correlation Coefficient was

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found to be 0.85, while the Kuder-Richardson (KR20) formula was used to determine the internal consistency and the result obtained was 0.78. Mean and Standard Deviation were used to answer the research questions while the Analysis of Covariance (ANCOVA) was employed to test the hypotheses that guided the study.

7.1 Lesson Plans

The researcher prepared two sets of lesson plan: one involves the use of instructional resources of multimedia and hypermedia to teach basic electricity technology while the other lesson plan uses the conventional method (without instructional resources). The lesson plans were given to two experts in Electrical Technology to make their inputs and ensure conformity with the NBTE guidelines. The researchers trained the electrical teachers on the use of this lesson plans. It gives details of the instructional requirements for each platform as well as the instructional guide for the students. Furthermore, the teachers' activities as well as the students' activities for each of the platforms were also explained in the lesson plan.

7.2 Research Question 1

What is the impact of multimedia and hypermedia instructional resources on students' academic achievement in Basic Electricity?

Table 1: Pretest and Posttest Mean Scores of experimental and control groups

Group	N	Pretest	Posttest	Mean Gain
		\bar{x}	\bar{x}	
Experimental	50	22.63	28.73	6.1
Control	50	15.20	16.48	1.28

The data presented in Table 1 shows that the experimental group had a mean score of 22.63 in the pretest and a mean score of 28.73 in the posttest, hence the pretest posttest mean gain of the experimental group was 6.1. Meanwhile, the Control group had a mean score of 15.20 in the pretest and a posttest mean of 16.48. Thus producing pretest posttest mean gain of 1.28. Since the mean gain of the experimental group (6.1) was greater than the mean gain of the control group (1.28) this result is an indication that the experimental group performed better than the control group. Consequently, this result affirms that the experimental group that were taught with the multimedia and hypermedia instructional resources performed better than the control group that were taught through the conventional method.

7.3 Research Question 2

What is the impact of gender on academic achievement of students when taught basic electricity with multimedia and hypermedia instructional resources?

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Table 2: Pretest and Posttest mean scores of Male and Female Students Taught Basic Electricity with multimedia and hypermedia instructional resources and those taught with the conventional method

Gender	Multimedia And Hypermedia Instructional Resources				Conventional Method			
	N	Pretest	Posttest	<i>Mean Gain</i> \bar{x}	N	Pretest	Posttest	<i>Mean Gain</i> \bar{x}
Male	70	21.84	28.65	6.81	70	22.27	28.73	6.46
Female	30	21.97	26.80	4.83	30	22.20	25.43	3.23

Table 2 shows that male students taught Basic Electricity with multimedia and hypermedia instructional resources had a mean score of 21.84 in the pretest and a mean score of 28.65 in the posttest making a pretest, posttest mean gain in the male students taught with multimedia and hypermedia instructional resources to be 6.81. Female students taught Basic Electricity with multimedia and hypermedia instructional resources had a mean score of 21.97 in the pretest and a posttest mean of 26.80 with a pretest, posttest mean gain of 4.83. Male students taught with conventional method had a mean score of 22.27 in the pretest and a mean score of 28.73 in the posttest making a pretest, posttest mean gain in the male students taught with conventional method to be 6.46. Meanwhile, female students taught Basic Electricity with conventional method had a mean score of 22.20 in the pretest and a posttest mean of 25.43 hence with a pretest, posttest mean gain of 3.23. With these results male students taught Basic Electricity had higher mean gain scores than female students. Consequently, it can be affirmed that there is an effect attributable to gender on the performance of students taught Basic Electricity.

7.4 Hypotheses

HO1: There is no significant difference in the mean achievement scores of students taught basic electricity with multimedia and hypermedia instructional resources and those taught with conventional method.

HO2: There is no significant mean difference between the effect of gender on students achievement when taught basic electricity with multimedia and hypermedia instructional resources.

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Table 3: Summary of Analysis of Covariance (ANCOVA) for Test of Significance between the Mean Scores of Experimental and Control groups in the Achievement Test and Effects of Gender on the treatments given to the Students

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3742.034 ^a	4	935.509	68.868	.000
Intercept	8036.005	1	8036.005	591.575	.000
Pretest	20.283	1	20.283	1.493	.224
Group	3178.541	1	3178.541	233.990*	.000
Gender	42.978	1	42.978	3.674*	.025
Group * Gender	4.111	1	4.111	1.002	.305
Error	316.443	279	3,786		
Total	48999.000	284			
Corrected Total	134.431	283			

7.5 *SIGNIFICANT AT SIG OF F < .05

The data presented in Table 3 shows F-calculated values for mean scores of experimental and control groups in the achievement test and gender on students' achievement in Basic Electricity. The F-calculated value for Group is 233.990 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 a significant difference between the mean achievement scores of students taught Basic Electricity with multimedia and hypermedia instructional resources and those taught with conventional method. The F-calculated value for gender is 3.674 with a significance of F at .025 which is less than .05. This means that there is significant difference between the effects of Gender on students' achievement in Basic Electricity. Therefore, the null hypothesis of no significant difference between the effect of gender (male and female) on students' achievement in Basic Electricity is rejected at .05 level of significance.

8 Discussion of Findings

The answer to research question one was provided by the data presented in Table 1. The information contained in the table revealed that the experimental group taught with Multimedia and hypermedia instructional resources had higher post test mean scores than those taught with the conventional method. Similarly, the analysis of covariance which was used to test the first hypothesis (Table 3) also revealed that there was a statistically significant difference between the effects of Multimedia and hypermedia instructional resources on the students' achievement in basic electricity.

The interpretation of this finding is that the use of Multimedia and hypermedia instructional resources are more effective than the conventional method in terms of improving the students' achievement in electrical technology. This concurs with the findings of similar researches conducted by Aloraini (2012), Ibrahim (2003), and Adamu (2016). The researchers individually investigate the effect of multimedia on academic achievement of students using and control

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groups and their findings unanimously agreed that the experimental group taught with computer instructional resources (such as those of multimedia and hypermedia) performed better than the groups that were taught using the traditional method of instruction. The finding that multimedia and hypermedia instructions are more effective in improving students' achievement in learning might not be unconnected with the fact that approach is a student-centered teaching method that uses e- learning resources to facilitate information sharing outside the constraints of time and place among a network of people. This assertion is in line with the view of Adamu (2016) that one of the major element of the e-learning instruction is that teaching and learning process can take place at different time and at different place, thus it allows students to schedule their learning activity at their own time, place and pace. This finding is most likely attributable to the fact that the multimedia and hypermedia tools and learning environments provide a high degree of interactivity between the students and the course materials. The students can work either individually or in group, they can review and study the course material again and again. They can review the task assigned by the teacher at their own pace, time and at their own convenience.

Analysis of covariance was used to test the first hypothesis, table 3. The result shows that at the calculated F value of 18.514 with a significance of .00 and confidence level of .05, there was a significance difference in the achievement of students. The interpretation of this result is that the use of multimedia and hypermedia instructional resources are more effective than the conventional approach in improving students' achievement in Basic Electricity.

The answer to research question two was provided by the data presented in Table 2. The information contained in the table revealed that male students had a higher mean score in the Basic Electricity achievement test than female students. Similarly, the result of Analysis of covariance from Table 3 shows that there was a significant difference between the main effects of gender (male and female) on students' achievement in Basic Electricity which confirmed that the difference between the achievement of male and female students in Basic Electricity was statistically significant favouring boys. The implication of this finding is that there was an effect attributable to gender on achievement of students in Basic Electricity. The finding of this study with respect to gender concurred with the findings of other similar studies that had been conducted on gender effects on achievement of male and female students in sciences and other fields. For instance, one of the important discoveries emerging from studies involving the effect of inquiry based instructional approach on academic achievement was the revelation of gender differences favouring boys [9] [15]. The findings of these studies revealed that disparity exists between male and female students' performance in sciences and other related fields, and in some cases boys had an edge over girls in academic achievement. Generally, boys were consistently found to perform better than girls on vocational and technical achievement tests suggesting that boys generally possess greater vocational and technical skills than girls. Male advantages in vocational and technical skills have been established in studies by [15] as well as [9]. According to these studies, the trends of gender differences were found to be stable and consistent. Thus, in studies where differences in achievement were evident males typically had stronger vocational and technical skills than girls. Conclusively, it can be affirmed that the identified gender effect on achievement in Basic Electricity was responsible for the significant gender effect found on students' achievement in Basic Electricity. Thus, the superiority of male in vocational skills had been responsible for their improved achievement in Basic Electricity. With these results male students taught Basic Electricity had higher mean gain scores than female students. Consequently, it can be

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affirmed that there is an effect attributable to gender on the performance of students taught Basic Electricity with multimedia and hypermedia instructional resources [16] [17].

9 Conclusion

In the light of the availability of numerous flexible alternative means of teaching and learning using ICT tools, it therefore becomes paramount for the teachers of basic electricity to exploit innovative modern e-learning techniques such as the use of multimedia and hypermedia instructions. It is against this backdrop that this study was carried out to determine the effect of multimedia and hypermedia instructions resources on Government Technical College students' achievement in Basic Electricity. The study found out that multimedia and hypermedia instructions were effective in enhancing students' achievement in Electrical Technology. The study also found out that there was a significant difference between the main effects of gender (male and female) on students' achievement in Basic Electricity which confirmed that the difference between the achievement of male and female students in Basic Electricity was statistically significant favouring boys.

These findings are confirmation of the fact that the use of innovative e-learning platform is a viable teaching method which is not only capable of improving the student' performance but it is also capable of stimulating their interest in learning and above all, enhance their learning retention. Conclusively, it therefore implies that adopting these instructional approaches in teaching and learning is an assurance of producing competent, qualified graduates that will teach electrical technology and also keep up with the rapid technological advancement in the field of Electrical Technology.

10 Recommendations

The following recommendations were made based on the findings, discussions and conclusion:

- The management of the institutions under study should adopt the use multimedia and hypermedia instructions in teaching.
- The management should mount capacity building programme for the teachers on the use of the multimedia and hypermedia instructions resources.
- The National Commission for Colleges of Education should develop appropriate framework necessary for encouraging the adoption of innovative e-learning platform such as that of synchronous and asynchronous instruction
- The students should be taught how to use E-learning technologies such as multimedia and hypermedia instructions.
- The female students should be given special attention in terms of the use of ICT tools.

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