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Improved Academic Performance: Utilizing Innovative Instructional Multimedia Devices Among Biology Education Students in University System in South-West, Nigeria

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Abstract

This study investigated the impact of the handheld devices allowing innovative multimedia interaction in the course of lecture delivery on the academic performance of the Biology Education students in University System in South West, Nigeria. The study adopted quasi-experimental design and the population of the study comprised all undergraduate students in South West, Nigeria. Multi-stage sampling techniques were used to select sample from University of Ibadan (Sandwish degree programme in Unilesa) and Osun State University for the quasi-experimental group and control respectively. Two treatment packages tagged Innovative Instructional Multimedia Handheld Method (IIMHM) and Conventional Lecture Method (CLM); and a Biology Education Achievement Test (BEAT) with ($r = 0.80$) determined using Kuder Richardons (KR=20) were utilized in the study. Data were analysed using T-test at 0.05 level of significance. The results revealed that there was a significant difference between the academic performance of students taught with innovative instructional multimedia method and those taught with conventional lecture method group ($t = 2.091$, $N = 300$, $p < 0.05$). The academic performance of the female students taught with innovative instructional multimedia handheld method was slightly higher with mean score of 34.45 whereas male students have a mean score of 32.38 with ($t = 1.045$, $N = 120$, $p < 0.05$). Based on the findings, utilizing multimedia handheld devices was considered better than Conventional Traditional Lecturing Method. Hence, it was recommended that lecturers should inculcate the use of instructional multimedia handheld devices in the course of lecture delivery.

Keywords: *Academic performance, handheld devices, innovative teaching, instructional multimedia devices, teaching methodology*

Improved Academic Performance: Utilizing Innovative Instructional Multimedia Devices Among Biology Education Students in University System in South-West, Nigeria

There is an unprecedented improvement at all fronts of human endeavours through technology in the contemporary era. This improvement involves accumulating experience, developing better ways of doing things and better approaches to resolving knotty situations. This developmental process is applicable to human activity with special emphasis on pedagogy. There is paradigm shift in education from classroom-based teaching to 'any place, anytime' learning. Students have become smarter in digital era. Our youths are digital natives who are more adaptable to infuse ICT resources with pedagogy in their reasoning. The need of the now is that teachers must learn and acquire the blended skills of technology and pedagogy. In recent years, there have been discussions about the need to improve University teachers' pedagogical thinking, skill as well as technology (Negassa &Engdasew, 2014). Improvement on pedagogy has brought about the concept of innovative pedagogy. Innovation is doing old things in a new way to solve problem. Innovations are always needed because every problem needs its solution; so, it becomes the need from time to time to discover something new and useful in education. The use of innovative teaching pedagogy helps to serve students in a better way to teach them the benefits of innovative thinking as it ignites passion for learning and provides students with the tools they need to succeed in the innovation economy (Kulkarni, 2017).

Pedagogical innovation is a form of social interaction which entails fundamentally new ways coupled with unique methods of interaction between teachers and students geared towards ensuring the effective achievement of the result of pedagogical activity. Abdullayevna (2019) posits that pedagogical innovations can be carried out both at the expense of the educational system's own resources (intensive development path), and through the attraction of additional capacities (investments) - new means, equipment, technologies, capital investment etc.

Innovative pedagogy is the infusion of technology into pedagogy by utilizing ICT devices in the course of lecture delivery. It is a means of maximally engaging students to benefit in the teaching-learning process. In teaching-learning process, students' engagement refers to the degree

of attention curiosity, interest, optimism and passion that students show when they are learning or being taught which extends to the level of motivation. When students are engaged with the lesson being taught, they learn more and retain more. The more the students are engaged in their studies, the more they enjoy completing academic tasks. The successful completion of academic tasks leads to academic success. Hence, innovative pedagogy enhances academic excellence.

Academic excellence plays an important role in individual's life, be it in family and social gathering, at working place, in an institution or even among peers. Much emphasis is placed on academic excellence because of the prominence, preference and social honour it confers on the successful achievers. Due to this, many people are concerned with the ways that they can improve their academic performance (Kyoshaba, 2009). The quest for successful academic achievement has made the infusion of technology into pedagogy to bring about innovative pedagogy. Additional benefit of social technologies provided on the internet is that they are frequently free or require marginal investment thereby eliminating a potential barrier to adoption (Brown, 2010).

Olaniyi (2021) posits that there is a correlation between social multimedia usage and academic performance of students in schools. Supporting this view, Wheeler, Yeomans (2008), claim that correlation exists between social multimedia and academic performance of students in the school. There have been various and opinions which recognize four major advantages of social multimedia use in higher education, these include; enhancing relationship, improving learning motivation, offering personalized course materials and developing collaborative abilities (Wheeler, Yeoman 2008; Rifkin Longnecker & Ortia, 2009). In consonant with that Enikanolaye (2021) found that there was a significant difference between the experimental groups taught mathematics using multimedia and the control group taught mathematics using conventional method. The use of digital handheld devises has become part of daily living of 21st century life. It is also evident that these devises are both beneficial to academic performance if used effectively and inimical to good performance if utilized without caution.

There are divergent opinions about male and female students' disposition to learning with multi-media instrumental materials. Schaumburg cited in Enikanolaye (2021) stated that female

students are not much interested in computer compared to male students. Likewise, any occupation related to computer and ICT such as computer scientist, system analyst and computer engineering are the dominant career choices for males (Derbyshire in Enikanolaye, 202). He also found that both female and male students were capable of competing in classroom activities when taught with a better instructional strategy

The use of the hand-held devices to enhance academic performance requires multi-tasking ability. Multi-tasking is a complex cognitive skill typical of 21st century life that calls for the attention of the youths today regularly engaging in media multi-tasking (Rideout & Foehr, 2005). It is not uncommon for adolescents to write a text using word processing software, instantly messaging their friends and listening to music, all at the same time frame. In trying to explain the meaning of multi-tasking, Colvet and Wells (2007) refer to it as a complex cognitive skill that requires a person to switch tasks, moving quickly from one activity to another. Multi-tasking can be defined at least in two ways; divided attention or dual-tasking that refers to simultaneously attending to more than one stimulus (Smith & Kooslyn, 2007) and rapid switching between two or more stimuli (Pesner, 1990). Lucas (2011) sees multi-tasking simply as doing multiple tasks at once, where one task is a primary task (the learning task) and the other is secondary (using digital devices) consistent with the instruction.

Innovative instructional multi-media is multi-tasking in that it demands the ability of a teacher to utilize different digital devices to promote learning. Since 2003, several new portable technological devices have been introduced into teaching and are widely available and used (e.g. blackberry and iPad). Multi-tasking with digital technologies is prevalent among youth and they are profitable for learning (Carrier, Cheever, Posen, Benitez & Change, 2009).

Statement of the Problem

Many have argued that multi-tasking leads to superficial processing on task. Such people maintained that when youth who are multi-tasking move rapidly from one task to another, they do not engage in attention flow that could be part of concentration. Attention inertia basically means that the longer the look is, the longer likely to continue. Children who demonstrate bouts of

attentional inertia became focused on an activity such as television viewing, and it is difficult to distract them from the task they are doing. They also demonstrate startle responses when somebody touches them.

Viewing multi-tasking from another perspective, it could be seen as multiple responses to a rapidly changing environment that makes multiple simultaneous and competing demands on people. Not everyone has the luxury in this day and age to have un-interrupted time to do a single task. Rather, days are filled with on-going interruptions that require people to move away from and come back to what the primary task is. From this point of view, multiple tasking could lead to the development of strategies, e.g. task switching, that are adaptive for the modern 21st century workplace.

Having considered multi-tasking from positive and negative perspective, the pertinent question is 'does multi-tasking promote learning? Interestingly, much work had been done on this in countries like America and United Kingdom but there is dearth of study that had examined the impact of the hand-held devices allowing innovative multi-media interaction (multitasking) in the course of lecture delivery on the academic performance of the Biology Education students in University System in South West. Hence, this investigated the impact of utilizing innovative instructional multi-media devices among Biology education students in University system in South-west, Nigeria.

The general purpose of this study is to determine the impact of utilizing innovative instructional multi-media devices among Biology education students in university system in South-West, Nigeria.

Specifically, the study was designed to:

i. Determine the mean scores of students' achievement in Biology Education based on each of the lecture methods.

ii. Ascertain the mean scores of students' achievement in Biology Education based on gender.

iii. Investigate whether there is significant mean difference in the academic performance of students who were exposed to Innovative Instructional Multi-Media Hand-held Method

(IIMHM) and those who were exposed to Conventional Traditional Lecture Method (CTLM) method of teaching.

iv. Examine whether there is significance difference in the academic performance of male and female students exposed to innovative instructional multi-media hand-held method.

Research Questions

The following research questions would be answered in the study;

1. What is the mean scores of students' achievement in Biology Education based on each of the lecture methods?
2. What is the mean scores of students' achievement in Biology Education based on gender?

Hypotheses

$H0_1$: There is no significant mean difference in the academic performance of students who were exposed to Innovative Instructional Multi-Media Hand-held Method (IIMHM) and those who were exposed to Conventional Traditional Lecture Method (CTLM) method of teaching.

$H0_2$: There is no significance difference in the academic performance of male and female students exposed to innovative instructional mult-imedia hand-held method.

Method

The study adopted a pre-test, post-test, quasi-experimental control group using 2 x 2 factorial matrix. The population of the study comprised all the 200 level university undergraduate students in South West of Nigeria offering of Biology Education. Multi-stage sampling technique was employed to select the participants for the study. From the six states in South-West of Nigeria two states (Oyo and Osun) were randomly selected. From each of the State, one University was randomly chosen (University of Ibadan [Sandwish programme at University of Ilesa under the auspices of Institute of Education]) and Osun State University). From each University, an intact class of 200 level Biology Education students was purposively chosen. Students in the two groups were pre-tested on Biology Education Achievement Test (BEAT). The Reliability of BEAT was

determined using Kuder Richardson (KR-20) and the coefficient was 0.80. Two treatment packages tagged Innovative Instructional Multimedia Handheld Method (IIMHM) and Conventional Lecture Method (CLM) were used as intervention for the two groups. The experimental group received the treatment using innovative instructional multimedia handheld devices; the control groups were not exposed to the Conventional (traditional) lecture method, the usual condition, the intervention they would have received without participating in the study or treatment (conventional lecture method). After the treatments, the two groups were given Biology Education Achievement Test that was used for pre-test as posttest. The researchers analyzed the data using descriptive and interferential statistics. Descriptive statistics used are ranking, mean, percentage and standard deviation. The interferential statistics utilized were Analysis of Covariance (ANCOVA) and Analysis of Variance (ANOVA) to test hypotheses generated for the study. All hypotheses were tested at 0.5 alpha level of significance.

The conceptual model of the design is presented thus:

Table 1

The Conceptual Model of the Design

Group	Pre-test	Treatment	Post-test
Experimental (Innovative Media Multitasking activities)	0_1	X_1	0_2
Control (Convention lecture method)	0_2	X_2	0_2

Table 1 illustrate the research design where;

0_1 = Pre-test on achievement in Biology Education for each group (treatment and Control).

0_2 = Post-test on achievement in Biology Education for each group (treatment and control).

$X_{1=}$ Represent group (treatment) exposed to treatment package (innovative instructional Multimedia handheld method)

X_2 = Represent group (control) exposed to conventional method of teaching (traditional lecture method)

Experimental Procedure: In order to ascertain direct exposure of the students to the innovative instructional multimedia handheld method, the researcher taught the experimental groups with various instructional media such as models, real object, charts, relia, among others. The experimental group was allowed to form groups to facilitate social net-working and interaction as they observe the various instructional models in the course of lecture delivery.

Innovative Instructional Multimedia Handheld Activities: Six weeks were used for the intervention procedure. At the first week, Biology Education Achievement Test was administered on the students. From the second week through the fifth week the students were exposed to two-hours lecture per week with access to any instructional material. The experimental group was subdivided to eleven groups with maximum of five members in each group. Each group democratically elected a group leader which controlled the activities of each group. The Innovative instructional multimedia handheld activities involve drawing, labeling, examining, making inferences and jotting down observations as the researcher directed. The researcher taught from the demonstration table in the Biology laboratory. He taught them using the various models on the table and then gave various tasks at the same time. At a time, he would pause and allowed interaction among the group as directed by each group leader. They were exposed to two-hours lecture per week with exposure to several instructional materials at the same time. They responded to many tasks at the same time using the various instructional materials at their disposal.

Conventional Traditional Lecture Method: The control group was taught by the researcher using the conventional lecture method without permitting the students to use any instructional aids or be exposed to any instructional aids. This group was referred to as conventional lecture method. Six weeks were used for the intervention procedure. At the first week, Biology Education Achievement Test was administered on the students. From the second week through the fifth week the students were exposed to two-hours lecture per week without access to any instructional material. The interval between the pre-test and post-test was four weeks. During these 4 weeks the

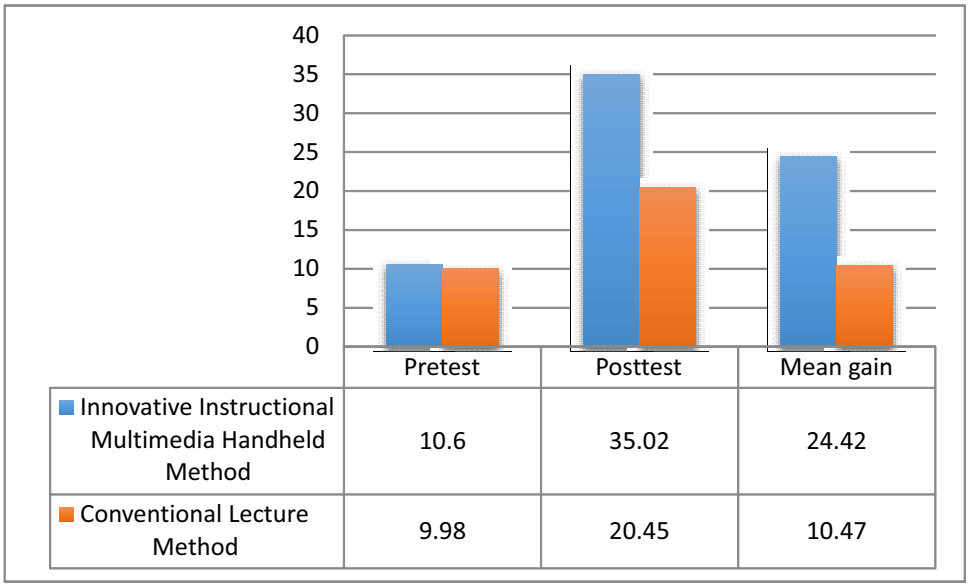
selected topics were thoroughly and effectively taught without using innovative instructional multimedia handheld method rather the conventional lecture method. The posttest was administered to the students at the sixth week.

Analysis and Results

Research question 1**:** What is the mean scores of students' achievement in Biology Education based on each of the lecture methods?

Figure 1

Pre-Test and Post-Test Mean Scores of Students' Achievement in Biology Education Based on each of the Lecture Method.



	Pretest	Posttest	Mean gain
Innovative Instructional Multimedia Handheld Method	10.6	35.02	24.42
Conventional Lecture Method	9.98	20.45	10.47

The result in Figure 1 revealed that the treatment group showed improved mean scores in the post-test, as compared to the pre-test mean scores as follows: the innovative instructional multimedia handheld method had a high mean score ($\pi = 35.05$) while the conventional lecture method had a low mean score ($\pi = 20.45$) and the mean gain of the treatment group (innovative instructional multimedia handheld method) over the control group (conventional lecture method) is ($\pi = 24.42$) . This implies that the treatment group gained more.

Research question 2: What is the mean scores of students' achievement in Biology Education based on gender?

Table 2

Mean Scores of Students' Achievement in Biology Education Based On Gen der

	INNOVATIVE INSTRUCTIONAL MULTIMEDIA HANDHELD METHOD		CONVENTIONAL LECTURE METHOD	
	FEMALE π (mean)	MALE π (mean)	FEMALE π (mean)	MALE π (mean)
PRE-TEST	20.78	19.56	20.89	18.19
POST-TEST	34.45	32.38	26.34	28.48
MEAN GAIN	13.67	12.82	05.45	10.29

The result in Table 2 showed that the female students in the treatment group gained more than their male counterpart in the post-test, as compared to the pre-test mean score as follows: female ($\pi = 34.45$), male ($\pi = 32.38$). On the other hand, the male students in the control group gained more than their female counterpart in the post-test, as compared to the pre-test mean score as follows: male ($\pi = 28.48$), female ($\pi = 26.34$). This implies that the female students gained more in the treatment group than their male counterparts while the male students gained more in the control group than their female counterparts.

Hypotheses testing

$H0_1$: There is no significant mean difference in the academic performance of students who were exposed to Innovative Instructional Multimedia Handheld Method (IIMHM) and those who were exposed to Conventional Lecture Method (CLM) method of teaching.

Table 2

Significant Main Difference in The Academic Perf ormance of Students Who Were Exposed to Innovative Instructional Multimedia Handheld Method (Iimhm) And Those Who Were Exposed to Conventional Lecture Method (Ctlm) Method of Teaching

Variables	Mean	Std .Dev	N	t	Sig.	Remark
Innovative Instructional Multimedia	9.60	2.579	300	2.091	.034	Sig.
Conventional Lecture Method	7.98	2.858				

Table 2 above showed there is also a significant difference between the experimental group i.e. group taught with innovative instructional multimedia method and conventional lecture method group ($t = 2.091$, $N = 300$, $p < 0.05$). The implication of this finding revealed that there is significant difference in the academic performance between the experimental and control group at the post-test level. From the Mean difference and Standard deviation of both Experimental and Control group, the Experimental group (Innovative Instructional Multimedia Handheld Method had a mean of 9.60 with 2.579 as standard deviation compare with the Control Group (Conventional Lecture Method) which had a mean of 7.98 with standard deviation of 2.858. It reflected that the performance of students in the experimental group (Innovative Instructional Multimedia Handheld Method of teaching) is far better than the Conventional Traditional Lecture Method of teaching. By implication, it means that the method employed by the teacher will determine whether students perform better or not academically. This indicated that those students that were taught utilizing Innovative Instructional Multimedia Handheld Method (IIMHM) performed significantly better than the students taught by Conventional Lecture Method (CLM). Thus, hypothesis one is rejected.

$H0_2$: There is no significance difference in the academic performance of male and female students exposed to innovative instructional multimedia handheld method.

Table 3

Significance Difference in The Academic Performance of Male and Female Students Exposed to Innovative Instructional Multimedia Handheld Method

Variables	Mean	STD.DEV	N	T	Sig	Remark
Female academic performance in Biology Education	34.45	2.997	120	1.045	.045	Sig.
Male academic performance in Biology Education	32.38	2.045				

Table 3 above showed that academic performance of the female students taught with innovative instructional multimedia handheld method have a slightly higher mean score of 34.45 and standard deviation of 2.997 whereas male students have a mean score of 32.38 and standard deviation of 2.081 with ($t = 1.045$, $N = 120$, $p < 0.05$). This is an indication that female students performed academically better than their male counterparts after being taught. This implies that there is significance difference in the academic performance of female and male students exposed to innovative instructional multimedia handheld method. Hence, the hypothesis is rejected.

Discussion

The study findings shed light on the utilizing innovative instructional multimedia handheld device for improved University students' academic performance in Biology Education. This discussion synthesizes the key results and explores the implications for students' achievement in Biology Education in the University system in South west, Nigeria. The result revealed that the students taught with innovative instructional multimedia handheld method gained more than those

taught with the conventional lecture method. In addition, the result showed that the students that were taught utilizing Innovative Instructional Multimedia Handheld Method (IIMHM) performed significantly better than the students taught using Conventional Lecture Method (CLM). This implies that innovative instructional multimedia handheld method could be an effective strategy for improving students' academic performance. This finding is in tandem with those of Olaniyi (2021) who posited that there is a correlation between social multimedia usage and academic performance of students in schools and Wheeler, Yeomans (2008), Rifkin, Lon necker, Leach and Ortia (2009) who claimed that correlation exists between social multimedia and academic performance of students in the school.

Furthermore, the finding unveiled that the female students gained more in the treatment group than their male counterparts while the male students gained more in the control group than their female counterparts. The finding revealed that there was significance difference in the academic performance of female and male students exposed to innovative instructional multimedia handheld method. The difference observed in the performance of male students in the treatment group over their male counterpart could be attributed to the fact that everyone including female are computer and internet compliant in this era of digitalization and there is the belief in this present time that what men can do women can do it better. These findings disagree with that of Schaumburg cited in Enikanolaye (2021) stated that female students are not much interested in computer compared to male students and Derbyshire in Enikanolaye (2021) who asserted that any occupation related to computer and ICT such as computer scientist, system analyst and computer engineering are the dominant career choices for males. Also, these findings are not in tandem with that of Enikanolaye (2021) who found that both female and male students were capable of competing in classroom activities when taught with a better instructional strategy

Conclusion

From the findings of the study, the following conclusions were drawn: the students taught with innovative instructional multimedia handheld method gained more than those taught with the conventional lecture method. Female students gained more in the treatment group than their male

counterparts while the male students gained more in the control group than their female counterparts. In addition, the students that were taught using innovative instructional multimedia handheld method (IIMHM) performed significantly better than the students taught using Conventional Lecture Method (CLM). Also, there was a significance difference in the academic performance of female and male students exposed to innovative instructional multimedia handheld method. Hence, the innovative instructional multimedia handheld method (IIMHM) engendered improved students' academic performance in Biology Education than conventional lecture method of teaching (CLM).

Implication of findings

This study has provided useful insight into the effect of Innovative Instructional Multimedia Handheld Method of Teaching on students' academic performance in Biology Education in the University system in South west, Nigeria. Education for self-reliance of learners in Biology requires exposing them to both theoretical and practical orientation through the use of reliable innovative teaching materials such as models, charts, with the intention of making them more resourceful, creative and innovative. This can be realized in teaching all courses where constructive, creative ability and interest find their fullest expression. Through careful integration of hand held devices, charts, models and relia materials that are involved in the Innovative Instructional Multi-Media Hand-held Method of Teaching (IIMHM). The students develop both mental and manipulative skills through correlation of muscular movement (manipulation) with mental age.

Recommendations

Consequent upon the findings of the study; it is hereby recommended that;

i. Lecturers should adopt the use of Innovative Instructional Multi-Media Hand-held Method of Teaching (IIMHM) in teaching concepts in educational and science-based courses.

ii. Federal Government, State Ministries of Education, Curriculum development should organize seminars and workshops for lecturers on regular basis to acquaint them and update their knowledge on the positive contribution of the contemporary digital

technologies to the academic performance of students.

iii. Charts should be used together with hand-held devices together with relia models for teaching various concepts in science-related course.

iv. Students irrespective of gender should be involved in the collection and production of locally- made models. By so doing, the students will retain better understanding of the principles underlying such equipments.

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