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EFFECT OF SMART BOARD INSTRUCTIONAL ON UNDERGRADUATE PHYSICS STUDENTS' ACHIEVEMENT AND MOTIVATION

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ABSTRACT

The study employed quasi experimental design to investigate the effect of smart board instructional tool on undergraduate Physics students' achievement and motivation in Imo State. One hundred and forty two (142) 100 level Physics Education students (87 males and 55 females) formed the sample of the study out of a population of six hundred and sixty eight (668) Physics Education students in the 2018/2019 session of the degree awarding government owned institution in Imo State. The instruments used for data collection were the Physics Achievement Test (PAT) and Motivation Scale (MS). The instruments were validated by experts in Physics Education and Measurement and Evaluation and their reliabilities obtained as 0.89 and 0.78 respectively for PAT and MS. Data were analyzed using mean and standard deviation to answer the research questions while the null hypotheses were tested at 0.05 significant levels using Analysis of Covariance (ANCOVA). Based on the findings of the study, it was concluded that smart board usage was significantly more effective in promoting students' achievement in physics than conventional lecture method. Lecturers and teachers were therefore advised to use smart board in teaching physics in order to achieve meaningful learning and desired knowledge in Physics.

KEYWORDS: Science and Technology, Smart Board, Achievement, Motivation, Information and Communication Technology

1. INTRODUCTION

The instructional delivery mode employed by the lecturers plays an important role in skills acquisition and meaningful learning. This mode of instruction in this era of Science and Technology is driven by information and communication technology (ICT). This is why governments, institutions, scholars and managements emphasize the need for a practically oriented science education curriculum and the need also to provide effective media for teaching science subjects like Physics in Nigerian schools and colleges (Abd-El-Aziz, 2014). Unfortunately, most of Nigerian classrooms from pre-primary to tertiary institutions are dominated by chalkboards and marker-

boards. The limitations of chalkboards and marker-boards instructional delivery mode include: ineffectiveness for very large group instruction; inability to allow information storage for future use; inability to accommodate illustrations to support the teaching; health hazard for teachers from chalk particles; making learning uninteresting, among other (Aliyu, 2013). To improve students' achievement in science related subjects in Nigeria, it is necessary to have a paradigm shift and join the developed world in embracing smart board instructional tools to teaching and learning. Such approach should be used in the country's educational system beginning from the basic school level up to the tertiary level.

Studies that examined the use of technology in schools and its effectiveness found that use of technology is efficient for students (Anderson & Dexter, 2015). Nitza Davidovitch and Roman Yavich (2017) explored satisfaction of students with use of technology at their schools, and the results showed that 72% of students think that each of the technologies introduced in their school helped in the understanding of the material taught in class. Use of assistive technologies that help convey the material visually is highly appreciated by students. Technologies are efficient pedagogical vehicles for conveying the study material through tools that create a great deal of interest in the lesson (Dror & Gershon, 2012). Dori and Kurtz (2015) checked the degree the use of technological means contribute to understanding the study material and to students' motivation. The research findings indicate that most students report that learning in a technological environment boosts their motivation, enhance their achievement and improved their learning experience. The major contribution of technology as perceived by students is in increasing access to a variety of tools that contribute to understanding the study material, organization of the information, efficacy in carrying out assignments, and development of knowledge. The most sophisticated education instructional tools in the school system today are the class smart board; these tools help students understand the material and create interest in the lesson (Dror & Gershon, 2012).

Enrique (2010) investigated the introduction of tablets to the school system and their impact on students with various levels of ability, and found that the tablet enables the weaker students to hear the texts at their own pace without feeling insecure or embarrassed at having to ask the teacher to review the material. Moreover, Education technology (Edutech) enables students to hear the precise pronunciation of the words. Its positive effect on students learning can be seen in their self confidence in speaking correctly to the class and their participation in the class. Encouraging this, Keengwe, Schnellert, & Mills, (2012) stressed that teachers should increase their technological knowledge and improve it in order to enhance teaching in class. In this study smart board was used during teaching and learning processes.

A smart board is like a large computer tablet with special touch-sensitive liquid crystal display (LCD) screen or a touch-sensitive white board that is used with a projector. The LCD display and white board are interactive that allow users to touch their surfaces to access software such as internet browsers, E-mail programs, word processors and multimedia programs. By using hand gestures,

object on the screen can be rotated, scroll through pages and perform zoom functions. White board marker can be used with the Smart white board display with special digital ink pen to write on the LCD display digitally. To use a smart board, the projector projects the computer's desktop onto the screen of the interactive whiteboard. The user controls the computer by using a special pen, finger or another tool to touch the screen of the interactive whiteboard. Normally, interactive whiteboards are fixed on walls. It is believed that teaching students Physics using smart board instructional tools will enhance their achievement in Physics.

Achievement depends on several factors among which are the instructional methods, learning environment and the learner. The brain does not pay attention to boring things. What makes smart board presentations so effective is that they add complementary, multisensory events designed to spark an emotional response among audience members. This helps maintain audience attention and improves achievement. The most effective presentations are the ones that are informative, educational, and entertaining (Gallo, 2010). Blau (2011) listed three characteristics that transform the smart board into an efficient pedagogical tool: Divergent learning, expand students' mind which facilitate supported joint thinking and interactive learning. Notwithstanding the importance of smart board instructional tool in teaching, the effects on students' achievement do not see to have been investigated. Despite the importance of science education and in particular Physics education to global development, student's performances are not encouraging, the problem could be attributed to the method of teaching employed by the lecturers which could adversely affect the achievement and motivation of undergraduate physics students. Hence the need to investigate effect of smart board instructional tools on undergraduate physics student's achievement and motivation in Imo State.

The purpose of this study was to determine the effects of smart board instruction on undergraduate physics student's achievement and motivation in Imo state. Specifically, the study sought to:

1. determine the mean achievement score of undergraduate physics students taught physics using smart board and lecture method.

2. determine the mean motivation score of undergraduate physics students taught physics using smart board and lecture method.

3. compare the mean achievement score of male and female undergraduate physics students taught physics using smart board.

4. compare the mean motivation score of male and female undergraduate physics students taught physics using smart board.

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2. METHODOLOGY

Pre-test, post-test control group quasi-experimental design was employed in this study. The experimental group was taught mechanics using smart board instructional tool while the control group was taught mechanics using the lecture method. One hundred and forty-two (142) 100 level Physics Education students in 2018/ 2019 academic session drawn from the population of six hundred and sixty-eight (668) Physics Education students in degree awarding institutions in Imo State. The sample size of 142 (87 males and 55 females) Physics Education students was selected using multistage sampling technique. Data was collected using two instruments namely; Physics Achievement Test (PAT) and Motivation Scale (MS). Both instruments were administered to the students as pretest before treatment. At the end of the study, the items of the instruments were reshuffled and re-administered to the students as post-test. All the research questions were answered using mean and standard deviation while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

3. RESULTS

Research Question 1: What is the mean difference in the achievement of undergraduate physics students taught physics using smart board and lecture method?

Table 1: Mean and Standard deviation of the achievement scores of students taught using smart board and Lecture method.

Method	N	Mean	SD	Mean difference
Smart board	26	53.2	10.3	
				20.6
Lecture	61	32.6	15.9	

Data in Table 1 shows that students taught with Smart Board instruction had mean of 53.2 and standard deviation of 10.3 while the lecture method had a mean of 32.6 and standard deviation of 15.9 given a difference of 20.6 in favor of Smart Board method.

Hypothesis 1: There is no significant mean achievement score of undergraduate physics students taught physics using smart board and lecture method.

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Table 2: ANCOVA result on mean achievement score of undergraduate physics students taught physics using smart board and lecture method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	45546.719a	4	11386.680	68.724	.000	.770
Intercept	26807.097	1	26807.097	161.794	.000	.664
Pretest	3123.610	1	3123.610	18.852	.000	.187
Method	**28000.083**	**1**	**28000.083**	**168.994**	**.000**	**.673**
Gender	91.884	1	91.884	.555	.459	.007
Method * Gender	430.110	1	430.110	2.596	.111	.031
Error	13586.339	82	165.687			
Total	250096.000	87				
Corrected Total	59133.057	86				

From the result of the ANCOVA test as shown in Table 2, the statement of hypothesis 1 is rejected; implying that there is a significant mean achievement score of undergraduate physics students taught physics using smart board and lecture method ($p < 0.05$).

Research Question 2: What is the mean difference in the motivation of undergraduate physics students taught physics using smart board and lecture method?

Table 3: Mean and Standard deviation of the motivation scores of students taught using Smart Board and Lecture method

Method	N	Mean	SD	Mean difference
Smart board	26	48.6	1.9	
				23.3
Lecture	61	25.3	2.5	

Data in table 3 shows that students taught with Smart Board instruction had mean of 48.6 and standard deviation of 1.9 while the Lecture method had a mean of 25.3 and standard deviation of 2.5 given a difference of 23.3 in favor of Smart Board instruction.

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Hypothesis 2: There is no significant mean motivation score of undergraduate physics students taught physics using smart board and lecture method.

Table 4: ANCOVA result on mean motivation score of undergraduate physics students taught physics using smart board and lecture method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	55024.855a	4	13756.214	401.004	.000	.951
Intercept	14563.368	1	14563.368	424.534	.000	.838
Pretest	134.878	1	134.878	3.932	.051	.046
Method	**39452.074**	**1**	**39452.074**	**1150.059**	**.000**	**.933**
Gender	22.867	1	22.867	.667	.417	.008
Method * Gender	92.312	1	92.312	2.691	.105	.032
Error	2812.961	82	34.304			
Total	209213.000	87				
Corrected Total	57837.816	86				

From the result of the ANCOVA test as shown in Table 4, the statement of hypothesis 3 is rejected; implying that there is a significant mean motivation score of undergraduate physics students taught physics using smart board and lecture method ($p < 0.05$).

Research Question 3: What is the mean difference in the achievement of male and female undergraduate students taught physics using smart board?

Table 5: Mean and Standard deviation of the achievement scores of Male and Female students taught using Smart Board.

Gender	N	Mean	SD	Mean difference
Male	40	82.5	7.7	
				3.4
Female	21	79.1	11.4	

Data in table 5 shows that Male students had mean of 82.5 and standard deviation of 7.7 while the Female Students had a mean of 21 and standard deviation of 11.4 given a difference of 3.4 in favor of Male Students.

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Hypothesis 3: There is no significant mean achievement score of male and female undergraduate students taught physics using smart board.

Table 6: ANCOVA result on mean achievement score of male and female undergraduate students taught physics using smart board.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	45546.719a	4	11386.680	68.724	.000	.770
Intercept	26807.097	1	26807.097	161.794	.000	.664
Pretest	3123.610	1	3123.610	18.852	.000	.187
Method	28000.083	1	28000.083	168.994	.000	.673
Gender	**91.884**	**1**	**91.884**	**.555**	**.459**	**.007**
Method * Gender	430.110	1	430.110	2.596	.111	.031
Error	13586.339	82	165.687			
Total	250096.000	87				
Corrected Total	59133.057	86				

From the result of the ANCOVA test as shown in Table 6, the statement of hypothesis 5 is accepted; implying that there is no significant mean achievement score of male and female undergraduate students taught physics using smart board ($p > 0.05$).

Research Question 4: What is the mean difference in the motivation of male and female undergraduate students taught physics using smart board

Table 7: Mean and Standard deviation of the motivation scores of Male and Female students taught using Smart Board.

Gender	N	Mean	SD	Mean difference
Male	8	49.6	1.6	
				1.5
Female	18	48.1	1.9	

Data in table 7 shows that Male students had mean of 49.6 and standard deviation of 1.6 while the Female Students had a mean of 48.1 and standard deviation of 1.9 given a difference of 1.5 in favor of Male Students.

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Hypothesis 4: There is no significant mean motivation score of male and female undergraduate students taught physics using smart board instructional tool.

Table 8: ANCOVA result on mean motivation score of male and female undergraduate students taught physics using smart board instruction

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	55024.855a	4	13756.214	401.004	.000	.951
Intercept	14563.368	1	14563.368	424.534	.000	.838
Pretest	134.878	1	134.878	3.932	.051	.046
Method	39452.074	1	39452.074	1150.059	.000	.933
Gender	**22.867**	**1**	**22.867**	**.667**	**.417**	**.008**
Method * Gender	92.312	1	92.312	2.691	.105	.032
Error	2812.961	82	34.304			
Total	209213.000	87				
Corrected Total	57837.816	86				

From the result of the ANCOVA test as shown in Table 8, the statement of hypothesis 7 is accepted; implying that there is no significant mean motivation score of male and female undergraduate students taught physics using smart board instruction ($p > 0.05$).

3.2 Discussion of Findings

Data in Table 1 shows that the mean achievement scores of physics students taught with Smart Board instruction were higher than that of their counterparts taught with the lecture method. Furthermore, the result in hypothesis 1 revealed that mean achievement score of students taught using smart board instruction was significantly higher than those of the students taught using conventional teaching method. The reasons for the higher achievement by the smart board group could be that they were more actively involved in the use of smart board which is efficient for students. The above findings is in line with the findings of Davidovitch and Yavich (2017) who reported that the greatest improvement since the introduction of smart boards is in the variable of clarity, and a significant difference was found in the favour of smart board students. The result also supported the work of Granito (2014) that used effect of technology on a student's achievement and knowledge retention and found significant effect on the mean achievement score of students in their studies. Also, this result agrees with the findings of Mbonu (2008) who reported that the more the students were exposed to interactive smart boards the quicker they progressed in acquiring knowledge.

The finding revealed that the mean difference in motivation of students ranked higher with those taught using smart board than those taught using the lecture method. The null hypothesis that there is no significant difference in motivation amongst undergraduate students taught physics with smart board

and lecture method was rejected. Meaning that a significant difference exists. This finding gave credence to the works of Davidovitch and Yavich (2017) and Granito (2014) who concluded that students' motivation in physics can be improved through the use of appropriate instructional resources. This finding is also in line with the works of (Granito, 2014; Mbonu, 2008; Blau, 2011) who reported that multimedia is a good motivator of the students learning different physics concepts.

Result of this study showed that there is a difference between the mean score in achievement and motivation of male students and that of their female counterparts taught physics with smart board. Results from data analyzed revealed that male students taught with smart board do not differ significantly in their mean physics achievement from their female counterparts taught in the same way. The finding of this study is in line with the findings of Mbonu (2008), Gbodi and Nworgu (2006) and Ifeakor (2005) who reported that gender had non-significant effect on physics achievement when students are taught with multimedia. The finding of this study is also in agreement with the finding of Iloputaife (2001) who reported that students' gender had no significant effect on their physics achievement when taught with analogy change instructional model. However, the result is not in agreement with the findings of Okebukola and Ajewole cited in Ifeakor (2005) who in their studies found out that boys achieved significantly higher than girls in biology. The study further revealed that smart board enhanced the achievement of both male and female undergraduate physics students. Thus, the technique was able to accommodate both sexes.

The test for significant difference further revealed that there is no significant difference in the mean score in motivation of male and female students exposed to physics through the use of smart board and PowerPoint instructional strategies. The finding of this study differs from the finding of Blau (2011) who reported that boys show significantly greater motivation in physics than girls. However, the result was in line with the finding of Ogunleye and Babajide (2011) that multimedia technique enhanced male and female students' motivation in physics equally.

4. CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, it was concluded that smart board usage was significantly more effective in promoting students' achievement in physics than conventional lecture method. There was a significant difference in achievement amongst students taught physics using smart board and conventional lecture method in favour of smart board. Smart board enhanced the motivation of physics students. Smart board had no pronounced differential impact on physics achievement among male and female students. The achievement was almost uniform for both sexes.

Based on the findings of the study, the following recommendations are made:

1. Lecturers should use instructional tool such as the smart board in teaching physics since this study has shown that meaningful learning and desired knowledge are acquired by using this technology, irrespective of the students' gender.

2. Government should provide and recommend the use of smart board for physics instruction in universities, and include same in the curriculum for teaching complex topics.
3. Some physics lecturers may lack the skill and competence for designing and producing smart board techniques. Therefore, efforts should be made by university authorities to organize periodic workshops, seminars and conferences to train lecturers and equip them with necessary competencies in the use of smart board.
4. Researchers should use smart board instructional tool for analyzing, tabulating of scientific discoveries and teaching of research methods to undergraduate students in large classes.
5. The university authorities should also digitalize lecture halls with smart board instructional tool and ensure steady power supply to enable distance learners have access to class discussions and assignments given by lecturers online.
6. Since the findings of this study show that male and female students benefited and performed better when taught with smart board instructional tool, therefore, students should be equipped with necessary ICT facilities to leverage the potentials of smart board instructional tool and improve student performance

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