

Interactive White Board and Biology Students' Performance Senior Secondary in Zaria Educational Zone Kaduna State, Nigeria

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Abstract

This paper discussed the use of Interactive Whiteboard (IWB) to enhance academic performance among SS Biology Students in Zaria, Kaduna State Nigeria. The study employed the quasi experimental (EG) and control group (CG) design involving two groups. The population of the study include all the senior secondary schools in Sabon-gari educational zone with a total number of one thousand, two hundred of forty-seven (1247) students. One hundred and forty students (140) were selected and used as sample size. The experimental group (EG) received teaching using Interactive whiteboard (IWB) which provided ways to show students everything which can be presented on a computer's desktop (educational software, web sites, and others). The Control group (CG) were taught using the traditional chalk-board method. The results showed that IWB has a positive effect on academic performance of the students. From the study, it was concluded that, IWBs when optimally utilized add value to the whole learning process and help teachers in planning and developing of resources prior the commencement of teaching as a presentation. The paper recommended that: teachers should be trained to utilize the technology for new pedagogical purposes, public and private owned Institutions should consider the integrated model of installing IWBs in classrooms, digital immigrant teacher (Generation "X") should be sensitized, train and ensure they utilize the IWBs in teaching-learning in the classrooms and/or laboratories and finally IWBs should be encouraged in Nigerian schools especially for teaching Science based subjects such as Biology and other practical oriented courses.

Key words: Interactive whiteboards, Science, Technology, Pedagogy, Classroom

Introduction

Pedagogy is the method and practice of teaching the young ones especially in practical subject or theoretical concept. Pedagogy might sound like complicated concept but, it simply refers to all levels of teaching, from nursery, primary and all the way to higher education. When it comes to the fundamentals of pedagogy, there are five different approaches to consider. Each of these approaches is usually placed on a spectrum from teacher –focused to learner-focused pedagogy. Teacher-focused pedagogy revolves around teachers, putting them at the center of the learning process, while learner-focused pedagogy is centered around learners as active role in the learning process. However, Pedagogy involves five main approaches namely,

Constructive approach, Collaborative approach, Reflective approach, Integrative and Inquiring approach.

Information and communication technology on the other hand is becoming part of the daily life in contemporary educational institutions across the globe. In Nigeria, the earliest initiative in this direction was the pilot scheme in the Federal Government Colleges in 1987 which was preceded with training programs for 197 teachers (Yoloye, 1990). Since the 1987 initiative, the process of ICT integration in Nigeria schools has been very slow. There is still lack of evidence that ICT can actually enhance students' performance, particularly in science and technology education where students' performance in public examination is poor. To improve on the achievements of students in science and technology education related subjects in Nigeria, it is necessary to have a paradigm shift and join the developed world in embracing interactive whiteboard for teaching and learning (Isiaka, Gambari, Sherifat Balogun & Ahmadu, 2014).

On the same note, Adeoye and Adanikin (2020) reveals that teachers are no longer dispensers of knowledge; they are facilitators and guiders of learners' learning. Manny-Ikan, Dagan, Berger-Tikochinski and Zorman (2011) opined that use of Interactive White Board (IWB) for instruction can serve as a catalyst for the change from traditional instructional methods to interactive and constructivist methods. IWB can also prompt change in teacher's pedagogy and produce enriched learning environment. This change began with build-up of the teacher's station in class, including infrastructure for use of a projector and a computer linked to the internet (Blau, 2012). This paper intends to proffer ways the interactive white board can be optimized by the science teacher in the teaching and learning process in the classroom.

Performance in Science and Technology Education (STE) is the inculcation in the citizenry, skills of searching for, and understanding nature (Ugo & Akpogho, 2016). The level of success of a nation to exploit the potentials of its environment depends on the quality of Science and Technology education provided to the citizenry, and how well the citizenry has imbibed the culture of science and technology. In Nigeria, and indeed many other developing countries, the effort towards technological development has been more on transferred, borrowed, or even bought technology. Neither of these will lead a nation to attain an appreciable technological height. Technology is a culture that has to be developed from within. Development is an expression of change and growth. That there is development presupposes that change and growth have occurred. In view of the dynamic nature of societies, development should be an on-going process. This is why Voogt and Roblin (2012) reviewed several frameworks for 21st century STE competence as: information literacy, technological literacy and ICT literacy. Information literacy refers to the capacity to access information in an efficient and effective manner, as well as the ability to critically evaluate information.

ICT literacy refers to more than technical skills and includes the use of digital technology, communications tools or networks to operate in a knowledge society. Technological literacy refers to the ability to use, understand and evaluate technology as well as applying it to develop solutions for particular problems (Voogt & Roblin, 2012). Thus, in the knowledge society teachers and students will have to understand and utilize the different

technologies like the interactive whiteboards (IWBs) in order to enhance teaching and learning in classrooms.

The technological generations in Nigeria are categorized into generation X-Y-Z as describe by Almog and Almog (2016) in a related article. Generation “X” is the older generation defined as “digital immigrants” as they acquire technology over time. Generation “Y” is the first generation to be born into a computerized world, affecting their manners of thinking and life style. The digital language is their first language. The children born to ‘Generation Y’ are designated “Generation Z” and their features are essentially similar. The definition of this generation can illuminate how IWBs are accepted in the schools by senior science teachers (Generation X) who were technically challenged in accepting the technological change, the younger science teachers (Generation Y) who were capable of dealing with IWBs and could use them properly, and the students (Generation Z) for whom it came naturally, as they were born into the digital world and thus their appreciation cannot be perceived as a significant touchstone. This generation was born into a technologically developed world, and a change such as IWBs which to many, seems far-reaching, appears to the younger science generation a natural and integral part of daily life.

There is need train on the job especially for Generation X to embrace this technological transformation in the educational system. It glaring those technological tools (i.e. smart phones, computers, IWBs etc) can provide new methods for teaching and learning in education. Glover, Miller, Averis and Door (2005) stated that, there is an increasing awareness of the need to understand the match between technology and pedagogy in the development of interactive learning supported by IWB in schools. Miller and Glover (2006) added that, “pedagogic structures developed to enhance conceptual cognitive understanding and awareness of interactivity as the key to this enhanced understanding”.

Blau (2011) in Davidovitch and Yavich (2017) listed three characteristics that transform the IWB into an efficient pedagogical tool:

- Divergent learning** -the ability to skip from pages on the screen to the internet in a structured and fluid manner. This ability simulates the associative organization of the student’s brain and contributes to the organization and clarity of the lesson as perceived by the student.
- Smart learning** -serve as a cognitive tool that expand students’ mind and facilitate supported joint thinking. Since some of the mental load is transferred from the students to the board, they are free to engage in higher thinking processes.
- Interactive learning** -smart boards enable interactions between study contents and the students themselves, both face-to-face and online. Notably, all science teachers who teach with IWB receive designated training, in which they learn how to operate it and how to teach with it, for example matching the text to visual presentation or avoiding excess explanations.

Based on the reviewed on the introduction of interactive whiteboards (IWBs) in educational setting, it indicated that IWBs have had a positive impact on teaching and learning.

According to British Educational communication and Technology Agency's (BECTA's) analysis (2003) revealed interactive whiteboard increases teaching time by allowing teachers to present more than one resource in the lesson and more efficiently

Walker (2003) indicated other influences of IWB on teaching as:

- a. Enables teacher to use web-based resources in whole-class teaching. They could bring the outside world inside classroom that is the Internet.
- b. Enables teacher to use face-to-face instructions and call environment at the same time.
- c. linking objects which is an excellent way to make classes non-linear and to bring the Internet straight into Science classes. Enables teacher to use multimedia materials that help them to present and explain various concepts.
- d. Enables teacher to provide authentic materials and information through text, pictures, sounds, video segments, and animation. Enhance learners' engagement more than conventional class teaching does.
- e. Encourages more varied, creative and seamless use of teaching materials.

Glover and Miller (2001) pointed out that IWB also allow teachers to share and re-use materials, thereby, reducing workloads Smith (1999) also opined the following impact of IWB on teaching:

Inspires teachers to change their pedagogy and encouraging professional development.

Inspires teachers to re-think their approach to teaching and learning.

Supports classroom management with the ability to walk around the classroom, and be near learners; this could make a difference in learners' behaviors. Interactive whiteboard supports many different learning styles and is used in a variety of learning environments.

It provides more opportunities for interaction and discussion in the classroom, especially when compared to other ICT. IWB captures learners' attention and encourages the involvement of learners in the subject. Learning techniques involves visual rather than verbal instruction. Learners are able to see their work on the board. IWB enables teachers to mix face-to-face interaction and e-learning platform – to create a rich learning environment. It also contributes to cognitive and conceptual developments of the learners.

Statement of the Problem

Nationwide, the use of Interactive whiteboard is a new comer to the corridor of teaching and learning in Kaduna State and Sabon-gari in particular. However, faced with challenges of poor performance among student in most of their science subject especially Biology. Recent results of West African Examination Council (WAEC) and NECO recorded below 40 percent pass in their examinations. This poor performance could be attributed to the poor exposure to technology and the primitive way of teaching using chalk-board method. In the traditional method i.e 'chalk-board' the students most at times do not observe objects or feel it, the method

explains a topic or concept which most students may not grab. The IWBs are always fixed to classroom walls, the data projector is hooked to the ceiling of the classroom for frequent check and observation.

Interactive Board technology provides students to perform a range of functions. They can write, drop and drag images or text on the touch sensitive surface. This technology enables its user to engage with educational multimedia activities, simulation can be watched, or graphs can be plotted or viewed, presentation of model in a 3D pattern as well as magnification of objects (like: cells, tissues, microbes) when connected with a specified microscope for use in the laboratory. Beauchamp (2004) pointed out that certain computers skills if learned will enhance the effective utilization of the IWB. It was on this note that the researchers employ the use of IWB to see if the academic performance of Senior Secondary School Biology Students in Sabon-gari Zaria Kaduna will improve.

Objectives of the Study are:

1. to determine the effect of IWBs on students' academic performance among SSS 3 students in Zaria area.
2. to determine the level of retention of Biology concept among the students when taught using IWB and the traditional chalk and blackboard.

Research Questions

1. what is the difference between the IWBs and the local materials ie blackboard, chalk and duster?
2. what is the difference in the academic performance of students when taught using IWB and traditional materials?
3. What is the difference in the retention of the concept taught when using the IWBs?

Null Hypotheses

1. There is no difference between IWBs and the traditional way of teaching ie blackboard, chalk and duster.
2. There is no difference in the academic performance of students taught using IWBs and those taught using local materials.
3. There is no difference in retention of the concept among those taught using IWBs and those taught using the traditional way.

Methodology

Descriptive design was used for the study, the population of the study involved all the SS2 students in the Public schools in Zaria Educational zone comprising a total number of one thousand two hundred and seventy-four (1274) students. A stratified random sampling technique was used to select two schools with a sample size of one hundred and forty (140) for the study. The researcher developed two instruments ie Biology Students Performance Test (BSPT) for pre and post-tests. Two lesson plans were prepared one for the experimental group (EG) who were taught using the IWBs and control group (CG) who were taught using the traditional way. Each of the groups received four weeks teaching before administering the test

questions. Forty (40) structured questions were set and validated by two Senior Biology teachers and Biology lecturers for the exercise. The assistance of the class teacher was employed to ensure good participation of the students. In the analysis, the SPSS with t-test and standard deviation were used for the analysis.

Result

Answering Research Questions

Research Question 1: What is the difference in academic performance of students when exposed to Interactive White Boards and those taught using local chalkboard?

To answer research question one, post-test scores of students in both experimental and control groups generated from performance test were subjected to descriptive analysis. The mean scores and standard deviation of the statistics is presented in Table 1.

Table 1: Posttest Mean Performance Scores for Students in the Experimental and Control Groups

Group	N	Mean	SD	Error	Mean Difference
Experimental	72	12.58	3.05	0.36	3.21
Control	73	9.37	2.90	0.34	

Table 1 showed that difference exists between the academic performance scores of students exposed to Interactive White Boards and those taught using local materials. The mean performance score of students in experimental group was 12.58 while the mean academic performance scores of students in control was 9.37 giving a mean difference of 3.21 in favour of students in the experimental group.

Research Question 2: What is the difference in academic performance of male and female students when exposed to Interactive White Boards?

To answer research question two, the post-test scores of male and female students in the experimental group generated from performance test were subjected to descriptive analysis. The mean scores and standard deviation of the statistics is presented in Table 2.

Table 2: Posttest Mean Performance Scores for Male and Female Students in the Experimental Group

Group	N	Mean	SD	Error	Mean Difference
Male	43	12.86	3.05	0.47	0.69
Female	29	12.17	3.06	0.57	

Table 2 showed that there is a slight difference between the academic performance scores of male and female students exposed to Interactive White Boards. The mean performance scores of male students were 12.86 while the mean academic performance scores

of female students was 12.17 giving an inconsequential mean difference of 0.69 in favour of students in the experimental group. To find out whether the difference is significant, the mean scores of male and female students in the experimental group were subjected to an independent samples t-test (Table 5).

Research Question 3: What is the difference in the retention ability of students exposed to Interactive White Boards and those taught using local materials?

To answer research question three, the post post-test scores of students in the experimental and control groups generated from the performance test were subjected to descriptive analysis. The mean scores and standard deviation of the statistics is presented in Table 3.

Table 3: Retention Ability Mean Scores for Students in the Experimental and Control Groups

Group	N	Mean	SD	Error	Mean Difference
Experimental	72	15.24	3.35	0.39	4.28
Control	73	10.96	2.76	0.32	

Table 3 showed that difference indeed exists in the retention ability of students exposed to Interactive White Boards and those taught using local materials. The experimental group had a higher mean retention score of 15.24 compared to that of the control group who had 10.96 with mean difference of 4.28.

Hypotheses Testing

Null Hypothesis 1: There is no significant difference between the academic performance of students exposed to Interactive White Boards and those taught using local materials

To test null hypothesis one, the post-test scores obtained from the performance test of the experimental and control groups were subjected to independent t-test statistics at $P < 0.05$. Summary of the analysis is presented in Table 4.

Table 4: Independent t-test Analysis of Mean Performance Scores between students in the Experimental and Control Groups

Group	N	Mean	Std. Dev.	Std. Error Mean	df	t	P	Remark
Experimental	72	12.58	3.05	0.36	143	6.50	0.00	Significant
Control	73	9.37	2.90	0.34				

Significant at $p < 0.05$ level

Table 4 revealed that there is significant difference in the performance mean scores between the experimental and control groups, $t(143) = 6.50$, $p = 0.00$, which is less than 0.05 level of significance. The experimental and control group recorded a mean of 12.58 and 9.37 respectively. Therefore, the null hypothesis which stated that there is no significant difference between the academic performance of students when taught using Interactive White Boards

and those taught using local materials is hereby rejected. This implies that students' scores at posttest exposed to Interactive White Boards is found to be more effective in improving students' performance in biology than the use of local materials.

Null Hypothesis 2: There is no significant difference between the academic performance of male and female students exposed to Interactive White Boards.

To test null hypothesis two, the post-test scores of male and female students obtained from the performance test of the experimental group were subjected to independent t-test statistics at $P < 0.05$. Summary of the analysis is presented in Table 5.

Table 5: Independent t-test Analysis of Mean Performance Scores between Male and Female Students in the Experimental Group

Group	N	Mean	Std. Dev.	Std. Error Mean	df	t	P	Remark
Male	43	12.86	3.05	0.47	70	0.94	0.35	Not Significant
Female	29	12.17	3.06	0.57				

Significant at $p < 0.05$ level

Table 5 revealed that there is no significant difference in the academic performance mean scores between the male and female students in the experimental group, $t(70) = 0.94$, $p = 0.35$, which is greater than 0.05 level of significance. The male and female students recorded a mean of 12.86 and 12.17 respectively. Therefore, the null hypothesis which stated that there is no significant difference between the academic performance of male and female students exposed to Interactive White Boards is hereby retained. This implies that both male and female students exposed to Interactive White Boards benefitted from the teaching method thereby enhancing their performance and the Interactive White Boards is found to be gender friendly.

Null Hypothesis Three: There is no significant difference between the retention ability of students exposed to Interactive White Boards and those taught using local materials

To test null hypothesis three, the post post-test scores obtained from the performance test of the experimental and control groups were subjected to independent t-test statistics at $P < 0.05$. Summary of the analysis is presented in Table 6.

Table 6: Independent t-test Analysis of Mean Retention Ability Scores of Students in the Experimental and Control Groups

Group	N	Mean	Std. Dev.	Std. Error Mean	df	t	P	Remark
Experimental	72	15.24	3.35	0.39	143	8.41	0.00	Significant
Control	73	10.96	2.76	0.32				

Significant at $p < 0.05$ level

Table 6 revealed that there is significant difference between the mean retention ability scores of students in the experimental and control groups, $t(143) = 8.41$, $p = 0.00$ which is less

than 0.05 level of significance. The experimental and control groups recorded a mean retention score of 15.24 and 10.96 respectively. Therefore, the null hypothesis which stated that there is no significant difference between the retention ability of students exposed to Interactive White Boards and those taught using local materials is therefore rejected. This implies that students' scores at post posttest exposed to Interactive White Boards is found to be more effective in improving students' retention ability in biology concept than the use of local materials ie chalkboard.

Summary

1. Teaching biology concepts using Interactive White Boards significantly improved students' performance when compared to their counterparts taught same concepts using local materials for example, blackboard ($p = 0.00 < 0.05$).
2. Interactive White Boards significantly improved the academic performance of both male and female students in biology thereby making Interactive White Boards a gender friendly teaching method ($p = 0.35 > 0.05$).
3. Students taught biology concepts using Interactive White Boards retained concepts taught more than their counterparts taught same concepts using local materials ($p = 0.00$).

Conclusion

Installation and optimization of interactive whiteboard technology in Nigeria schools for science and technology education (STE) will enhance effective teaching and learning in the classrooms. The information and communication technology tool carry the hope for meaningful pedagogical change in traditional classroom learning. Teachers, students, and educational professionals in Nigeria need to embrace this change and contending with complex questions on how the usage of the technology could serve as an effective impetus for the anticipated changes. The teachers use and create a variety of learning resources that strengthen inquiry-based learning processes. The learners become centrally involved in the use of the IWB through the active building of knowledge via interaction. In general, this approach views the science teacher as the central authority, who is responsible for what goes on in class, and it is reasonable to expect that the students will develop a low level of personal responsibility for the learning and social processes.

Literatures reveals that with effective teacher training on the utilization of IWB as a tool for pedagogical change and improvement, teachers can indeed use it to work together with their students on developing thinking skills and abilities that will enable them to address the challenges of the 21st century.

Recommendations

The paper recommended the following:

1. Teachers should be trained to utilize the technology for new pedagogical purposes.

2. Public and private owned Institutions should consider the integrated model of installing IWBs in classrooms as well as in specific departments (such as science laboratories or halls).
3. Where there is availability of IWBs, a team of supervisors should be established in schools to monitor the optimization of its usage in teaching-learning process.
4. The digital immigrant teacher (Generation “X”) should be sensitize, train and ensure they utilize the IWBs in teaching-learning in the classrooms and/or laboratories.
5. IWB should be encouraged in Nigerian schools especially for teaching technological based and other practical oriented courses.

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