Original Article

IMPACT OF USING INTERACTIVE WHITEBOARDS (IWBs) ON STUDENTS' ACHIEVEMENT AND RETENTION IN BIOLOGY IN SENIOR SECONDARY SCHOOLS IN ABUJA MUNICIPAL AREA COUNCIL, FEDERAL CAPITALTERRITORY, ABUJA

Egbunu Roseline

Department Of Science Education, National Open University of Nigeria, Jabi, Abuja

Email:
regbunu@noun.edu.ng

Abstract The study investigated the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council, Federal Capital Territory, Abuja. Two research objectives, research questions and hypotheses guided the study. The study adopted descriptive survey research design. The population was made up of 1,646 respondents; comprising 38 Biology teachers and 1,608 SS III Biology students in all the eighteen (18) public senior secondary schools in Abuja Municipal Area Council. The sample size of 108 respondents comprising 90 Biology students and 18 Biology teachers and 9 senior secondary schools were adopted for the study. The sample size was selected using the combinations of purposive and simple random sampling techniques. Eight (8) items structured questionnaire titled "Interactive Whiteboards and Academic Achievement and Retention Questionnaire (IWAARQ)" was used as instrument for data collection. Content validity was used. Test-retest method of reliability was used to obtain the internal consistency. The reliability index was obtained through Cornbrash's alpha (0.79). Data collected was imputed into the SPSS (25) software package. Mean score was used to answer the research questions and t-test was used to test the null hypotheses at 0.05 alpha level of significance. The results revealed among others that interactive whiteboards have positive impact on students' achievement and retention in Biology in senior secondary schools. Inadequacy of interactive whiteboards and lack of power supply were constraints to the use of IWBs in senior secondary schools. It was recommended among others that government should equip the schools with adequate ICT media like interactive whiteboards, government should ensure stable power supply in all schools and Biology teachers should undergo training courses on ICT application in classroom instructional delivery.

Keywords: Impact, interactive whiteboards, achievement, retention, Biology.

Original Article

Introduction

Biology which is defined as the science of life is offered by both science and art students in all senior secondary schools in Nigeria. It is a prerequisite science subject for many fields of learning that contribute immensely to the technological growth of any nation especially in the field of forensic science, medicine, agricultural sciences, dentistry, biotechnology which includes genetic engineering, nursing, medical laboratory science among others (Samuel & Obikezie, 2020). Meanwhile, the academic achievement of students in science subjects particularly in Biology in both WAEC and NECO has been an issue of concern to every stakeholder in secondary education system in Nigeria. Narad and Abdullah (2016) see academic achievement as the knowledge gained which is assessed by marks by a teacher and/or educational goals set by students and teachers to be achieved over a specific period of time. It is defined as the performance portrayed by students in tests, course works and examinations. Grades in examinations could serve as predictive and criterion measures for academic achievement. These students' grades can either be high or low.

Arokoyu and Chimuanya (2017) assert that students' achievement in Biology at the secondary school level is becoming worse than the other science subjects. Bichi, Ibrahim and Ibrahim (2019) while citing the WAEC Chief Examiners' Reports, reveal that the percentage of students that passed Biology at credits was very low compared to the total entry. In 2014, it was 33.9%, fell to 28.6% in 2015 and 33.9% in 2016. In the year 2018, only 28% of the students passed Biology at credit level. Also, Osuafor and Chukwuemeka (2023) assert that evidence from WAEC Chief Examiners' Reports between 2018 and 2021 revealed the poor performance of students in the West African Examination Council (WAEC) examinations in the subject from 2018 to 2021. Throughout the examination results, the performance of Biology students is always below 50% of the total number students who offered Biology in the external examination.

Meanwhile, scholars like Akinjide (2018) and Ihekwoaba (2020) blame the poor achievement of students in Biology on a number of factors that include inadequate learning facilities, inappropriate use of teaching method, over loaded curriculum, poor mastery of language of instruction (English language), poor knowledge of the concepts, lack of qualified teachers and over populated classes among others. Also, Etokeren and Okwelle (2019) are of the view that the cause of poor achievement of students in Biology is conceptual difficulty. The authors stressed that students generally experience difficulties in understanding some difficult Biology concepts. One aspect of senior secondary school Biology curriculum that students find difficult to understand is ecological concepts. Parenting factor, nonchalant attitude of students to studying, ill-equipped laboratory, science equipment and training of Biology teachers in certain concepts in the Biology curriculum are also responsible for poor students' achievement in the subject (Egbunu, 2019).

Government, researchers and other stakeholders in educational sector have made efforts in seeking ways of improving students' learning outcomes in this subject. But these efforts are yet to yield satisfactory outcome. There is therefore the need to make Biology classroom instruction more interesting for students. As noted by Okolocha and Nwaukwa

(2020) that Biology achievement is usually measured by tests scores which is usually expressed in students' grades in the subject. This can only be obtained maximally by innovative technological instructional strategy. The question that easily comes to mind in this regard is; can utilization of Interactive Whiteboards (IWBs) facilitate students' achievement in Biology?

The interactive whiteboard (IWB) is a part of the information and communication technologies (ICT) integration process in educational system. It is one of the technologies most schools in developed countries like the US, Demark, England, Spain, and Turkey invested in to promote quality teaching and learning process. Interactive whiteboard otherwise referred to as Smart boards is a large interactive display in the form factor of a whiteboard. Mâţă, Lazăr and Lazăr (2016) see interactive whiteboard as a large touch-sensitive and interactive display that connects to a computer and projector. It is an electronic device that enables interactive work with computer directly from the board itself through clicking on the projected picture, interactive pen or a human finger. They are used in a variety of settings, including classrooms at all levels of education, in corporate boardrooms and in broadcasting studios, among others.

Interactive whiteboard represents the first type of educational technologies suitable for interaction in the classroom environment. As a part of ICT enhanced teaching and learning, the use of interactive whiteboard in the classroom can make a difference for students who have trouble with thinking in abstract subjects, because it makes the teaching and learning process more concrete. Mâţă, Lazăr and Lazăr (2016) argued that the interactive whiteboard (IWB) is part of information and communication technologies (ICT) enhanced learning and teaching Science and is able to combine a lot of beneficial features of ICT in one medium. The main advantages of IWB lie in the simplification of teachers' preparation for particular lesson, better visualization of presentations, possibility to be connected on-line and also, active remote participation. It serves as effective tool for presentation of classroom instruction, especially in Biology.

The interactive whiteboard generally consists of a computer, a data projector, and an electronic screen. Biology teachers can enrich their instructions with the use of interactive whiteboards to increase students' attention, motivation, participation, and collaboration (Ceren & Ergul, 2017). Interactive whiteboard has the potential of enhancing students' achievement in Biology. This is because it appeals to many human senses at a time and the lesson being communicated by teachers using the IWB could be made self-explanatory. This will not only increase the understanding of students in Biology but will also improve their achievement in Biology examination. The result of study by Ifeakor, Akujieze and Erutujiro (2020) showed that students taught with interactive whiteboard perform significantly better in achievement test than their counterparts who were taught using the convectional teaching method. Interactive whiteboards have brought significant improvements in Biology classrooms because it simplifies the learning processes, thereby improving students' achievement.

According to Eztalks (2020), with interactive whiteboards, a Biology teacher can easily formulate and plan for the lesson beforehand. He/she can schedule for specific learning tasks like labeling parts of a picture and matching words with their respective meanings. This is where the benefits of interactive whiteboards in Biology class in secondary school come in handy. Students can understand how to handle naming tasks quite profoundly as the images are displayed right in front

of them. IWB's capacity allows flip back, to review material by the teacher as well as to assist lower ability groups in Biology class. This learning technology may lead to an increase in learners' motivation and task engagement.

Sani, Danladi and Amos (2019) observed that the present school plants which include ICT infrastructure in Nigeria seem inadequate to meet educational needs of students. The above observation portrays a situation that available ICT infrastructure fall below the number of person utilizing them. The majority of public secondary schools in Nigeria are not equipped with interactive whiteboards. Most public secondary schools in Nigeria do not have these ICT technologies. For the few schools with the gadgets, many teachers cannot successfully manipulate the gadgets. Many are not computer literate; therefore, they cannot use interactive whiteboard to improve students' academic achievement and retention. Many of the public school teachers lack the expertise in the mechanical and technical handling of some of the sophisticated ICT equipment such as the interactive whiteboards, projector, and film strip among others used to facilitate students' understanding of Biology.

The challenge of electricity is a constraint to effective implementation of ICTs in our school system. Since successful implementation of interactive whiteboard cannot be assured without constant power supply, then the problem of electricity comes into focus. According to Jegede, Ebio and Iroegbu (2019), Nigeria a developing country is facing the challenge of providing adequate power for its citizens. The inability of the government to provide constant electricity and to ensure every nook and crannies access electricity is affecting the utilization of ICT facilities in the Nigerian schools. Many public schools are not yet connected to electricity. Nigeria is yet to have stable electricity supply, this create problems for effective integration of most technological media in the delivery of education in the school. High cost of alternative sources of electricity such as the power generator also makes it difficult for secondary schools to sustain the use of generator in powering their academic programme.

Interactive whiteboard features offer the Biology teacher an opportunity to share screen, text, audio and video files with students in real-time. Students can also record full lessons and share them with friends who were not able to attend classes. Recorded lessons also provide a more convenient reference point during revision, which makes grasping important points quite easier. The benefits of using interactive whiteboards in Biology classroom instruction can never be underestimated especially with regard to enhancing students' academic achievement and retention. It is against this background that this paper investigated the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council, Federal Capital Territory, Abuja.

Statement of the Problem

The academic achievement of students at external examinations in recent times in Biology is not encouraging (Osuafor & Chukwuemeka, 2023). The WAEC and NECO Chief Examiners have consistently lamented the poor performance of candidates in Biology by using phrases like, "not satisfactory"; "downward trend"; "abysmal/dismal performance" "decline in pass rate"; "fluctuating performance"; and "persistent failure" in describing the performance of students (Piwuna & Mankilik, 2023). Some scholars attributed lack of understanding, insufficient teaching-learning materials and inadequate involvement of parents in learners' education as factors contributing to poor

achievement of students in Biology (Ndayambajeet al, 2021; Piwuna & Mankilik, 2023). But from the observation of the researcher, the poor state in which the subject and science in general are taught in secondary school need to be checked. "Chalk and Talk" method has been the most widely used science teaching method. This has often make Biology class boring and uninteresting for students. The researcher also observed that Biology teachers and many students are faced with difficulties in the use of modern technologies to facilitate teaching and learning process in classroom situation to improve students' achievement. Many public schools in the Federal Capital Territory are not equipped with modern ICT media like interactive whiteboards. There is also observable problem of epileptic power supply to power the electronic interactive whiteboard gadget where available. This problem thus necessitated the current study on the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council, Federal Capital Territory, Abuja.

Objectives of the Study

The specific objectives the study sought to achieve were to:

1. Find out the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council.
2. Find out the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council

Research Questions

1. What are the impacts of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council?
2. What are the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council?

Hypotheses

The following null hypotheses were tested in the study:

Ho_1 There is no significant difference between the mean rating of Biology teachers and students on the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools.

Ho_2 There is no significant difference between the mean rating of Biology teachers and students on the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools

Methodology

The study adopted descriptive survey research design. The population was made up of 1,646 respondents; comprising 38 Biology teachers and 1,608 SS III Biology students in all the eighteen (18) public senior secondary schools in Abuja Municipal Area Council (AMAC). The sample size of 108 respondents comprising 90 Biology students and 18 Biology teachers and 9 senior secondary schools were adopted for the study. The sample size was selected using the combinations of purposive and simple random sampling techniques. 9 public senior secondary schools were randomly selected from the 18 public senior secondary schools in AMAC. 2 Biology teachers from each schools and 10 Biology students were purposively selected across the nine (9) schools to participate in the study. Eight (8) items structured questionnaire titled "Interactive Whiteboards and Academic Achievement and Retention Questionnaire (IWAARQ)" was used as instrument for data collection. Content validity was used. Test-retest method of reliability was used to obtain the internal consistency. The reliability index was obtained through Cornbrash's alpha (0.79). Out of the 108 questionnaires administered, 98 were

returned valid, representing 91% success rate. The analyses of data were carried out based on the specific objectives and research questions of the study. Data collected was imputed into the SPSS (25) software package. Mean score was used to answer the research questions and t-test was used to test the null hypotheses at 0.05 alpha level of significance. Discussions of findings were done immediately after each data analysis.

Results

Research Question One: What are the impacts of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council?

Table 1: Impacts of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools N =98

S/n	Variables	Mean	Std. Deviation	Decision
1.	Student will learn better when IWB is used to teach them	3.54	.705	Agree
2.	Abstract concept is made real to student when teachers use IWB to teach	3.58	.772	Agree
3.	Learning is made permanent when students view the image of lesson taught through the application of IWB	3.56	.747	Agree
4.	The use of IWB will reduce the stress of explaining difficult concepts by Biology teachers	3.52	.735	Agree
	Average mean score and Std. Dev.	3.55	.739	Agree

Source: SPSS version, 25

Table 1 presents data with respect to the impacts of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council. The analysis shows agreement with all items. The average mean score of 3.55 creates basis for the conclusion that the use of interactive whiteboard impacts positively on students' achievement and retention in Biology in senior secondary schools.

Research Question Two: What are the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council?

Table 2: Constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools N =98

S/n	Variables	Mean	Std. Deviation	Decision
5.	Unavailability/inadequacy of IWBs serve as barrier to the use of IWBs by Biology teachers in my school.	3.73	.547	Agree
6.	Lack of power supply deters Biology teachers from using the few available ICT media in my school.	3.67	.588	Agree
7.	Lack of technical knowledge of handling IWBs by many Biology teachers is a constraint to the use of IWBs teachers in my school.	3.47	.692	Agree
8.	Poor maintenance culture is a challenge to the use of IWBs in public secondary schools	3.63	.648	Agree
	Average mean score and Std. Dev.	3.63	.619	Agree

Source: SPSS version, 25

Table 2 presents data with respect to the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council. The analysis shows agreement with all items. The average mean score of 3.63 creates basis for the conclusion that unavailability/inadequacy of interactive whiteboards in public schools, lack of power supply and technical knowledge of handling IWBs by Biology teachers as well as poor maintenance culture are constraints to the use of IWBs in public secondary schools.

Ho_1 There is no significant difference between the mean rating of Biology teachers and students on the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools.

Table 3: t-test on significant difference between the mean rating of Biology teachers and students on the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools.

Status	N	Mean	Std. D	t	df	Sig. (2-tailed)	Decision
Students	80	3.7875	.41166	10.796	96	.001	rejected
Teachers	18	2.4444	.70479				

Source: SPSS version, 25

Table 3 presents t-test which determines significant difference between the mean rating of Biology teachers and students on the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools. The table reveals that df = 96 and t = 10.796 at p = .001. The mean rating of Biology teachers and students on the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools is considered significant since p = .001 < 0.05. The null hypothesis which states that there is no significant difference between the mean rating of Biology teachers and students on the impact of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools is hereby rejected.

Ho_2 There is no significant difference between the mean rating of Biology teachers and students on the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools

Table 4: t-test on difference between the mean rating of Biology teachers and students on the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools

Status	N	Mean	Std. D	t	df	Sig. (2-tailed)	Decision
Students	80	3.9500	.21932	14.748	96	.001	rejected
Teachers	18	2.7778	.54832				

Source: SPSS version, 25

Table 4 presents t-test which determines significant difference between the mean rating of Biology teachers and students on the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools. The table reveals that df = 96 and t = 14.748 at p = .001. The mean rating of Biology teachers and students on the constraints to the use of interactive

whiteboard on students' achievement and retention in Biology in senior secondary schools is considered significant since $p = .001 < 0.05$. The null hypothesis which states that there is no significant difference between the mean rating of Biology teachers and students on the constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools is hereby rejected.

Discussion of Findings

The finding on the impacts of using interactive whiteboards on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council. It revealed that interactive whiteboard impacts positively on students' achievement and retention in Biology in senior secondary schools. The finding agreed with the result of study by Ifeakor, Akujieze and Erutujiro (2020) which showed that students taught with interactive whiteboard perform significantly better in achievement test than their counterparts who were taught using the convectional teaching method. Interactive whiteboards have brought significant improvements in Biology classrooms because it simplifies the learning processes, thereby improving students' achievement.

The findings on constraints to the use of interactive whiteboard on students' achievement and retention in Biology in senior secondary schools in Abuja Municipal Area Council. It revealed that unavailability/inadequacy of interactive whiteboards in public schools, lack of power supply and technical knowledge of handling IWBs by Biology teachers as well as poor maintenance culture are constraints to the use of IWBs in public secondary schools. These findings were in line with the report by Katitia and Tanui and Oruta (2019) that Nigeria a developing country is facing the challenge of providing adequate power for its citizens. The inability of the government to provide constant electricity and to ensure every nook and crannies access electricity is affecting the utilization of ICT facilities in the Nigerian schools. Many public schools are not yet connected to electricity.

Conclusion

Based on the findings of the study, it is therefore concluded that the use of interactive whiteboards significantly contribute to students' achievement and retention. Interactive whiteboards enhance students' achievement and retention in Biology in senior secondary schools. Lack of IWBs in secondary schools, inadequate power supply and lack of technical knowledge of IWBs by teachers are constraints to the use of interactive whiteboard in enhancing students' academic achievement in Biology in senior secondary schools.

Recommendations

Based on the objectives and findings of the study, the following recommendations were put forward.

- Government at all levels should equip the schools with adequate ICT media like interactive whiteboards to enhance students' academic achievement and retention in Biology in senior secondary schools.
- Government at all levels should ensure stable power supply in all schools to facilitate the use of electronic powered ICT media like interactive whiteboards.
- Biology teachers should undergo training on ICT application in classroom instructional deliver

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