

Effect of Interactive Smart Board Instructional Strategy on Students' Academic Performance in Cell Biology Concept: A Study of Senior Secondary School Students in Maiduguri, Borno State

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Abstract

The study examined the impact of interactive smart board instructional strategy on students' academic performance in cell biology concept. The study mainly targeted senior secondary students in Maiduguri, Borno State. The study adopts a quasi-experimental design, particularly the pre-test-post-test, for the study. The population comprised of all 5936 SS2 Biology students from public schools' senior secondary schools in Maiduguri Metropolis. A sample of 125 students from two randomly selected schools was used for the study. The group were divided into an experimental group using Interactive Smart board and a control group/lecture Method. The Cell Biology Performance Test (CBPT) was used for data collection. (CBPT) was duly validated with a reliability coefficient of 0.90 which subjected to the Pearson Product Moment Correlation (PPMC). Two research question and two null hypotheses were formulated to guide the study. Inferential statistics were used to test the null hypotheses at a 0.05 level of significance. Results obtained from data analysis showed students in experimental grouped performed significantly better than those in control group. Also, there was no significant difference between performance of male and female students taught biology using Interactive smart board. Based on the findings of this study, it was recommended that biology teachers should effectively make use of Interactive Smart board in teaching irrespective of gender. In addition, qualified teachers who are already in the field that are not knowledgeable in the act of production and use of Interactive SMART Board technology should be re-trained through seminars, workshops, and conferences.

Keywords: Interactive Smart Board, Educational Technology, Academic Performance, Senior Secondary School, Gender, Learning.

Introduction

Biology is a brach of natural science that deals with all aspect of a life (living and non-living things (Nlewem 2012, Onoja and Kemka–Evans (2020). It is an exceptionally broad discipline encompassing specialties as diverse as cell biology, genetics, biochemistry, taxonomy, pathogenic, bacteriology, microbiology and ecology. Being a science of life. Biology occupies a distinctive position in the school curriculum (Kareem 2003, Umar, 2011

and Sadiq, 2021). It is designed ultimately to educate individuals who may or may not pursue biological related careers, but could at least acquire the knowledge as prerequisite for pursuing careers in science related disciplines (FGN 2014). It is noticeable that the student proposing to study this discipline can do with biology and currently a standard subject of instruction at all levels of our educational systems (FME, 2009). Essentially it could be considered the only core science subject at Senior Secondary School Certificate Examination (SSSCE) (FGN 2013), Ahmad and Sari (2019) examined that whose study is very relevant to man's successful living, because of its importance, more students enrolled for biology in the senior secondary school certificate examination (SSCE) than for physics and chemistry (West African Examination Council, 2021). Biology is introduced to students at senior secondary school level as a foundation ground for human development, where career abilities are groomed, and potentials and talents discovered and energized (Federal Republic of Nigeria, 2009). In spite of the importance and popularity of biology among Nigerian students, performance at senior secondary school level has been poor (Ahmed, 2008, Adam, Lameed, Ayodele, and Muraina, 2023). The implication of this failure in education is that Nigeria may have shortages of manpower in science- and technology-related disciplines. This may affect Nigeria's vision to become one of the 20 industrialized nations in the world today.

Literature has reported the causes for this dismal performance to include: traditional teacher centered instructional methods, poor learning environment including crowded classrooms, lack of laboratories and resistance to employ innovative strategies just to mention a few (Umar, 2011; Gambari, Yaki, Gana, and Ughovwa, 2013; Ndagi, 2014 and Gambari 2020). Therefore, for Nigeria as a nation to be an active player in the dynamics of the 21st century economy nation.

Interestingly, technology in many ways is growing globally and the need to adopt a technology-based instructional strategies such as "smart board" to enhance the teaching and learning of biology for effective performance of students cannot be overemphasized. The use of interactive smart board in the classroom has proven to be effective in the teaching and learning of sciences particularly biology. It offers new idea, creative and the most engaging ways of teaching. Interactive "smart Board" instructional strategies make display with screen touch text, images, video and sound. Also, the use of Interactive smart board provides an enabling environment through which different types of learners can feel the interaction with smart board by touching, display and writing (text, visual, and audio,) to be learn.

The concept of Cell biology in Biology draws the attention of the researcher as a topic that needs selected instructional design approach for proper accommodation and assimilation of knowledge such as smart board instructional strategy. Cell biology concepts are one of the difficult concepts in biology, researcher like Sadiq (2021) identified students have difficulties in learning biology and also have no interest in the lessons due to the fact that students' motivation to learn this subject was low.

Furthermore, the poor performance in SSCE biology becomes more evident from the reports of the West African Examinations Council (WAEC) Chief Examiners Report, revealed that only a few candidates attempted questions on Cell biology and they showed a poor understanding of Cell biology concepts (West African Examinations Council, 2022). In view of the foregoing, the observed classroom practices have not been effective in Nigeria and that is seen clearly in the dwindling performance of students in science especially biology. While the expected for learners to acquire science knowledge and skills because most science, technology, engineering and mathematics job opportunities in the 21st century require some science skills and knowledge. Therefore, a gap is established between the observed classroom practices and the expected demand in the global market, which this study will attempt to fill the gap using an interactive smart board instructional strategy.

Recent literature indicates that the interactive smart board is one of the modern technological innovations that represent a revolution in presentation methods, especially in the field of teaching, as it is possible to display learning materials in an attractive and interactive manner and employ all its skills and tools to develop practical and performance skills for students, in addition to the various features that, it can be implemented by this board, such as recording, documentation, application, direct drawing on the board and the computer, as well as the ease of preparing lessons via the board, save, print, and arrange the contents of the board, saving time and effort, and direct communication, whether inside the classroom or via the global network and e-mail (Buzkan, Ersoy, Cico & Ceni, 2016; Cakiroglu, 2016; Bicak, 2019 & Imoke, Ushe & Ofem (2024).

De Vita, Ver Chaffe and Elen, (2014) referred that interactive smart board is a large touch-sensitive white boards with projector and linked with data, it has accessibility and function to display the multimedia and stored on the computer. This allows the teacher to add input and operate data through using an electronic pen or finger. Having an advanced software with board shall offer teachers additional functions

According to Jung and Suhyun, (2012) the smart board is one of the modern instructional innovations used in the interactive class for teaching purposes. It is a different type of interactive sensitive whiteboard that is dispensed with by touch or by pen and written on it electronically. It can also be used and displayed on the computer of various applications. Fernandez and Luft glass, (2003) and Tunaboyle and Demir (2017) observed that interactive smart board are powerful learning tools as they enable teachers to instruct using the latest technology, with access to the internet, videos and educational software. This empowers students to learn and explore new concepts with technology to create a more dynamic learning experience. The using smart board provides teachers and students with whole new interactive learning environment to share ideas, information, images, animations, audio or video. Learning is much more powerful if it is multimodal and the smart board support different styles-visual-spatial, auditory and Kinesthetics. (SMART-Technologies, 2004; SMART-Technologies, 2006).

The students are highly motivated when content is presented on smart board, it increases their enjoyment by being physically involved touching and moving objective and by the size

of the screen which makes image large enough for everyone to see. The engagement and knowledge building of students is fostered when they are given the opportunity to interact in a physical and mental learning environment. (Harlen and Rivkin, 2000) and (Lant, and Lawson, 2016). Further student's excitement in demonstrating a skill or 'operating' the smart board boost their self-esteem and build confidence in science and technology and aids them to work independently at a later time.

The influence of students' gender in their academic achievement had been a concern to researchers in education, yet no consistent result had emerged. Gammie, Gammie and Duneam (2023) viewed that gender issues and academic performance of students in sciences has become a recurring decimal in educational studies and research. Research findings in the past reported the dominance of male in achievement especially in sciences. In contrast to this some studies reported that female students are academically better than male students in social sciences. There are also a number of research studies which revealed that gender has no effect on academic performance of students in mathematics and science (Iftakar, Akujieze and Erutujiro, 2020)

Thus, the issue is still far from being conclusive. This shows that more works on gender differences and academic performance is still needed and gender is variable in this study. Against this background, the study investigates the effect of interactive smart board on academic performance in biology among secondary schools' students in Borno, Nigeria.

In the review of empirical studies, the usage and availability of interactive smart board in education and its effect on achievements have been the subject of many research studies. Onder and Aydin (2016) carried out an investigation for the influence of using interactive boards on achievement in a biology course in Turkey. Fifty 10th grade students in Anatolian High School in Buca, Izmir were sampled. A quasi-experimental approach is adopted, and pre-test and post-test were developed and administered. The researchers carried out semi-structured interviews with several members of the experimental group. They concluded that using interactive boards positively affects the achievement of students in biology course.

Ifeakor, Akujieze, and Erutujiro (2020) carried out an investigation for the influence of using interactive smart board on students' achievement on maths in Senior secondary school students. 100 students were sampled and two intact class consist of fifty students were randomly assigned to the experimental and fifty to control group. Analysis of covariance (ANCOVA) was conducted. Pre-test and post-test were used. The researchers concluded that using interactive boards positively and significantly affects the achievement of students in math. They concluded that such use improves problem solving skills and ability to solve equation.

Mohammed (2020) carried out an investigation on impact of using interactive smart board on secondary school students' learning outcomes in Egypt in the course titled (computer skills). The learning outcomes in this regard refers to academic achievement in the latter course. An experimental approach is adopted to ensure that the goals are met. 40 male school students were sampled. They were selected from 2 sections of the first secondary

grade in a private secondary school in Cairo, Egypt. They got divided in an equal manner into control and experimental groups. To teach the control group, interactive boards weren't used. To teach the experimental group, interactive boards were used. During the trial, 4 lessons were covered in each section through 4 periods. Pre-test and a post-test were employed for having the achievement measured in the latter course. SPSS program was used. Based on analysis, the two groups are similar in terms of the computer literacy level. The researcher concluded that using interactive boards significantly and positively affect achievement in the latter course. He recommends providing secondary school teachers in Egypt with training courses that improve their ability to use interactive boards in classroom. However, use of 'Smart board' has received widespread attention in context of learning innovation in schools. This tool has benefits in the teaching process, starting from more interesting presentation of material, active student participation, increasing understanding of concepts with visualization, to collaboration in completing learning tasks. Smart board as one of the innovations in digital learning media, it is also used to improve reading comprehension lesson skills in language learning in elementary schools (Hala & Arifin, 2020). However, despite its potential, the effectiveness of use Smart board improving learning innovation in schools still requires more in-depth research.

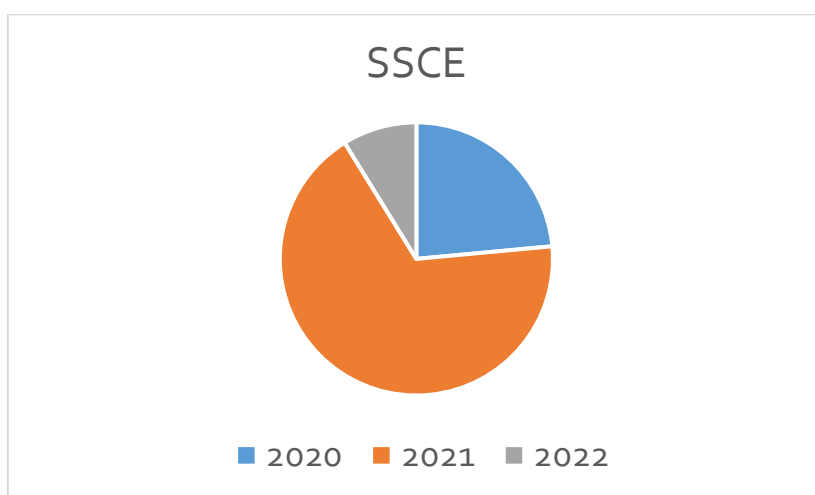
Based on mentioned above, this study comes to address the effect of the interactive smart board, as one of the technological innovations in the achievement of students with learning difficulties in Cell Biology.

Statement of the Problem

Cell biology is an important and fundamental area in Biology Education. The study of Cell biology offers insights into the way the living world works. However, as important as it is, it is also one of the most difficult topics. For example, students find the sequences of events in Cell structure and organelles DNA replication and transcription and the components of the processes is difficult to understand. Various research studies such as Ahmad and Sari (2019) and Adam, U, Okebukola, A and Oladejo, A. (2021), have identified different difficulties associated with teaching and learning of Cell biology. One of the problems is the abstract nature of the topic. Due to the abstract nature, many students have difficulties in visualizing the concept because the processes involved are not physically observable. It has been observed that teachers in Nigeria constantly used lecture method in teaching the concept and ignore new innovative teaching tools such as smart board, a gap in the application of media technology to improve students' learning. From an educational perspective, visualization aids student understanding of complex processes because it assists in the conversion of an abstract concept into a specific visual object that can be mentally manipulated. This research therefore seeks to investigate the effect of interactive smart board instructional strategy on the academic performance of secondary school students in Cell biology.

The researcher as a teacher has observed over the years that there had been worrisome decline in the percentage of public senior secondary school students passing biology as a

subject in WASSCE examination and a sharp rise in percentage of failure recorded. This problem is clearly seen in the performance of public senior secondary school students from the results of WASSCE in 2020, 2021 and 2022 respectively where 33,614, 26,734 and 25,798 Borno state students sat for WASSCE examination in biology and (3,274 %), (10.76 %) and (18.89 %) and out of the total population recorded A1 – C5 for the years above (Borno state Ministry of Education)



(Source: Borno State Ministry of Education).

Poor academic achievement of students is a social menace and had been reported to be the cause of anti-social behaviours, like truancy, deviance, rebellion and insurgency, poor academic achievement in science subjects especially Cell biology. Many factors have been claimed to militate against the achievement of sound academic performance and gender disparity in Biology still persist even after many spirited efforts have been made to counter than like training of teachers, incentives for science teachers, spirited gender awareness effort by governments as well as intervention by NGO's (non-governmental organization), provision of infrastructure and resources like laboratory materials, equipment and I.C.T Centres. Availability of resource like computers, laboratory equipment, audio-visuals, for both teaching and learning help students achieves in science generally influence academic performance in cell biology. The influence of the social media too has been reported to have benefits them demerits.

Objectives of the Study

The main aim of the study is to find out whether interactive smart board instructional strategy would have any significant effect on students' academic performance among senior secondary school students in Biology in Maiduguri metropolis, Nigeria. Specific Objectives of this study were to:

- i. Determine the difference that exists in performance between students taught Cell Biology concepts concept using interactive smart board instructional strategy and

- those taught Biology concepts using lecture method among secondary students in Maiduguri metropolis, and
- ii. determine the effect of concept using interactive smart board instructional strategy on academic performance in Cell Biology between male and female students in Maiduguri metropolis.

Research Questions

The following research question were formulated to guide the research:

1. What is the difference in the mean scores of students taught Cell Biology concept using Interactive smart board instructional strategy and those taught the same concept using Lecture method?
2. What is the difference in the mean scores of male and female students exposed to interactive smart board instructional strategy?

Hypotheses

The following hypotheses were formulated and tested at $P \leq 0.05$ level of significance

Ho₁: There is no significant difference in the mean score of students taught Cell Biology concept using Interactive smart board instructional strategy and those taught using lecture method.

Ho₂: There is no significant difference in the score of male and female of students exposed to interactive smart board instructional strategy.

Design of the Study

The design of the study was quasi-experimental design specifically the pre-test, post-test non-equivalent control group design. This design was adopted because the design does not have full control of the characteristics of students. In this design intact classes were used as groups; therefore, students were not randomized to avoid interfering with school activities. Two groups of students were used for both the experimental group and the control group (i.e., one Experimental group and one Control group). The two groups were given a pre-test and post-test exercises. The post-test came up after the experimental group (EG) received treatment and the control group (CG) without treatment, the research design is presented in Figure 1.

Design is graphically illustrated as follows:

EG → O₁ → X₁ → O₂

CG → O₁ → X₀ → O₂

Fig 1: Quasi –Experimental Design

Where:

EG = Experimental group

CG = Control group

X_1 = Treatment (Interactive smart board)

X_0 = No Treatment (lecture method only)

O_1 = Pre-Test

O_2 = Post-test

Where EG represents the experimental group taught using interactive smart board instructional strategy, CG represents the control group that was taught with the traditional/ lecture method. O_1 represents the test administered on the subjects before treatment. X_1 represent treatment and O_2 represents the test administered on the subjects after treatment.

Population of the Study

The target population of this study comprised all the public Senior Secondary School's Biology Students in Maiduguri Metropolis of Borno State, Nigeria (single sex and co-education schools); two (2) male schools, two (2) female schools and two (2) co-educational school comprised of six (6) schools with a total number of 5936 students. (Borno State Education Resources Centre, 2022) there are a total of 5936 students offering biology in the zone.

Sample and Sampling Techniques

Purposive and simple random sampling techniques were used in the study. Co-educational schools were purposely selected from the population due to gender involvement in the study. Four schools were randomly selected in the zone for participation. Cell Biology Performance Test (CBPT) was administered to SSII Biology students in each of the four schools selected from the zone to determine their equivalence in terms of academic performance. This was achieved by subjecting the students' scores to the Analysis of Variance (ANOVA) and Scheffe's post hoc test. ANOVA was used to determine any significant difference in the selected schools, while the Scheffe's Post Hoc test was used to separate the schools and determine which schools were significantly or not significantly different. Two schools were found to be relatively similar statistically. The status of the schools was then determined by simple coin tossing. As a result of this exercise, one school became the experimental school, and the other became the control school. The two schools selected had a total number of one hundred and twenty-three (123) students who constituted the sample. A sample of 62 male and 61 female students from the two coeducational sampled schools was chosen. This is in line with Usman (2010), who suggested that the sample of 50 was in line with the Central Limit Theorem (CLT), which recommended a minimum of 30 subjects as an adequate sample size. The experimental group was also labelled "School A", while the control school was labelled "School B". Because of the large number of students in the sample schools, one Arm was randomly selected and used from each of the selected schools. Table 2 represents the sample for the study.

Table 1: Sample for the Study

School	Group	Male	Female	Total
School A	Experimental	32	31	63
School B	Control	30	30	60
Total		62	61	123

Instrument for Data Collection

One instrument was design by the researcher. The instrument used for data collection was named Cell Biology Performance Test (CBPT). It was duly validated by two (2) qualified Biology teacher with B.Sc. (Ed) in Biology (Borno state) and two Ph.D. holder in the Department of Science Education, Ahmadu Bello University, Zaria. To ascertain the reliability of (CBPT), test-retest method was used to statistically estimate the internally consistency of the instrument, Tuckman (1975), who proposed the minimum interval of two weeks or more intervals.

Reliability of the Instrument

The result of the test was correlated using Pearson Product Moment Coefficient and reliability coefficient was found to be 0.90 which is considered reliable for the study to measure the academic performance of the concepts. The test questions were adopted from the West African Examination Council (WAEC) past examination question papers. The scoring of the test items was 2.5% for each correct answer such as, (i) which of the following is a eukaryote cell and (ii) how many cell divisions occur in mitosis. Lessons for experimental and control group lasted for six weeks. The concepts selected for this study are; Cell biology Genetics and Heredity. At the end of the treatment, a post test (o2) was administered to both the EG and CG to evaluate the effectiveness of the teaching strategies in the academic performance in Cell Biology Concepts learning.

Experimental Procedure

The pre-test was first administered on the subjects before treatment to ensure homogeneity of the subjects. In the pre-test, the instrument was administered on the participants by the teacher (research assistants) in the school, the biology teachers marked the script using marking scheme prepared by the researchers. Each script was vetted and totalled section by section by the researchers. Each participant's score in a section of the instrument was entered against his or her name. After the treatment which lasted for six weeks that covered six topics in Cell biology, the same instrument was re-administered for the post-test. The conditions of the testing indicated in the instrument were strictly observed in both the experimental and control groups. In the group that served as control, conventional/ traditional lecture lesson notes with the same instructional objectives were used for instruction as prepared by the researchers. This was to ensure uniform implementation of the content and check teacher's effect. The two research assistants in

the groups were used to teach the students. Also, uniform discussion guides prepared by the researchers were used by the two research assistants in the experimental group. Traditional teaching method was used for teaching the control group as a base for establishing the effect of treatment.

Teacher Participation

The teacher participation for this study, the researchers organized three days training for the two research assistants so that differences in the effectiveness of individual teachers were made to follow the lesson plans strictly.

Results

The study's main objective is to investigate interactive smart board instructional strategy on academic performance of SSII Biology students in Maiduguri metropolis, Borno state, Nigeria. The data collected were answered and analysed using descriptive statistics and inferential statistics using the Statistical Package for Social Science (SPSS). The significance level adopted for rejecting or retaining the stated hypothesis was set at 0.05. The results obtained are presented as follows.

Research Question One: What is the difference between the mean academic performance scores of secondary school students in Biology taught Cell biology concepts using interactive smart board instructional strategy and those taught the same concept using lecture method?

To answer this research question, post-test data were subjected to descriptive statistics and mean scores and the standard deviation of the two groups were calculated as shown in Table 2.

Table 2: Mean and Standard Deviation of the Performance Scores of Students in the Experimental and Control Groups.

Groups	n	Mean	Standard Deviation	Mean difference
Experimental	63	41.40	8.81	14.70
Control	60	26.70	5.50	

Results from the descriptive statistics in Table2, shows among the Experimental group the mean performance score for students was 41.40 and a standard deviation of 8.81. While the mean performance score for their counterparts in the control group was 26.70 and a standard deviation of 5.50 with the mean difference of 14.70 respectively. This indicates that there is difference in the mean performance score of experimental groups and the control group when taught using interactive smart board instructional strategy and those taught using lecture method in Favor of the experimental group.

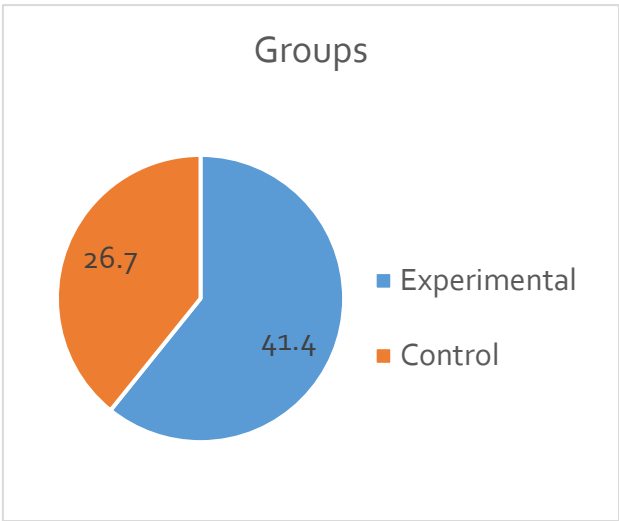
Null Hypothesis One: There is no significant difference in the mean score of students taught Cell biology concept using interactive smart board instructional strategy and those taught using lecture method.

In order to test the null hypothesis, the data generated from Cell Biology concepts performance test (CBPT) were subjected to independent sample t-test statistics and the summary of the result is presented in table 3.

Table 3: Summary of t-test Statistics on the difference between the Mean Performance for Experimental and Control Groups.

	n	Mean	Standard Deviation	Mean difference	Difference	t-val	p-val	Remark
Experimental	60	41.40	88.1	11,8	121	7.35	0.01	Sig.
Control	63	26.70	5.50					

Table 3 shows a P-value of 0.01 observed at degree of freedom (df) 121. This P-value 0.01 is less than the $P \leq 0.05$ alpha level of significance, indicating that that there is a significant difference between the mean Academic performance scores of students taught Biology using Interactive smart board instructional strategy and those taught using lecture method. The difference so observed is in Favor of the experimental group which was exposed to the Interactive smart board instructional strategy. Hence, the null hypothesis is rejected, implying that interactive smart board instructional strategy significantly enhances secondary school students in Biology academic performance in Cell biology concept than lecture method.



Research Question Two: What is the difference between the mean academic performance scores of male and female secondary school students in Biology taught Cell biology concept using interactive smart board instructional strategy?

To answer this research question, the post test data of the Experimental Group are exposed interactive-smart board instructional model were sorted out according to gender and subjected to descriptive statistics. Summary of analysis is shown in Table 4.

Table 4: Mean and Standard Deviation of the Performance Scores of Male and Female Students in the Experimental Group.

Gender	n	Mean	Standard Deviation	Mean difference
Male	32	46.11	7.71	4.44
Female	31	41.67	9.84	

Results from the descriptive statistics in Table 4, shows among the Experimental group the mean performance score for male students was 46.11 and a standard deviation of 7.71. Whereas, the mean performance scores for female students in the same group was 41.67 and a standard deviation of 9.84 with mean difference of 9.84 respectively. This shows that there is slightly difference between the male and female students in the experimental group.

Null Hypothesis Two: There is no significant difference between the mean academic performance scores of male and female secondary school Biology students in Cell biology taught interactive smart board instructional strategy.

In order to test the null hypothesis 2, the data generated from Cell biology concepts performance test (CBPT) were subjected to independent sample t-test statistics and the summary of the result is presented in table 5.

Table 5: Summary of t-test Statistics on the differences between the mean Performance for Male and Female Students in the Experimental Group.

Gender	n	Mean	Standard Deviation	Mean difference	Difference	t-val	p-val	Remark
Male	32	45.79	10.09					
Female	31	40.57	9.66	1.26	61	2.92	0.87	N.s.
				1.23				

Table 5 reveals a P-value of 0.32 observed at degree of freedom (df) 61. This P-value is less than the 0.05 alpha level of significance, indicating that that there is a significant difference between the mean academic performance scores of male and female students taught using Interactive smart board instructional strategy. Hence, the null hypothesis is retained, implying that gender does not significantly influence secondary school students in Biology

academic performance in Cell biology Concepts when taught using Interactive smart board instructional strategy.

Discussion

From the finding number one in Table 2 and 4, the experimental groups were higher than that of the control group students taught with interactive smart board instructional strategy performed significantly better than those taught with the lecture method. The result also indicated that there is significant difference among male and female students' experimental group of male and female control group as well as between them. It could be inferred that interactive smart board instructional strategy has an enhancing effect on the teaching and learning Cell biology concepts.

The above result is in agreement with previous findings, Onder and Aydin (2016), Ifeakor, Akujieze, and Erutujiro (2020). They found that the use of interactive smart board in teaching and learning makes learning interesting and motivating to students. They clarified that interactive "smart board" instructional medium serves as a spring board for further learning and that the flexibility of electronic board medium makes it an effective learning tool.

From the findings number two in Table 3 and 5, the academic performance of biology in case of gender, the result is in agreement with previous research findings of Mohammed (2020) no significant difference between the mean scores of male and female students taught cell biology using the interactive smart board instructional strategy, this signifies that there are equal chances between males and female counterparts in relation to performance. Therefore, the interactive smart board instructional strategy can be said to be gender friendly. These findings also similar to that of Imoke, Ushe, and Ofem. (2024) who reported no significant difference between the mean scores of male and female students taught educational technology with the interactive whiteboard. Awoniyi (2000) and Mohammed (2000). They came out with the finding that the use of interactive smart board instructional strategy is gender friendly and enhanced both the performance of male and female students.

Conclusion

The study has examined the poor performance in biology education especially within the secondary school level in a rapidly technology changing world. The innovative technology using interactive smart board instructional strategy for teaching biology seems to be the answer to the poor performance problem. interactive "smart Board" instructional strategy was more effective in teaching the biology concept of Cell, Heredity and Genetics, improved learners' performance, enhanced their learning well, and is also gender friendly. Based on the findings of the study, it is concluded that students taught with interactive smart board achieved better than students taught with the conventional/lecture method. Student performance greatly improved irrespective of gender by the use of interactive-

smart board in teaching Cell biology showing that use of interactive" smart board" is independent of gender.

Recommendations

Based on the findings of this study, the following recommendations are made.

1. There is the need for Borno State government to build and equip computer laboratories in each secondary school in the state. This will assist in effective utilization of interactive smart board as viable instructional strategy for the 21st century teaching and learning;
2. Interactive smart board was found to be effective as a teaching strategy for cell biology instruction when compared with traditional method of instruction. Therefore, biology teachers should be encouraged to use it;
3. The effective use of interactive smart board in teaching can enhance performance of students such as difficult concept like cell biology and among other;
4. Secondary school's teachers should effectively make use of interactive "smart Board" in teaching the students irrespective of gender;
5. There should be training and retraining of teachers on computer applications especially on interactive smart board instruction.

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