Vol. 02, No. 01 (2024) 43-48, doi: 10.61552/JEMIT.2024.01.006 - http://jemit.aspur.rs

ANALYSIS OF SECONDARY SCHOOL STUDENTS' PERFORMANCE IN BIOLOGY AND CHEMISTRY IN NIGERIA: INFLUENCE OF INNOVATIVE ICT

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Received 11.08.2023.
Revised 19.11.2023.
Accepted 12.12.2023.

Keywords:

Analysis, Secondary School Students, Academic Performance, Biology and Chemistry, ICT.

Original research

A B S T R A C T

This study investigates ICT's impact on secondary school students' academic performance in Biology and Chemistry in Nigeria from 2018 to 2020. Data from 218 teachers and students' WAEC 2018-2020, was analyzed using a descriptive research approach. The study examines academic trends and ICT's influence. Results revealedthat ICT had a positive effect benefiting both Biology and Chemistry students in 2020 through the challenges posed by covid 19 and addressed by ICT. The findings established that students' performance in both subjects improved significantly, especially in 2020. Furthermore, the findings ascertained that ICT has nobiased influence on the mean academic performance in Biology and Chemistry. The study recommends that more effort should be geared toward investment in ICT infrastructure and teacher development for improved science education in Nigeria.

1. INTRODUCTION

Education is the most powerful tool for the all-round development of human beings (Miao, 2017). It is an effective tool for fostering intellectual growth, forming cultural perspectives, and gaining information and expertise. In Nigeria, science education is taught and learned starting at the youngest age. According to the Federal Republic of Nigeria (2013), every Nigerian child who has completed the first nine years of basic education is expected to have acquired the necessary functional literacy and numeracy, as well as the cultivation of positive attitudes that promote cooperation, community, and continuous learning that support national development (Olatunji & Ajero, 2022). Additionally, they should have acquired the ethical, moral, and civic values needed to lay the groundwork for lifelong learning, which is essential for thinking critically and scientifically.

Basic subjects including biology, chemistry, and physics are taught in science classes in secondary schools in Nigeria. According to studies like Alebiosu (2017), science is a subject that interests secondary school kids. This might be the case since a large number of science majors aspire to work as physicians, engineers, or in related fields.

The study of living things is the primary focus of the scientific field of biology. It is the field of research that looks into the lives of people, animals, plants, and other living things (Abidoye, 2021). The study of matter's composition, structure, and properties as well as the structural, compositional, and energetic changes resulting from chemical reactions is known as chemistry. Any country's technical advancement is dependent on its study of science, particularly chemistry (Eremie & Ekpete, 2008**).** In senior secondary classrooms, several variables work for or against students' academic performance in science in general

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and Biology and Chemistry in particular (Oginni et al., 2013).

For numerous industries worldwide, information and communication technology (ICT) has emerged as a significant driver of innovation and increased productivity. The United Nations Educational, Scientific, and Cultural Organization (UNESCO, 2002) declared that innovation requires the adoption of Information and Communication Technologies (ICTs) by the global education system for the delivery of classroom instruction to students to impart the knowledge and skills required to function in the society of the twenty-first century. Information and communication technology was defined as a system that can capture, store, retrieve, alter, transmit, or receive information or data by Onwuagboke et al. (2015).There is strong evidence that ICT fosters high-quality education and a productive teaching-learning environment that benefits both teachers and students. ICT offers educational opportunities and makes the classroom setting ready for instruction, according to several research studies (Aiyebelehin, 2012; Olakulehin, 2007; Yusuf, 2000). ICTs are becoming incredibly powerful teaching and learning tools. A large number of these digital tools were created expressly to be used in classroom instruction delivery, aiming to improve student performance (Yusuf & Balogun, 2011).

2. STATEMENT OF THE PROBLEM

The outbreak of Covid 19 has improved secondary school teachers' and students' use of ICT. Few studies have compared the academic achievement of senior school students in biology and chemistry over three years in Nigeria using ICT, even though many have compared senior school students' performance in these subjects. Therefore, the purpose of this study was to determine how much information and communication technology-aided instruction has enhanced students' academic progress in Biology and Chemistry over three years (from 2018 to 2020) in Nigeria.

Objectives of the Study

The study investigated the analysis of secondary school students' academic performance in Biology and Chemistry in Nigeria. The study specifically examined:

i. The trends of student academic performance in biology and chemistry subjects in Nigeria through the influence of ICT;
ii. If there is any bias in the influence of ICT on the mean academic performance of studentsin Biology and Chemistry.

Research Questions

The following research questions were raised to guide the study:

i. What are student academic performance trends in biology and chemistry subjects in Nigeria through the influence of ICT?
ii. Does ICT have any biased influence of ICT on the mean academic performance of students in Biology and Chemistry?

Methods and Procedure

Ex-post facto and descriptive research designs are also used in this study. Target students included all secondary schools in Nigeria offering senior secondary school courses in chemistry and biology. 109 senatorial districts in Nigeria's chemistry and biology departments, as well as all secondary schools offering these subjects, made up the research population. To choose 109 biology and 109 chemistry professors, a purposeful sampling strategy was applied. The population of the research comprised all students who sat for the West African Examination Council (WAEC) in Nigeria between 2018 and 2020. The Likert scale, which has four points for agreeing (strongly agree) = 4, agree (A) = 3, disagree (D) = 2, and strongly disagree (SD) = 1, was used to create the questionnaires. Within three months of being issued, questionnaires were retrieved via the respondents' email. Following that, the information was gathered for processing. Using percentage, mean, and bar charts, data taken from the completed questionnaire were examined.

3. RESULTS OF RESEARCH

Research Question 1: What are student academic performance trends in biology and chemistry subjects in Nigeria through the impact of ICT?

Table 1 reveals the performance of students in biology and chemistry in secondary schools in Biology and Chemistry. The result showed that the percentage of students' performance in Biology and Chemistry was higher in 2020 which was the era of the Covid 19 pandemic.

Table 1.. The trend of students'performance in Biology and Chemistry subjects in Nigeria

Year	No of the Students that sat for the Biology Exam	Biology Pass A1-C6 (%)	No of the Students that sat Chemistry for the Chemistry Exam	Pass A1-C6 (%)
2018	1086081	62.35	727954	58.17
2019	1058149	74.16	742678	77.02
2020	1039766	84.08	750182	89.89

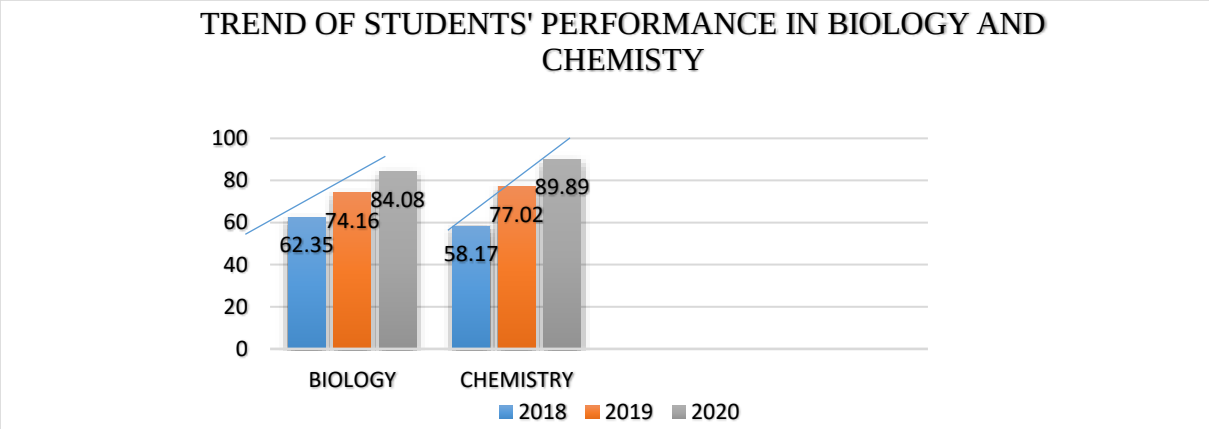

Figure 1: Bar chart showing the trend of academic performance of candidates that sat for Biology and Chemistry in WAEC from 2018 to 2020

Research Question 2: Does ICT have any biased influence of ICT on the mean academic performance in Biology and Chemistry?

Data presented in Table 2 shows that the mean responses to items 2, 4, and 5 have a mean score above 2.50 benchmark while 1, 3, 6, 7, and 8have a mean score below 2.5. The grand mean is 2.43, which is below the mean response of 2.42. The respondents have indicated that ICT has no biased influence on the mean academic performance in Biology and Chemistry. This is also reflected in each of the mean responses on the items in the table 2. This simply means that the use of computer animation, internet facilities in mobile phones, power points, projectors, and e-library by the students influences students' academic performance in both subjects and not either or none.

Table *2.* Mean ratings of response on the influence of ICT on the performance in Biology and Chemistry

S/N	Item	Mean	Remark
1	The use of computer animation improves either biology or chemistry students' understanding of concepts during teaching and learning	2.03	Rejected
2	The use of computer animation improves both biology and chemistry student understanding of concepts during teaching and learning	3.04	Accepted
3	The internet facilities in students' mobile phones provide concrete information that enhances either biology or chemistry student performance	2.21	Rejected
4	The internet facilities in students' mobile phones provide concrete information that enhances both biology and chemistry student performance	3.18	Accepted
5	When PowerPoint is used to display information during teaching and learning Biology students perform better unlike Chemistry student	3.07	Accepted
6	Teacher's use of projectors to explain concepts has not improved students' performance in biology and chemistry at all	2.12	Rejected
7	The use of electronic mail for information sharing in class has helped to boost either biology or chemistry student performance	2.09	Rejected
8	Student utilization of facilities in e-library has positively influenced either biology or chemistry student performance	1.62	Rejected
Grand Mean		2.42	

4. DISCUSSION

The results demonstrated that, throughout the reviewed years, Information and Communication Technology (ICT) improved secondary school students' academic performance in Chemistry and Biology in Nigeria. This is in line with Yesilbag et al. (2020), who investigated tenth-grade students' attitudes and academic performance are impacted by educational video games. Sixty tenth-grade students from an Anatolian high school took part in the study during the 2019–2020 school year with a control group, a pre-and post-test experiment, and both. On an academic achievement exam, however, the experimental group fared better than the control group. Whereas the experimental group outperformed the control group on an academic achievement test. The findings show that video games can be used as an ICT method in education to improve students' academic performance in English learning

Students' academic performance in biology and chemistry classes improved in the years under study, according to Table 1 and Figure 1 data. For example, during the COVID-19 epidemic in 2020, when ICT was used for teaching and learning, students performed best

in biology and chemistry. This may have been because of the exposure of both teachers and students to the advantages and activities of ICT. The use of ICT as an alternative instructional strategies for biology and chemistry teaching and learning, which exposed students to the capabilities and availability of ICT during the time, may be responsible for the upward trend in student performance in these subjects in 2020. This is consistent with Bashir et al.'s (2016) investigation of the effects of internet use on the academic achievement of the University of Punjab, Pakistan, undergraduate and graduate students. The study's conclusions showed that pupils' academic performance was positively impacted by their use of the internet.

The results in Table 2 demonstrated that ICT has no biased influence on the mean academic performance in either Chemistry or Biology; students' use of e-books, power points, projectors, computer animation, and internet resources on their phones affects their academic performance in either subject, not just one or the other. This is consistent with the findings of MEB (2018), which looked at the scientific course curriculum and found that the fundamental subjects of science are biology, chemistry, and physics. This is consistent with the findings of Ajagun (2006), who looked at effective scientific teaching in Nigeria and discovered that ICT use improves students' performance in math and science.

5. CONCLUSION AND RECOMMENDATIONS

The results of the findings showed that the use of ICT had a positive influence on students' academic performance in these subjects, with the COVID-19 pandemic period, marked by increased ICT usage for education, showing significant improvements. Importantly, the study determined that ICT did not favor one subject over the other, indicating a balanced impact on both Biology and Chemistry.

Based on the findings of the study, the following recommendations were given:

1. Promote the further integration of Information and Communication Technology (ICT) into science education. Invest in ICT infrastructure, including computers, internet access, and educational software for schools. Provide training programs for teachers to enhance their proficiency in using ICT effectively in the classroom.
2. Ensure a balanced focus on both Biology and Chemistry subjects when using ICT in the curriculum. Develop subject-specific ICT resources and tools to cater to the unique requirements of each subject.

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