# *THE ROLE OF TECHNOLOGY AND STATISTICAL ANALYSIS IN IMPROVING SCIENCE EDUCATION IN NIGERIA*

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**Keywords**

Technology, Statistical Analysis, Science Education, Nigeria, Educational Development, Educational Technology

**Abstract**

***Research Problem:***
*Science education plays a vital role in national development, yet many schools in Nigeria still face difficulties in the effective use of technology and statistical methods in teaching and learning. Poor infrastructure, inadequate technological facilities, and limited application of statistical analysis in educational research have continued to affect the quality of science education. This study examined the role of technology and statistical analysis in improving science education and identified the challenges affecting their effective use in schools.*

***Methods:***
*The study adopted a descriptive survey research design. Data were collected from respondents using a structured questionnaire designed to obtain information on the use of technology, the importance of statistical analysis, and the challenges affecting science education. The reliability of the instrument was tested using Cronbach's Alpha, which yielded a coefficient of 0.82, indicating good internal consistency. Data collected were analyzed using descriptive statistics such as frequency counts, percentages, and bar charts.*

***Results:***
*The findings showed that the majority of respondents agreed that technology is used in science education and that it improves teaching and learning. Respondents also indicated that statistical analysis is very*

*important for educational research and decision-making. However, the study revealed that poor electricity supply, lack of computers, and limited internet access are the major challenges affecting the effective use of technology in schools, while lack of teachers' training was reported as a minor challenge.*

***Conclusion:***

*The study concluded that technology and statistical analysis play significant roles in improving the quality of science education. Their proper integration can enhance students' understanding, promote interactive learning, and support effective educational planning. However, the benefits cannot be fully achieved without adequate facilities and supportive learning environments.*

***Key Contribution to Knowledge:***

*This study provides empirical evidence on the importance of integrating technology and statistical analysis into science education in Nigeria and highlights the major factors limiting their effective use. The findings contribute to existing literature by showing that infrastructural challenges remain the major barrier to technological advancement in science teaching.*

***Recommendation:***

*It is recommended that government and educational stakeholders should provide adequate technological facilities, improve electricity supply, and ensure reliable internet access in schools. Teachers should also be given regular training on the use of modern educational technologies and statistical tools to improve the teaching and learning of science subjects.*

## Introduction

For many industries around the world, including education, technology has become an essential source of innovation and efficiency improvement. In the education sector, the use of technology both inside and outside the classroom has become a significant aspect of the teaching and learning processes for both students and teachers. People have created numerous strategies for communicating their thoughts, wants, and wishes to others since ancient times. People used to congratulate one another in geographically limited clusters in which communication was properly achieved by vocal and written communications in early civilized times. Smoke signals, carrier pigeons, and other long-distance communication systems were tried as civilization spread across broader geographical areas.

The usage of fire signals by Greeks in the eighth century B.C. for sending alerts, pleas for help, or announcements of particular occurrences was one of the earliest known optical linkages. We are now living in an Information Age which is marked by the rapid adoption of new technologies (Holland, 2015). ICTs which are the forerunner of all the new technologies have influenced the way we live, communicate, socialize, learn or educate. As sciences include complex relationships of unfamiliar and abstract concepts, it is quite difficult to be taught and learned. Students often experience difficulty in understanding certain scientific concepts and try to learn them via

memorization without understanding (Kilic & Salam, 2004).

The application of technology to the teaching abstract concepts can help understand such concepts better. Students can best improve their generic skills when they understand the concept of technology and their teachers fully understand that technology is most employers' expectations in this century (Adewumi M. et al., 2017). A survey in the Nigeria Education system has shown that learning becomes more interesting and lively through the use of multimedia equipment and wireless signals in classroom through active participation of learners in the learning process (PMID, 2013). It is especially important in the sciences as computers can present information virtually through well-prepared pictures, three-dimensional models, animations, interactive environments, etc. (Wang Q., 2017).

The acts of technology include all automated means of teaching with the aid of computers and web-related resources. The age of automation and technology has added a vast array of instructional materials and media to conventional education. These new materials supplement the 'natural' contrivances of the educational profession and can substantially be instructional methods and techniques. The need to integrate the use of ICTs into the teaching and learning of sciences has been the subject of a good deal of debate. In Nigeria, a relationship between ICT development and penetration and their use in the sciences is finally and gradually beginning to take hold.

ICT is a broad phrase that refers to the act of creating, editing, storing, and transmitting data in various formats between humans and machines around the world, utilizing a variety of electronic technologies, to achieve a goal (be it recreational or otherwise) (Akanbi G.O, 2014). ICT has contributed a lot to change our everyday life such as letter to e-mail, market shopping to on-line shopping, classroom learning to e-learning and many others (Bosamia, 2018).

Statistics has always been seen as a factor in the development of a nation, most especially in education. The prosperity of any country depends on the volume and the quality of statistics offered in the day-to-day activities of man. The importance of statistics as instrument in science and technological development in Nigeria education is no doubt, well appreciated by our policy makers. According to Rao and Richard (2007) the term "'Statistics" has been used to indicate facts and figure of any kind: Health statistics, vital statistic or business statistics. Opera (2010) defined statistics as a branch of science which provide methods for collecting, organizing, summarizing and analyzing data which can be used in drawing valid conclusions. Elele (2005) affirmed that an enhanced awareness of the need for good statistics on the part of politicians and decision makers, presents an opportunity to raise the profile of statistics, services generally and to address some pressing resource constraints.

According to Pearson (1978), every country needs goods statistics, therefore, the collection and use of statistics to support government is as old as the business of government itself in almost all countries, at different times there has been a debate about the role and function of statistical research (Fienberg, 1991). It is only fairly recently, however, that the importance of statistics in developing countries, to guide crucial resource allocations and policies that have a direct bearing on the welfare and even survival of most of the population, has received more widespread recognition. This paper therefore focuses on the impact of statistics research in science and technological development in Nigeria. The aim of this paper is

to examine the importance of statistics and its effects on science and technological development in Nigerian polytechnic education. Science education is widely recognized as one of the most important drivers of national development and technological advancement. Countries that invest heavily in science education often achieve significant progress in innovation, industrialization, and economic growth. Science education provides students with the knowledge, skills, and competencies necessary to understand natural phenomena, develop technological solutions, and contribute to scientific discoveries.

In Nigeria, science education plays a critical role in preparing students for careers in fields such as medicine, engineering, information technology, environmental science, and biotechnology. Subjects such as Physics, Chemistry, Biology, and Mathematics form the foundation for technological development and scientific innovation. However, despite the importance of science education, many Nigerian schools face numerous challenges that affect the quality of science teaching and learning.

Some of the major challenges include inadequate laboratory facilities, shortage of qualified science teachers, outdated teaching materials, and limited access to modern technological tools. In many schools, science lessons are still delivered using traditional lecture methods that do not adequately engage students or promote practical understanding of scientific concepts.

The rapid development of digital technology has created new opportunities for improving education systems worldwide. Educational technologies such as computers, tablets, interactive whiteboards, simulation software, and virtual laboratories have transformed teaching methods and enhanced student learning experiences. These technologies enable teachers to present complex scientific concepts using visual demonstrations, animations, and interactive simulations.

In addition to technological tools, statistical analysis plays an essential role in educational research and evaluation. Statistical methods allow educators and researchers to analyze academic performance data, assess the effectiveness of teaching strategies, and identify factors influencing student learning outcomes. By applying statistical techniques such as descriptive statistics, correlation analysis, and regression analysis, educators can make informed decisions that improve educational quality.

The integration of technology and statistical analysis into science education has the potential to significantly improve teaching effectiveness and student learning outcomes in Nigeria. Technology can make science learning more engaging and interactive, while statistical analysis can help educators monitor academic progress and develop evidence-based educational policies.

Therefore, this study explores how technology and statistical analysis contribute to improving science education in Nigeria. The study also examines the challenges affecting the integration of technology in Nigerian schools and provides recommendations for improving science education through technological innovation and data-driven decision-making.

## Statement of the Problem

Science education plays an important role in the development of a nation because it promotes innovation, critical thinking, and technological advancement. However, the quality of science education at different levels of the educational system has continued to raise concern among

educators, researchers, and policymakers in Nigeria. Many students perform poorly in science subjects and this poor performance has been linked to inadequate teaching methods, lack of instructional materials, poor laboratory facilities, and limited integration of modern technology in the teaching and learning process.

Despite the global advancement toward digital learning, many Nigerian schools still rely heavily on traditional teaching approaches that are teacher-centered rather than learner-centered. The limited use of technology such as computer-assisted instruction, virtual laboratories, data analysis software, and online learning platforms has reduced students' opportunities to develop practical and analytical skills required for effective understanding of scientific concepts. In addition, statistical analysis, which is essential for interpreting scientific data, conducting experiments, and making evidence-based decisions, is not adequately emphasized in science teaching and learning. As a result, many students lack the ability to analyze data, draw valid conclusions, and apply scientific reasoning to real-life problems.

Furthermore, the absence of proper data-driven evaluation in the education sector makes it difficult to identify the factors responsible for poor performance in science subjects. Without the effective use of statistical methods, educational planners may not be able to make accurate decisions regarding curriculum improvement, teaching strategies, and resource allocation. The integration of technology together with statistical analysis has the potential to improve teaching effectiveness, enhance students' understanding, and provide reliable information for educational planning, yet the extent to which these tools are being utilized in Nigerian science education remains unclear.

Therefore, the problem of this study is the persistent poor performance of students in science subjects in Nigeria and the inadequate use of technology and statistical analysis in the teaching, learning, and evaluation processes. This study seeks to examine how the application of technology and statistical analysis can contribute to improving the quality of science education in Nigeria and to provide evidence-based recommendations for educators, researchers, and policymakers.

## Literature Review

The advent of technology has provided our society with a vast array of new opportunities which has changed the way people think and approach their chores. Technology has made both developed and developing countries of the world witnessed significant changes in almost all facets of human endeavour. In Africa for example, the use of technology in sectors such as banking, insurance, travel, health, education and others has witnessed a dramatic increase.

The introduction of technology into teaching and learning has brought a lot of innovation into the field of education. The application of technology in education allows students and teachers to experience new ways of learning and teaching. It allows schools to ensure that students have access to curriculum materials while in the classroom and also ensure that students who are outside the classroom, such as home or hospitals, can learn. Technology tends to increase educational access. Learning may take place at any time and in any location when technologies are involved.

Teaching and learning are no longer solely dependent on printed materials or physical contacts between students and teachers, thanks to technology. The use of technology is growing increasingly popular as a result of several

unprecedented happenings in our life. There is a general idea that technologies which can assist both instructors and students by shifting teaching and learning processes from primarily teacher dominated to student-cantered (Castro and Aleman 2011); and that this transition will lead to greater student learning gains by providing an opportunity for learners to enhance their creativity, problem-solving abilities, informational reasoning skills, communication skills, and other higher-order thinking capabilities. Information and communication are the ultimate powers of technology.

Technology is critical for social life, business, and the economy, as well as for educational growth, to fulfill the demands of today's information society (Aduwa, Ogiegbaen & Iyamu, 2005). Its use by the teacher to teach the students is highly advantageous in that it enables them to exhibit an understanding of the opportunities and implications of using technology in the classroom; design, implement and manage learning and teaching in an open and flexible learning environment (UNESCO, 2014). According to Balasubramanian et al. (2009), employing technology in education improves both the quality and quantity of education, while Adeosun (2010) believes that technology improves greater innovation, creativity, cognitive thinking, as well as educational productivity and efficiency. It allows for individualized, flexible, and asynchronous learning, as well as a shift in learning from instructor to student, and so catalyzes classroom, educational institute, community, and system reforms (Youssef & Dahmani, 2008).

In another study conducted by Adegbite (2017) on the analysis of the impact of technology on the performance of students in Secondary Schools in Oyo State; Nigeria, it was found that the adoption of technology in teaching students of secondary schools in Oyo state had a significant impact on the performance of students, as the entire statistic outcomes used for analysis in the study suggested positive significant effect on the impact of technology in teaching the students.

In a study on the effects of computer simulation package on Ekiti State senior secondary school science students' attitude in some science concepts conducted by Alake, Olojo & Abe (2018), it was found that the developed simulation package had positive effects on students' attitude towards the learning of science concepts.

The study also revealed that gender did not have any significant influence on both the experimental and control groups and consequently, it was recommended that teachers of science subjects in secondary schools should be trained on how to use the developed package. Similarly, Alake & Olojo (2020) found that the use of the Computer Simulation Package (CSP) improved the performance of students in some scientific concepts. Consequently, the researchers recommended that the usage of the designed package be incorporated into the school curriculum.

Science education refers to the process of teaching and learning scientific knowledge, skills, and methods. It involves helping students understand natural phenomena, develop scientific thinking, and apply scientific principles to solve real-world problems.

Effective science education promotes critical thinking, curiosity, and creativity. It encourages students to ask questions, conduct experiments, analyze data, and draw logical conclusions. Science education also helps students develop problem-solving skills that are essential for innovation and technological development. In modern educational systems, science education is not limited to classroom instruction. It also

involves laboratory experiments, fieldwork, project-based learning, and collaborative research activities. Technology has become an essential component of modern education systems. Educational technologies provide new ways of delivering knowledge, enhancing student engagement, and supporting interactive learning environments.

Digital technologies such as multimedia presentations, online learning platforms, educational videos, and virtual laboratories enable teachers to explain scientific concepts more effectively. For example, simulation software can demonstrate chemical reactions, biological processes, and physical phenomena that may be difficult to observe in traditional classrooms. Technology also provides students with access to vast amounts of information through the internet. Online educational resources allow students to explore scientific topics beyond the classroom and develop independent learning skills.

Research has shown that the integration of technology into science education improves student motivation, enhances conceptual understanding, and increases academic achievement.

Statistical analysis is an important tool used in educational research to interpret data and draw meaningful conclusions. It involves collecting, organizing, analyzing, and interpreting numerical data related to educational activities. In science education, statistical analysis helps educators evaluate student performance, measure learning outcomes, and identify factors affecting academic achievement. Statistical tools such as mean, standard deviation, correlation, and regression analysis are commonly used to analyze educational data.

For example, teachers can use statistical analysis to examine students' examination results and identify areas where students perform poorly. This information can help teachers adjust their teaching methods and provide additional support to students who need it. Statistical analysis also helps policymakers evaluate educational programs and develop effective policies for improving education systems. Several studies have examined the impact of technology on science education in Nigeria. Research findings indicate that schools that integrate technology into science teaching often achieve better academic outcomes compared to schools that rely solely on traditional teaching methods. However, the adoption of educational technology in Nigerian schools is still limited due to several challenges. These challenges include inadequate funding, poor infrastructure, unreliable electricity supply, and limited access to computers and internet facilities. Despite these challenges, there is growing recognition of the importance of technology in improving education. Government agencies, educational institutions, and international organizations are increasingly investing in digital learning initiatives aimed at enhancing science education in Nigeria.

## Methodology

This study adopts a descriptive research design to examine the role of technology and statistical analysis in improving science education in Nigeria. The descriptive approach allows the researcher to analyze existing educational practices and identify factors influencing the use of technology in science teaching. Data for the study were obtained by administering a structured questionnaire to 50 selected science teachers in some selected secondary schools in Nigeria.

The population of the study consists of science students and science teachers in selected secondary schools in Nigeria, while a sample will be selected using simple random sampling technique; data will be collected through the use of structured questionnaires and observation, the questionnaire serving as the main research instrument which will be validated by experts to ensure content validity and tested through a pilot study to ensure reliability using Cronbach's Alpha, and the data obtained will be analyzed using descriptive such as frequency, percentage, and charts.

**Research Instrument:** The researchers constructed a well–structured questionnaire based on some perceived attributes of technology and statistical analysis usage for teaching and learning purposes; for data collection. The instrument was made up of two parts A and B. Section A consists of items aimed at the respondents' personal information, Section B is made up of items arranged in a four-point Likert scale format of Strongly Agree (4), Agree (3), Disagree (2), Strongly Disagree (1) aimed at the respondents' perceived attributes of technology usage, effects of technology and importance of statistical analysis in science education. The validity of the instrument was ascertained using the Cronbach's Alpha formula. The estimate was 0.82; a value that was considered to be high and significant enough for the study.

## Data Analysis

The data obtained were analyzed using descriptive statistics such as frequency, percentage, and bar charts. The frequency, percentages and bar charts were analyzed using SPSS 20 and EXCEL.

## Results

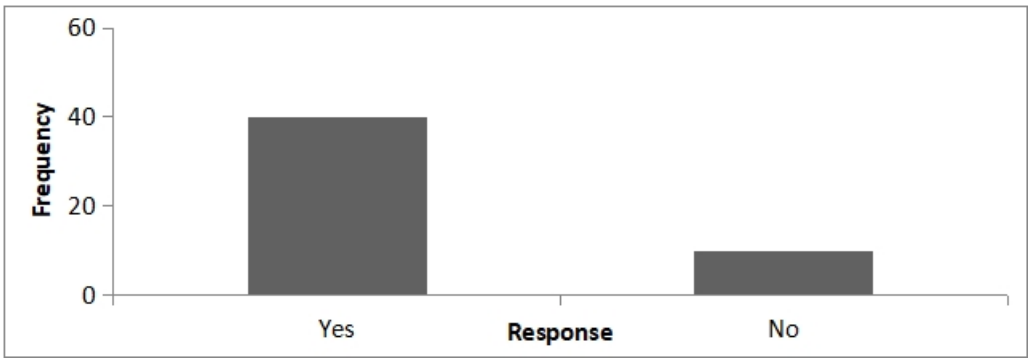
### I. Use of Technology in Science Education

**Table 1: Response on Use of Technology in Science Education**

| | | Frequency | Percentage |
|---|---|---|---|
| Response | Yes | 40 | 80.0 |
| | No | 10 | 20.0 |
| | Total | 50 | 100.0 |

The result in table 1 shows that 80% of respondents reported that technology is used in science education, while 20% indicated that technology is not used. This result means that the majority of respondents agree that technology is being used in science education, indicating that technological tools play an important role in the teaching and learning of science subjects.

**Figure 1: Bar chart showing the Response on Use of Technology in Science Education**




The bar chart indicates that the majority of respondents agreed that technology is used in science education. Specifically, 40 out of 50 respondents (80%) said Yes, while only 10 respondents (20%) said No. This means that the use of technology in science education is widely accepted and commonly practiced among the respondents.

## II. Effect of Technology on Students' Understanding

**Table 2: Response on Use of Technology in Science Education**

| | | Frequency | Percentage |
|---|---|---|---|
| Response | Strongly Agree | 25 | 50.0 |
| | Agree | 15 | 30.0 |
| | Disagree | 7 | 14.0 |
| | Agree | 3 | 6.0 |
| | Total | 50 | 100.0 |

The result revealed that the majority of respondents supported the use of technology in science education, as 25 respondents (50%) strongly agreed and 15 respondents (30%) agreed, while 7 respondents (14%) disagreed and 3 respondents (6%) strongly disagreed. This implies that technology is widely accepted as an important tool in science education.

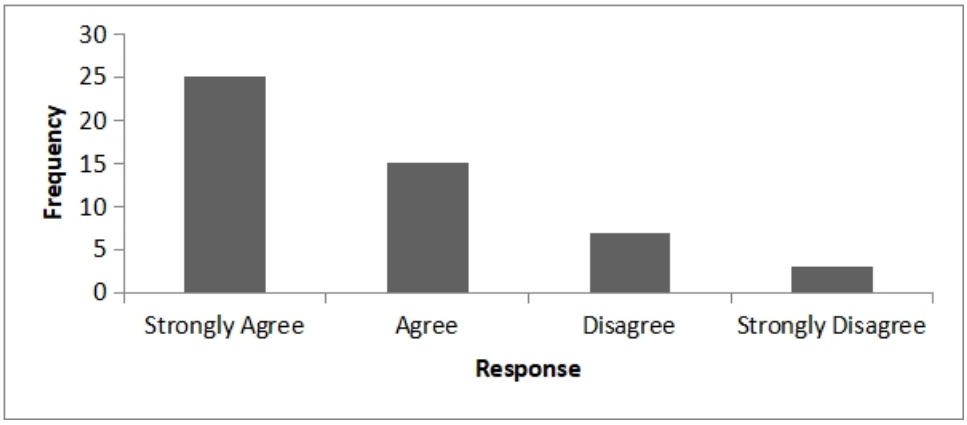



**Figure 2: Bar chart showing the Response on Use of Technology in Science Education**

From the chart, the highest number of respondents strongly agreed (25) that technology is used in science education. This is followed by 15 respondents who agreed, while only 7 respondents disagreed and 3 respondents strongly disagreed. This shows that the majority of respondents have a positive perception about the use of technology in science education, with only a small number expressing negative views.

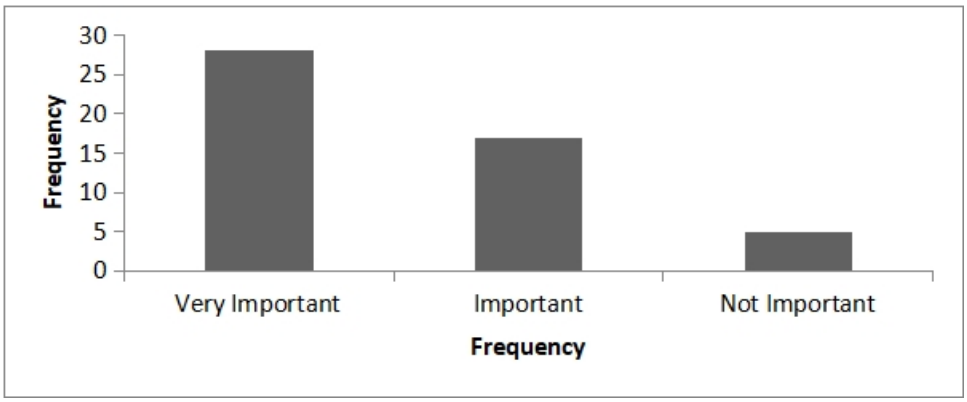
**III Importance of Statistical Analysis**

**Table 3: Response on Importance of Statistical Analysis**

| | | Frequency | Percentage |
|---|---|---|---|
| Response | Very Important | 28 | 56.0 |
| | Important | 17 | 34.0 |
| | Not Important | 5 | 10.0 |
| | Total | 50 | 100.0 |

The result shows that most of the respondents considered statistical analysis to be important, as 28 respondents (56%) indicated that it is very important and 17 respondents (34%) indicated that it is important, while only 5 respondents (10%) considered it not important. This suggests that statistical analysis plays a significant role in the study.

**Figure 3: Bar Chart Showing the Response on Importance of Statistical Analysis**




The bar chart shows that the majority of respondents considered statistical analysis to be important, as 28 respondents indicated that it is very important and 17 indicated that it is important, while only 5 respondents responded that it is not important. This implies that statistical analysis is highly valued by the respondents.

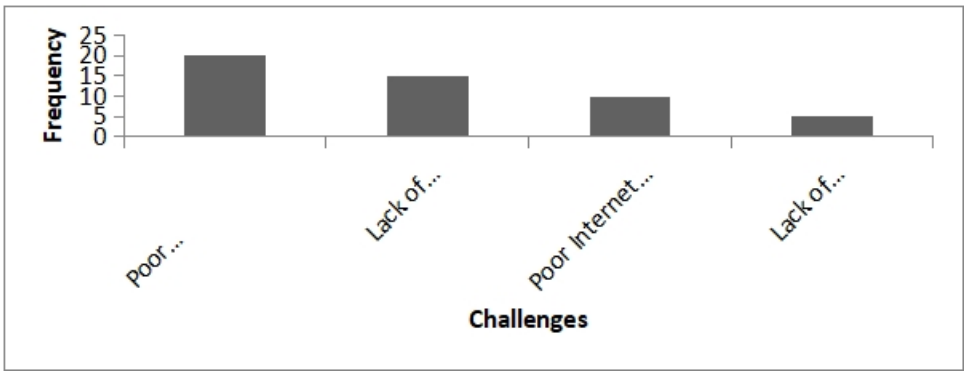
## IV. Challenges Affecting Technology Use

**Table 4: Response on Challenges Affecting Technology Use**

| | | Frequency | Percentage |
|---|---|---|---|
| Challenge | Poor Electricity Supply | 20 | 40.0 |
| | Lack of Computers | 15 | 30.0 |
| | Poor Internet Access | 10 | 20.0 |
| | Lack of Teachers Training | 5 | 10.0 |
| | Total | 50 | 100.0 |

The result indicates that the major challenge affecting the use of technology is poor electricity supply, which was reported by 20 respondents (40%). This is followed by lack of computers (30%) and poor internet access (20%). The least reported challenge is lack of teachers' training (10%). This implies that infrastructural problems, especially electricity and availability of computers, are the main factors limiting the effective use of technology.

**Figure 4: Bar Chart Showing the Response on Challenges Affecting Technology Use**




The bar chart shows that the majority of respondents considered poor electricity supply as the major challenge affecting technology use, as 20 respondents indicated it is the most challenge facing the use of technology in Nigeria and 15 respondents indicated that lack of computers is also a major challenges affecting technology use, followed by poor internet access with only 10 respondents and lack of teachers training with only 5 respondents.

## Discussion of Findings

The reliability test of the research instrument using Cronbach's Alpha produced a coefficient of 0.82, which indicates a high level of internal consistency. This shows that the instrument was reliable enough to generate consistent responses, therefore the data obtained from the respondents can be considered dependable for the study.

Findings from the study revealed that the majority of respondents confirmed that technology is used in science education. About 80% of the respondents indicated that technology is being used, while only 20% disagreed. This suggests that technological tools are already integrated into the teaching and learning of science subjects in the study area.

The bar chart also supported this result, showing that most respondents selected "Yes," which further confirms that the use of technology in science education is common among the respondents.In addition, the responses showed a strong positive perception towards the use of technology in science education. Half of the respondents strongly agreed, while a large proportion also agreed that technology is an important tool in science teaching. Only a small number of respondents expressed disagreement. This implies that most respondents believe that technology improves the teaching and learning process in science, and its use is widely accepted.

The findings also indicated that statistical analysis is considered important in the study. More than half of the respondents rated it as very important, while a large number also considered it important, and only a few respondents saw it as not important. This shows that respondents recognize the value of statistical analysis in research and decision-making, which supports its use in this study for proper interpretation of data.

Despite the positive responses on the use of technology, the study identified some major challenges affecting its effective use. The most

common problem reported was poor electricity supply, followed by lack of computers and poor internet access, while lack of teachers' training was the least reported challenge. This means that infrastructural problems, especially power supply and availability of technological facilities, are the major factors limiting the effective use of technology in science education. These findings suggest that improving basic facilities will greatly enhance the use of technology in schools.

## Conclusion

Technology and statistical analysis are essential tools for improving science education in Nigeria. When effectively integrated into the education system, technological tools can enhance teaching methods, improve student learning outcomes, and promote scientific innovation.

Statistical analysis also provides valuable insights into educational performance and supports evidence-based decision-making. By combining technological innovation with data-driven educational strategies, Nigeria can significantly improve the quality of science education and support national development.

## Recommendations

1. Government should invest more in technological infrastructure in schools and teachers should receive training on the use of digital learning tools.
2. Schools should adopt data-driven approaches for evaluating student performance.
3. Electricity and internet infrastructure should be improved.
4. Educational institutions should promote research in science and technology education.

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