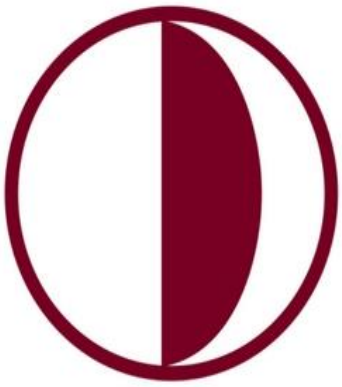

NEAR EAST UNIVERSITY
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DEPARTMENT OF
EDUCATION PROGRAM AND INSTRUCTION

THE INFLUENCE OF TECHNOLOGY ON THE TEACHING AND LEARNING OF BIOLOGY IN THE FACE OF COVID 19.

MASTER'S THESIS

EJIMADU LINDA UGONNA

Nicosia
February, 2022

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February, 2022

ADMISSION AND APPROVAL

We certify that we have read the thesis submitted by Linda Ugonna Ejimadu titled **"the influence of technology on the teaching and learning of biology in the face of Covid 19"** and that in our combined opinion, it is fully adequate in scope and in quality as a thesis for the degree of Master of Educational Sciences.

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DECLARATION

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

Name and Surname of the Student

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LINDA UGONNA EJIMADU

ABSTRACT

THE INFLUENCE OF TECHNOLOGY ON THE TEACHING AND LEARNING OF BIOLOGY IN THE FACE OF COVID 19.

Ejimadu Linda Ugonna,

MA, Department of Education Programs and Instruction

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The aim of this study is to explain how technological advances influenced Nigerian teachers' and students' biology teaching and learning during the COVID-19 pandemic. The lockdown caused by covid-19 and the lack of studies regarding the use of technology in teaching and learning of biology, pushed the researcher to carry out this study. A qualitative single case study method of research was used to investigate how technology influences biology teaching and learning in the face of COVID-19 in Abuja city. Interview google forms were used as data collection tools to collect data from both Nigerian Biology students and teachers. Biology teachers and students selected randomly from five different schools participated in this study. Thirty Biology teachers who have taught using technology and seventy students who have attained lessons using technology during this pandemic participated. The data collected best conveyed the teachers' and students' perceptions on the utility and simplicity of the use of technology in biology lessons during this time period. This data collected revealed the influence of technology in their Biology lessons during this coronavirus pandemic. The data was analysed using the content analysis method. The results obtained showed that technology positively impacts Nigerian students' and teachers' learning and teaching, respectively, in the face of COVID-19. These results can be used by instructors to improve their teaching methods and the government of Nigeria to improve the standard of education during this pandemic. Implying technology contributes to learning biology and the community positively in the face of COVID-19.

Keywords: technology, biology lessons, covid-19, teaching and learning.

ÖZET

TEKNOLOJİNİN ÖĞRETİM ÜZERİNDEKİ ETKİSİ VE COVID 19 KARŞISINDA BİYOLOJİ ÖĞRENİMİ.

Ejimadu Linda Ugonna,

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Şubat, 2022, 87 sayfa

Bu tezin amacı, COVID-19 salgını sırasında Nijeryalı öğretmen ve öğrencilerin teknolojinin biyoloji öğretme ve öğrenmelerini nasıl etkilediğini açıklamaktır. Pandemi döneminde yaşanan kapanmalar ile Biyoloji derslerine yönelik teknoloji kullanımı ile ilgili araştırmaların eksikliğinden dolayı bu tez konusu belirlenmiştir. Abuja şehrinde COVID-19 karşısında teknolojinin Biyoloji dersinin öğretimi ve öğrenimini nasıl etkilediğini araştırmak için nitel araştırma yöntemi ve örnek olay araştırma deseni kullanılmıştır. Veri toplama aracı olarak mülakat soruları Google form aracılığı ile hem Biyoloji dersini veren öğretmenler hem de dersi alan öğrencilerden veriler toplanmıştır. Araştırmaya beş farklı okuldan öğretmenler ve öğrenciler rastgele katılımcı belirleme yöntemiyle belirlendi. Bu pandemi döneminde teknoloji kullanarak derslerini yürüten yirmi Biyoloji öğretmeni ve Biyoloji dersini alan kırk tane öğrenciden veriler toplanmıştır. Toplanan veriler, Biyoloji derslerinde teknolojinin kullanım kolaylığı ve faydası hakkındaki öğretmen ve öğrencilerin algılarını belirlemeye yöneliktir. Toplanan bu veriler, korona virüs salgınında teknolojinin Biyoloji derslerindeki etkisini ortaya koymuştur. Veriler kodlama yöntemi kullanılarak analiz edildi. Elde edilen sonuçlar, teknolojinin Nijeryalı öğrenciler ve öğretmenlerin öğrendiklerini ve öğretilerini sırasıyla COVID-19 karşısında olumlu yönde etkilediğini gösterdi. Bu sonuçlar, eğitmenler tarafından öğretim yöntemlerini geliştirmek için ve Nijerya hükümetini bu salgın dönemde eğitim standardını iyileştirmek için kullanılabilir. Biyoloji derslerinde COVID-19 pandemi döneminde teknoloji kullanımının olumlu katkıları olduğu görülmüştür.

Anahtar kelimeler: Teknoloji, Biyoloji dersleri, covid-19, öğretim ve öğrenme.

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CHAPTER I

Introduction

This chapter presents the problem statement, the study aim, the questions on which the research is based, the research significance, the limitations of the study, and it ends with some definition of some significant terms used in the study.

Statement of the Problem

Students in Nigeria have always found it difficult to excel in science classes. The scientific method of science classes, a lack of adequate educational tools (Huffcutt, 2010), differences in culture (Dkeidek,Mamlok-Naaman, &Hofstein, . 2011), variation between the instructor and the learners, a lack of consistency regarding instructors requirements and standards are all factors that contribute to this struggle (Childs. (2012)). Promoting the use of technical technologies in teaching requires a thorough understanding of the importance of technology in changing teaching and learning environments (Blundell, Lee, &Shaun 2015). These developments are also being used as instruments for educational change through teacher practice transformation. Without teachers who are educated about technology and how to use it to achieve educational goals, technology cannot be incorporated into the classroom (Garba&Alademerin, 2014).

Technology has become an integral part of the teaching and learning process, especially during COVID-19. This implementation challenges the conventional method of instruction by directing learning practices toward the use of technology. Teachers must also have knowledge of technology and information, as well as the skills to access and use modern technology to solve issues. They must also have knowledge of subject material. To deal with new problems in technology implementation, this growth necessitates a lot of changes in the revolutionary and evolutionary education industry (Onasanya, 2010). To effectively overcome these challenges and equip teachers with practical resources related to the growth of technology use, the educational sector at all levels must be modified (Garba&Alademerin, 2014).

Students gain flexibility and participate in constructive learning as technology is used in the classroom. Students may develop their own expertise based on interactions with new knowledge using technologies such as audio-visual (Bester & Brand, 2013). Associate educational institutions are piloting schools that were founded in 2015 as part of the UK aid/DFID-funded Teacher Development Programme (TDP) project to enhance student learning by improving the way learners are taught in school (Teacher Development Programme. 2014). It has been the centre of attention today as a result of the on-going Coronavirus outbreak. One of the main priority intervention activities in the field of in-service training was access to audio-visual services through mobile technology. Teachers agreed that one should be confident in one's abilities to use technology and dedicated to doing so while evaluating their views and their impact on technology use. A study conducted shows that teachers integration of technology in teaching is however poor, though majority of the teachers who have successfully integrated technology into their teaching and learning process have brought forth positive impacts on their students learning ability (Murtala A, Norazrena A, 2019).

A further research to provide a diverse comprehension of teachers TPACK (Technological, Pedagogical, And Content Knowledge), showed that teachers knowledge of Technology and use of technological gadgets directly influenced the teacher’s integration of technology in teaching. Other factors such as teacher’s experience, characteristics and class size statistically also affected use of technology in teaching (Ifinedo E et al, 2020).

Teachers are now battling to improve their technical skills in order to meet the demands of teaching in the face of COVID-19. The more experienced a teacher is with technology, the more likely he is to incorporate it into classroom teaching (Hsu, &Kuan, 2013). Teachers often view students in Nigeria as being culturally inferior, with less willingness, intellect, and competence to excel in science, when it comes to teacher expectations of their commitment and achievement. Nigerians have faced digital literacy challenges as a group because most Nigerians are unfamiliar with computer technology and it is not part of regular cultural activities. Since few Nigerians own computers, most students are not exposed to technology. Despite

extensive studies in educational technology, very little reported about students' technological experiences,(Beckman, Bennett, &Lockyer.2014).

With the onset of COVID-19, and the massive closure of schools globally, continuity of education rested solely on eLearning and most school activities drifted to online too (Dhamawan, 2020). This use of technological trend in teaching and learning and learning presents new opportunities to the teachers and students, as well as the whole education sector. Therefore exploring the digital gaps in a pandemic context has become a great interest for field experts (Ramalingnam&Prabhu, 2020; World Bank 2020). Bridging the gap and transitioning from traditional method of teaching to this modern method of teaching has become imminent and pertinent (Dayagbil et al 2021; World Bank 2020).

Furthermore, despite all this digital poverty and social marginality, in reality, millions of Nigerian students especially those from poorer backgrounds who had no access to internet and lacked technological gadgets to perform like their mates however found it really difficult to cope (Adeleke, 2021).

Due to this, the problem addressed in this research is how Nigerian learners and instructors view the use of technology in biology lessons during the COVID-19 pandemic. According to current research, an issue that is both important and significant to the field of technological application in science lessons is the lack of research into why Nigerian students and teachers fail to apply technology in science courses. Thus these issues prompted the researcher to conduct a study in order to gain a better understanding of how technological advances have become an important accelerator for instructional reforms in biology lessons, as well as resources for modifying more appropriate biology lessons for Nigerian students during the COVID-19 pandemic.

Purpose of the Study

The aim of this study is to investigate how technological advances influenced Nigerian teachers' and students' biology teaching and learning during the COVID-19 pandemic.

The pandemic affected the method of teaching and learning in Nigeria. This was due to the fact that face-to-face classrooms were shut down. Most

lessons turned to distance education that was facilitated by technology. The biology department was not left behind. Reasons why the researcher decided to carry on a study on how technology influenced the teaching and learning of Biology in Nigeria. To attain this purpose, the research was established on the notion that task-technology outcome anticipation is influenced by personal and social influences (Gu, Zhu. &Guo, X2013). This model is used by the researcher to describe how Nigerian students and instructors perceive the ease of use and utility of technology in biology classrooms.

Research Questions

The research questions for the study were determined by the conceptual framework and the study's purpose. The research questions contained one main question and two associated research topics. Using these three research questions, the researcher was able to investigate the perception of both Biology teachers and students of Nigeria on how the teaching and learning of Biology was influenced by technology in the face of COVID-19.

Main Research Question. In the face of COVID-19, how do technological advances in biology lessons affect the teaching and learning of biology among Nigerian students?

Associated Research Questions.

1. How do Nigerian students feel about the use of technological tools in biology classes during the coronavirus pandemic?
2. How do biology teachers in Nigerian feel about the use of technological tools in their lessons during the coronavirus pandemic for Nigerian students?

Significance of the Study

The study's importance is determined in terms of advancing field awareness, improving field practice, and contributing to a sudden shift to technology in lesson delivery during the COVID-19 timeframe. Educators and researchers could acquire a better grasp of how advancements in technological programs affect technology usage among Nigerian educators and students during the coronavirus outbreak. In terms of enhancing practice, this research can enable science teachers to use hands-on technology during the pandemic. During this time, students will also obtain

additional guidance on how to use technology. The Ministry of Education and school administrators can incorporate the use of technology in Training Colleges for teachers. In terms of social change, this research has a positive impact as it has the capability to improve the learning ability of Nigerian students. Nigerian students can learn more about how to apply technology to address complex scientific problems. As a result, Nigerian students will be better problem solvers who can control their own studies by identifying challenges, devising solutions, and putting those answers to the test with the help of innovative thinking and technology.

Limitations

- Data Collection; the first weakness was the researchers' ability to collect data in Nigerian. It was difficult for the researcher to travel and collect data due to the regular lockdown that resulted in airport closures during this research. The use of Google forms and reaching out to students and teachers via email and phone helped to mitigate this.
- Applicability; the second constraint concerns the applicability of case study findings. While gathering and analysing data from several sources can increase the construct validity of a case study (Yin, 2014). This study's conclusions may only apply to Nigerian children and teachers in similar schools in similar states with similar populations. Similarly, this study's findings may only be relevant to high school biology instructors and learners that use technology in their lectures.This was overcome by presenting extensive explanations of the data and information analysis procedures, as well as the study's surroundings, participants, and outcomes.
- Another problem is researcher bias, which stems from the researcher's role as principal investigator, which requires full responsibility for data collection and interpretation. The researcher, on the other hand, used strategies like data collection and reflexivity to combat any potential bias. In Chapter 3, in the section on qualitative research dependability, these methodologies are examined in depth. Using a single conceptual structure, the Technology Acceptance

Model (TAM), is another constraint (Adetimirin, 2015). TAM's drawbacks include the lack of understanding the social implications of technology in terms of social progress, technological advancement, and social consequences (Adetimirin, 2015).Gu et al. (2013) devised a TAM that combines both individual and interpersonal influence features, which may help to overcome this constraint.

Some Related Definitions. The following concepts are focused on analysis and are crucial to comprehending this report.

Biology Technology.Fibre optic systems, hand-grip heart rate monitors, optic signal generators, EKG sensors, blood pressure sensor, EKG Electrodes, temperature probe, surface temperature sensor, hand dynamometer, etc. are other probes and devices used in the biological sciences to capture, calculate, and explain scientific data are included.

In addition, biology technology may include mobile device apps like LoggerPro and Vernier Graphical Analysis that help with biological data collecting, measuring, and reporting. Biology technology, according to PLTW (2016), is a subclass of science technology.

Educational technology. It is characterized as the use, development, and management of acceptable technological systems and processes to enhance student learning. Among the tasks that computers assist students with are different frameworks for immediate results or instant discovery of knowledge based on student requirements, preferences, or objectives.

Educational technology includes virtual laboratories or online laboratories that incorporate computer simulations that allow manipulation of digital materials and products on a computer monitor. Educational tools such as iPads, Smart Boards, and mobile phones help pupils learn and remain busy focusing (Zacharia et al., 2015).

Learning through electronic means. Electronic media forms such as satellite radio, audio/video cassette, television, and CD-ROM, as well as the digital Internet, intranet, and extranet, can all be used to deliver instruction. Electronic learning, or e-learning for short, does not always require the use of a computer or an internet connection, but rather the utilization of electronic materials. (AlAzawei&Lundqvist, 2015;Ngafeeson& Sun, 2015)

Information technology. Computer hardware and software applications for collecting, processing, and disseminating information that improve cooperation efficiency. Information technology includes things like microprocessor manufacturing, microprocessor design, electronic communication, and corporate resource planning (Oon&Sorooshian, 2013).

Mobile Learning. E-learning includes mobile phones and portable gadgets such as iPads, desktop computers, laptops, or notebooks, MPs players, gaming systems, digital cameras, and electronic textbooks (Jung, 2015).

Multimedia Learning. This is when learners use technology such as databases, computers as personal devices, and gadgets for visual aural lectures to record material expressed visually and audibly delivered explanations, and participate with the knowledge in a variety of ways (Odcházelová, 2015).

Outcome Expectancy. The first component of the technology acceptance model (TAM), which describes students' embrace of technology, is the apparent utility or real use of a technology. The outcome is determined by the technology's usefulness, simplicity of use, effectiveness, and comparative advantage (Gu et al. 2013).

Perceived Ease of Use. Perceived ease of use is a facet of outcome expectations in the technology acceptance model (TAM), and it pertains to students' perceptions of how simple or straightforward technology will be to utilize. (Gao& Wu, 2015).

Personal Factors. The fourth part of the technology acceptance model (TAM), which specifies a learner's self-awareness and personal ingenuity when it pertains to technology use (Gu et al., 2013).

Project Lead the Way (PLTW). A nonprofit organization dedicated to closing the gap among college and professional readiness by providing learners with the knowledge and abilities they need to excel in today's rapidly digital world. PLTW provides students with an interactive, project-based training experience (Cahill, 2016).

Core teaching is a hands and fingers, interactive technique in which teachers take on the role of students and engage in in-depth examination of PLTW coursework before reporting back to their colleagues. Through core training,

teachers build competence and trust in real concern learning, allowing them to bring studying to life.

Science Technology. hands and fingers apparatus or learning aids designed specifically for science activities (Bigler and Hanegan, 2011) describe science technology as the use of computers in conjunction with probe ware such as equipment such as micropipettes, trays, heat cyclers, gel boxes, centrifuges, and vortex.

Self-Efficacy.The belief that a person is capable of accomplishing a specific task (Adetimirin, 2015).

Social Influence. The third aspect of the technology acceptance model (TAM) is when a person assumes that other students will influence how they use a new system (Adetimirin, 2015). Social pressure, environmental factors, and interpersonal interactions are all examples of social influences.

Subjective Norm.The social pressure from others to accomplish or not accomplish a mission. The user believes that other people think they should or shouldn't do anything (Ngafeeson& Sun, 2015).

Task-Technology Fit. When a student uses technology to help him or her achieves or finishes a purpose, this is the second aspect of the technology acceptance model (TAM) (Gu et al., 2013).

Technology Acceptance Model (TAM). It is a model to explain how external variables affect students' views, ambition to use technology and the actual usage of technology. Social impact, result expectancy, task-technology match, and personal factors are the four components of the TAM. The goal of TAM is to define the factors that influence computer acceptance and to understand why people embrace or resist technology (George &Ogunniyi, 2016).

Technology Innovations.Students' usage of biology and educational technology in the delivery of biology courses. Students may use biology-specific probes and machines, as well as software, instruments, and facilities, thanks to biology technology (Cildir, 2016; PLTW, 2016). Students will learn about science using mobile devices, computers, and online resources thanks to educational technology (Preston et al,2015).

(Ngafeeson& Sun 2015) define technology innovation as the process of introducing new technology.

CHAPTER II

Conceptual Framework

In this chapter, we will look at the study's conceptual framework as well as additional literature on the research topic. The part will present literature on the adoption of technology in teaching, instructors' and students' opinions and views about using technology in a lesson, and the section will conclude with some material on the influence of technology in teaching and learning in Nigeria.

Conceptual Framework

For decades, the TAM has been used to research the impact of technology in classrooms. The TAM was designed by Davis (1985) with the goal of encouraging acknowledgement as a technology mind set. Researchers were able to use the model to look at student reception of technology and how it impacts classroom learning. It's a model that's been tied to information and communication technology studies (Fleming et al., 2007). Several modifications of Davis's model of TAM were developed as a result of research conducted in school environments on attitudes regarding technology (Nistor et al., 2014).

TAM created by Gu et al. (2013) was modified to create the conceptual structure for this analysis. This model includes four determinants of technology usage, all of which are related to students' attitudes and actual usage technology in Biology classes throughout the face of COVID-19. This approach uses internal beliefs and usage habits to forecast students' approval of technology. Outcome expectancy, personal variables, social influence and TTF are the four indicators of adoption and usage of technology. ***Outcome Expectancy.*** According to Gu et al. (2013), the most important measure of technology use is outcome anticipation. Another name for outcome expectations is performance expectancy. The term "outcome" refers to a user's acceptance model for technology based on its purchase intention or factual use. The outcome, according to Gu et al., is influenced by the relative advantage, utility, ease of use, and efficiency of technology. For example, if technology is easy to use, assists people in completing tasks efficiently, and enhances results, it can be beneficial or good for them.

People's expectation of outcomes, on the other hand, may be low if the technology is difficult to use, takes longer to perform a task, and produces poor results. As a result, a good experience is considered as advantageous, leading to favourable perceptions and beliefs toward technology use. A bad experience, on the other hand, can lead to negative attitudes and beliefs regarding technology use.

Task-Technology Fit. Another part of the TAM is effort expectation or TTF. According to Gu et al. (2013), TTF is the degree to which technology assists a person in completing a task. TTF is important to the TAM because, regardless of their conduct, students embrace technology because of its great potential rewards in fulfilling a mission. The use of technology to assist a student in executing and finishing activities is referred to as TTF. Whenever technology, for example, meets students' task requirements, it increases their chances of success. TTF has the advantage of encouraging students to consider technology as a result of better performance and task accomplishment, which is comparable to the relative advantage result expectancy Additionally, as students' technological competency grows, so do their expectations of TTF (Gu et al., 2013).

During this time of coronavirus pandemic, TTF is critical while researching acceptability and the use of technology in Biology classes. TTF is intrinsically related to expectations for outcomes, with simplicity of use demonstrating a high correlation with learners' belief that tech will help them improve their grades (El-Gayer et al., 2011). Well-used technology has a favourable impact on individual outcomes, and technology deployment is based on how well the new technology fits the job it supports. TTF has a significant and positive impact on the willingness to employ technology (Shih & Chen, 2013). ***Social Influence.*** Social impact is the third aspect of TAM. It presumed social pressure to engage or not to engage in an action is used to describe social control (Gu et al., 2013, p. 394). Another definition of social influence is the degree to which a learner believes significant others, such as professors, mentors, and classmates, believe he can use technology (El-Gayar, Moran, & Hawkes, 2011).

The decision to adopt or reject the use of technology or an invention is influenced by the interaction with those around. This social impact accounts

for peers, society, and family influences as well as technology usage in and outside of the classroom. While social impact does not explain technology use out of school, it does explain technology use in the classroom (Gu et al., 2013). Social influence has been incorporated in the TAM version since youngsters learn from one other through contact with trusted friends. Despite the fact that social influence was not used in the early TAM framework, research has demonstrated that it has an impact on a student's technology desires and views.

Personal Factors. The final section of TAM is personal factors. To further understand students' usage of technology in and out of school, this idea of personal influences was employed, which is related to social impact. Two personal elements include computer and technology awareness, as well as personal inventiveness (Gu et al., 2013). Personal innovativeness is characterized as an individual's willingness to experiment with new technology. Positive technology use is linked to both self-efficacy and personal inventiveness, which is described as "trust in one's ability to do a certain action." Personal factors benefit teachers and students, according to Gu et al., because of their ability, trust, and attitudes related to good technology use. Personal factors have also been considered by other scholars in the context of technology approval. Self-efficacy has indeed been demonstrated to influence learner engagement, success, and contentment in e-learning. It is impossible to overestimate the importance of self-efficacy in increasing students' capacities to accomplish different learning tasks. Even though the usage of technology does not suit the student's learning style and may prevent the learner from accomplishing the assignment, the lecturer's learning strategy may allow the student to complete the work. When it comes to technology adoption, it's also important to understand learning styles. As a result, researchers have looked at personal variables like learning styles and how they affect technology acceptance. Because students' learning styles must match teachers' teaching approaches, learning styles determine educational excellence, learning duration learning routines and learner contentment (Al-Azawi&Lungvist, 2015).

As a result, learners' perceptions of technology's utility and satisfaction can be influenced by how well it accommodates their styles of learning. The

observed utility and happiness with technology is determined by the personal involvement of trainees, as well as the user's technology maturation (Al-Azawei&Lungvist 2015). While self-efficacy and training style are personal factors that influence technology adoption and satisfaction, other variables can have a major impact on student achievement. People's attitudes and actions toward computers are influenced by culture as a personal aspect. The impact of cross-cultural differences on students' beliefs and attitudes about technology adoption is also important. Learners' digital talents in technology that they bring to the classroom are crucial cultural resources for achievement (Rafolow, 2018).

Faced with COVID-19, this research leads to increased social change by improving the quality of biology education and behaviour for Nigerian students. There are options for Nigerian students to improve their academic performance by enhancing the academic achievement of students, which may boost their test scores and encourage their interest in the subject. Nigerian students may even be encouraged to enter college in order to improve their job prospects and financial stability. The goal of this is to provide resources to Nigerian students to assist them to succeed in their learning so that they can prosper in society during this coronavirus outbreak. Educators will effectively build tools to help Nigerian students' Biology learning by recognizing the effects of science instruction and technological advances on their learning. As a result, the researcher explored how technological developments in biology courses affect biology studies for Nigerian students using a TAM in the face of COVID-19.Related papers on the effects of technology on learning and teaching will be discussed in this segment. There have been few reports published on this topic, specifically on the effects of technology on Biology classes in Nigeria during the COVID-19 pandemic. As a result, relevant papers on the impact of technology on science lessons were reviewed, and the next chapter will explore how it influenced Biology lessons in the face of COVID-19 in Nigeria

Technology Acceptance.

Technology Acceptance in School Science. TAM is the most frequent approach for demonstrating technology adoption and usage in the areas of

information technology (Adetimirin, 2015). Since the aim of this research is to see how technological advancements affect Biology teaching and learning in Nigerian high schools, the researcher looked at the research on technology adoption four concepts; outcome expectations, societal impact, personal, TTF, and variables (Gu et al.,2013).

Students' attitudes about adopting technology are influenced by its apparent utility and ease of usage. Observed utility which describes a student's views, has a significant impact on technological acceptance (Al-Azawi&Lundqvist, 2015). Similarly, user satisfaction with use influences perceived utility and student perceptions toward a technology. As a result, technology acceptance is described as a student's willingness to engage in a specific activity as a result of the student's intention to engage in the behaviour. To put it another way, a student uses a research tool in the hopes of obtaining knowledge that will help him or her enhance their learning efficiency and results (Gao& Wu, 2015). On the other side, technological adoption can be defined as selecting when and how pupils can use modern technology (Jung, 2015). The observed utility and satisfaction of using technology were used to gauge students' acceptance of it.

Students' attitudes toward using a specific technology are determined by their expectations of its utility and ease of use, which in turn decide their continuance intention to use technology, which leads to technology usage (Juhary, 2014). As a result, students who intend to use a technology will almost certainly use it more than those who do not, and students who assume a technology is valuable and easy to use will almost certainly intend to utilize it greater than those who do not. Overall, adoption of technology refers to a desire to employ numerous technologies in a straightforward and effective manner in one's profession. According to a description generated from various literature evaluations, learner contentment in the fulfilment of a learning project is the definition of technology adoption (Hsu, 2016). As a result, when a learner's learning needs are met, learner objectives are exceeded or exceeded, and the level of satisfaction with acquiring valuable learning is defined by the learner's attitudes and beliefs. Based on the literature's descriptions of technology adoption, the researchers defined it as the way pupils view, accept, and apply technology usage.

Technology in the school refers to a variety of digital gear and software employed to support the learning process, such as laptop, smartphone, and mobile computers and apps (Wu, Hsu, & Hwang, 2008). ***Technology Acceptance in Biology Courses by students.***The use of technology for education is widely accepted. Technology is essential in education for integrating science concepts and facilitating real classroom encounters. According to studies, technology assists students and teachers in understanding the roles and abilities of technology, and also their benefits for students' schooling (Puhek et al 2013). Expectations of a favourable outcome, task-technology fit, societal impact, and personal qualities can all influence students' acceptance of technology. When it comes to outcome expectations, students will accept modern technology, even if it is harder to use, if they think it will benefit them (Yusoff, 2011). TTF enabled learners to use technology more effectively in STEM classrooms than in social studies classes or volunteer activities for subject-specific learning strategies (Thompson, 2012).

Horzum et al (2014) discovered that outcome expectation has a major impact on attitude and purpose in a study on students' technology acceptance. Scientific students appreciated virtual field trips in science lectures because they considered the technology was approachable and effective in helping them comprehend natural connections (Puhek et al, 2013).

Learners who have great expectations for accomplishment are more certain to accomplish in their design engineering activities, but learners who do not have great expectations for accomplishment are less likely to achieve (Cornacchione et al, 2012). As a result, learners' adoption of technology can be influenced by their perceptions of the technology's outcome and benefits. While technology assists in the attainment of positive outcomes, it also assists in the attainment of harmful outcomes. Due to the intricacy of using web-based apps, learners may not have been competent in checking for grammar or procedures, they may not have been comfortable with the user interface, and there may be insufficient resources accessible for learners to use (Güngören et al 2014). As a result, students who face cognitive

challenges when engaging with technology are more likely to have negative outcomes, and they may need additional special training in order to succeed.

Task-technology fit.TTF has been shown to affect technology acceptance in studies. This research focuses on the effect of technology on Biology lessons in the face of COVID-19, but there are few studies on Nigeria. Ngafeeson and Sun (2015) conducted a survey of undergraduates to determine how technological innovation, subjective custom, observed simplicity of use, and observed benefit, influence their willingness to utilize e-textbooks. They revealed that technological innovation, subjective norm, perceived ease of use, and perceived usefulness all influence their willingness to use electronic textbooks in both straight and indirect ways.

Tablets were found to be advantageous for information finding, search, archiving, document authoring, viewing, tagging, and communication (Neufeld and Delcore, 2018). As a result, students are adopting the use of tablets because of their versatility and the part they play in meeting their computer needs. Furthermore, apparent simplicity of use, task fit, and students' exposure to technology might influence technological innovation, acceptability, and acquaintance.

Social influence. Peer pressure is when children are influenced by what they find their friends doing. This pushes them to do the same. While peer pressure has been found to play a role in students' absorption of technology in various researches, there are few investigations on the social influence of school biology. In a TAM study of individuality and peer pressure involving 15-year-old children, researchers discovered that learners who have access to technology connections are less influenced by social influence than those who do not. When openness to knowledge, interest, emotional maturity, and personality are poor, it affects technology acceptance (Svendsen et al 2013).

Instructors and school officials who see the iPad as a useful learning tool have a favourable impact on students' willingness to use technology. Some students often feel compelled to be using the technology that their instructors use instead of using it of their own willingness (Courtois et al, 2014). As a result, interactions come from a variety of places, staff, such as classmates, and school administrators.

Personal factors. Personal characteristics play a significant effect in pupils' acceptance of technology in school. Students will be unable to learn efficiently if they think that individual reasons are keeping them from accomplishing their objectives. Other personal characteristics that add to learner discomfort include self-motivation, trouble in building new knowledge without competent guidance, and a lack of professional self-efficacy (Al-Azawei&Lundqvist, 2015). Learners who had a bad attitude toward technology from the outset are significantly less likely to continue using it in the face of stimulation. Learners who have a good attitude toward using a laptop as an educational tool are more likely to master new abilities and have high standards for utilizing technology at school, according to a continuous study (Courtois et al., 2014). As a result of the improved perception of action, a more hopeful view will emerge. Even if the educational setting does not meet their specific demands in terms of technology use, students are encouraged to learn while using a current technology platform provided they remain hopeful and easily adapt to varied learning contexts (Al-Azawei&Lundqvist, 2015). Furthermore, with tough technologies, students typically have a better degree of motivation since they may create and exercise new material without losing desire in studying. Learners are unsatisfied with their technology use because it is too tough for them and they lack the requisite information to completely appreciate the technology, so they submit fast, according to research on how to learn biotechnology through writings and comics. Students are under confident in their use of technology due to a lack of previous experience and instructor support. (Lin & Lin, 2016). In other studies, students claimed that using computers and ICT equipment, as well as receiving training to deal with technical problems, made them happier (Kubiatko et al2011).

Horzum et al. (2014) conducted a systematic analysis of secondary school students' approval and readiness for tablet computers, finding that self-efficacy had a beneficial impact on secondary school students' views toward using laptops. Learners, on the contrary, may be unsatisfied if they lack belief in their ability to use the technology or if it presents a new challenge to them. Inspiration, teaching, and self-efficacy all play a role in a lecturer's approval of technology use.

Students will be less motivated to use technology if they experience a lack of motivation from teachers in terms of its use, since they obviously have a limited awareness of the technology. Learners, on the other side, could be motivated to use technology with support and advice from their professors, which has been demonstrated to raise the morale of low personality learners and urge them to utilize technology assuming that they are assisted.
In study on technology adoption in school science, the issues related with technology adoption in biology are all tackled (Yang, Wang, & Chiu, 2015). According to the literature study, concepts such as outcome expectations, task-technology fit, societal impact, and individual characteristics influence individuals' use of technology. Teachers who have a better awareness of the various driving elements that influence technology adoption in school science will be ready to further comprehend their students' aspirations to study biology based on interests and achievements in school.

In addition, a greater knowledge of college technology adoption may shine a light on how students see their education and progress in Biology in the face of adversity such as the COVID-19 pandemic, which has impacted numerous educational institutions throughout the world. While some research has looked into technology adoption in high school and college settings using the characteristics of task-technology fit, outcome anticipation, self-efficacy and impact on society this research have only looked at one or two sources. (George&Ogunniyi, 2016).

Students and Teachers Beliefs and Views on Technology usage.

Students' Views on Technology Usage.Students' actions and attitudes may be influenced by the technology usage in the classroom. In a related study, Giannakos (2014) discovered that students' attitudes and views about technology and communication are connected to their academic success, and their aspirations are tied to what they have previously studied and what they plan to achieve next.
Researchers will investigate the impact of technology on science instruction at the secondary level, starting with learners' perceptions of technology usage. As a result of new technologies in scientific classes, learners are urged to employ probes and models. Learners can study STEM and careers

in biology by using models and by employing probes, learners can collect high-quality data on time, analyse it, and store it (Staudt, et al., 2015).

In this literature study, there was a lot of research on quantitative studies of technology use, but very little research on quantitative studies of biological technology usage. There is a deficit in the literature on learners' impressions of biology technology, and there is also a dearth in studies on Nigerian students' views of using technology in biology. Regardless of the fact that there are few analyses on student impressions of biology technology, there have been no studies on Nigerian students' attitudes of technology use in biology lectures in the face of COVID-19. This proposed study aimed to close this gap by improving instructors' and learners' awareness of technology acceptance in Nigeria.

Teachers' Views of Technology Use.Many researchers have turned their attention to instructor activity in the classroom when it comes to computer and biology technology use. In addition to teaching approaches, students' academic performance and views toward science are related to their opinions of the educational surroundings and their instructors' views of guiding their learning experiences (Kim, 2018). The use of innovative and interactive technologies to increase the quality of education has been recognised by researchers, scholars, and instructors who acknowledge that technology aids effective science education (Owusu, 2015). Depending on how instructors use technology, it can be a source or method for communicating knowledge and information, as well as an entertaining tool that promotes teaching andlearning (Incantalupo et al., 2014).

Teachers' Beliefs about Educational Technology Use.Teachers' opinions about the usage of educational technology vary from one institution to the next. Teachers' attitudes toward educational technology have been demonstrated to have an impact on their capacity to use the right technology with pupils in research (Moses et al., 2013). Furthermore, research has indicated that instructors' attitudes influence how they utilize educational technology in their lectures, with professors who have a good attitude toward technology use being more likely to use laptops in their classes (George &Ogunniyi, 2016). Similarly, how much technology is used and modified in

the classroom is determined by the enthusiasm, knowledge, and technology abilities of the instructors. Some teachers are adamant about not using technology in the classroom. While it has been proven that introducing technology into teaching improves learning outcomes, it is stated that teacher endorsement of technology has the biggest impact on its effective deployment (Ursava et al. 2014). While learners may be capable of learning, it is doubtful that technology will be fully integrated into classroom instruction lacking sufficient instructor competence and acceptability (Mac Callum et al., 2014). Previous quantitative and qualitative research focused on teachers' perspectives on using educational technology to improve teaching and learning.

In this analysis of the literature, there were also studies that looked at teacher attitudes toward educational technology usage in a qualitative way. While qualitative research differs from quantitative research in terms of methods, the findings in terms of teachers' impressions of technology were identical. Teachers' opinions regarding educational technology are focused on perceived utility, their desire to use technology for teaching, and the technology's efficacy, according to the following qualitative studies.

Yarden and Yarden (2013) looked at the problems that high school biotechnology instructors encountered when it came to using animation in teaching, and they discovered that the instructors had a good attitude about the use of animation in lessons. Teachers deemed animation to be an effective visualization approach when contrasted to other ways. Students viewing animations was also a source of concern for instructors. Yarden and Yarden (2013) were worried that pupils would acquire misunderstandings owing to the way molecules and chemical bonds are depicted because the size of the DNA molecule and enzymes is never reliable from a scientific standpoint.

Another concern was that the vagueness of the animation hampered teachers' choice about when to use it in their lesson plans. Despite these challenges, biotechnology educators feel that the advantages of employing animation to teach biotechnological approaches outweigh the disadvantages. Opinions of teachers on the Use of Biology Technology on technology-enhanced teaching science.In scientific lectures, biology technology can

assist students to understand abstract ideas such as unseen chromosomes, mechanics, electric current, electricity, molecules and electrons (George &Ogunniyi, 2016). The following qualitative and qualitative research, looked at teachers' perceptions of biology technology use.

There were a few qualitative studies on instructors' impressions of biology technology use, but only just a few quantitative research of the same type were found (Childers & Jones, 2015; Tsai, 2015). There were also a few quantitative studies on instructors' perceptions of biotechnology material, but nothing on the actual usage of biology technology to learn biotechnology (Machluf&Yarden, 2013). As a result, there has been little quantitative research on teachers' attitudes toward biology technology. Using technology in biology, the teachers' overall experience of the technology-enriched unit was favourable. While there was limited quantitative study on biology technology in this analysis, prior studies on biology issues like biotechnology indicated that teachers who include biotechnology into college curricula confront considerable hurdles. According to teachers, technology, genetics, and genomics are one of the most challenging subjects in the scientific curriculum (Mueller et al., 2015).

There was more qualitative research on teacher attitudes toward the use of biology technologies than quantitative studies. Lesson observations, a semi-structured interview methodology to evaluate high school biology teacher's opinions, factors contributing, and career development on technology use. Technology was used as a teaching method and as a learning activator, according to these teachers, technology incorporation in biology, according to the instructor, is useful for presenting instructional content, offering tangible representations to alter students' misconceptions, assisting students in better understanding abstract concepts, and empowering learners to study science subjects like Biology (Tsai, 2015). In all, instructors had a positive attitude in using technology in their lessons.

Childers and Jones (2015) conducted a study to show how educators value the usage of biotechnology. Childers and Jones have spoken to three biology teachers who used scanning microscopes and an internet remote microscopy lab application to educate biology. All three teachers thought the online microscopy lesson was beneficial, stating that it is critical for all

learners to be able to connect with scientists (Childers and Jones, 2015). Instructors believe that all scientific instructors should employ technology that enables students to communicate with scientists since it allows learners to ask questions and assess content from colleagues, researchers, and educators' perspectives. Because the learners, the microscope, and the instructors were all there, the instructors believed that the experience was genuine for the students and instead of being in the same place; the professionals were in separate locations. The utilization of the online microscopy lab and electronic microscope indicated a lack of connection between learners and professionals because the experience was conducted over the Online instead of face-to-face. As a result, educators thought it was a wonderful idea to use biology technology to engage and excite pupils.

Students of colour have long been stereotyped as deficient in science expertise, training, and achievement (Varelas et al., 2011). Black American learners and Latino, contrary to few professors, suffer in science since science is not historically relevant in their backgrounds and they are uncomfortable with the educational settings (Meyer & Crawford, 2015). Additionally, some professors may acquire stereotypes about Black students, believing that they should not pursue careers as doctors, lawyers, or researchers (Mutegi, 2013).

The social construction. According to studies, students who have created positive relationships with their instructors perform higher in education than students who have created no such connections and are more prone to disconnect or become distanced from the classroom (Gehlbach et al., 2016). In both cross-sectional and longitudinal research, supportive student-teacher relationships have been linked to higher levels of student involvement (Kelly & Zhang, 2016). This link created a favourable association when teachers learned about their learners' commonalities, resulting in a two-thirds drop in the educational attainment (Gehlbach et al. 2016). Educators who build meaningful interactions with learners and know about their backgrounds have a good influence on their students' education, according to this finding.

Students acquire favourable emotions about the teacher and a sense of belonging when trainers encourage personal opinions, treat individuals

with humanity and respect, set clear expectations for accomplishment, and make an attempt to address student interests (Kelly & Zhang, 2016). As a result, regardless of race or ethnicity, teacher-student relationships should be focused on promoting student learning. Teachers must be familiar with their own culture in order to better appreciate the background of the learners. Teachers find it difficult to establish an equitable educational atmosphere for all kids, ensuring that each person meets academic demands while remaining culturally receptive to all kids, due to ethnic and linguistic variety among students (Lopes-Murphy et al., 2016). Comprehending learner cultural identity can help you better comprehend how to improve education and use resources to suit the requirements of your students. One option to be culturally competent is to use an intercultural inquiry strategy that incorporates marginalized individuals in science lessons while also offering them with written language help and directions. Learners' consciousness in scientific method can be transformed through the use of a multi-ethnic inquiry educational method, which promotes a learning environment that inspires learners to investigate actual science operations and provides chances for mediation between student, college, and society (Meyer & Crawford, 2015). Building ethnic bridges to assist kids acquire science while employing their traditional awareness as per a teacher is crucial. In order to enhance scientific understanding, instructors must integrate students' views of science with professionals' conceptions of science. (Meyer and Crawford, 2015). As a response, inquiry-based techniques that allow heterogeneous learners to interact in actual science while building on their everyday knowledge, tradition, and language resources will aid their comprehension of scientific learning.

Studies demonstrate that instructors who assist learners' cultural characteristics will assist their learning, which can help them understand ethnic differences (Bang & Baker, 2013). Female students in Korea partake in lesser science groups, have little science experiences, and choose fewer scientific-related occupations than male students (Bang & Baker, 2013). Indicating the fact, in comparison to male learners in Korea, female learners face major disadvantages in science education. Bang and Baker also discovered that science instructors had out-dated beliefs about female

learners' abilities to learn science, which led to less scientific accomplishments and negative attitudes about science among these female learners. Instructors frequently infer that female learners are lousy in science, that they have little to no confidence in their abilities to understand scientific investigation, they are bored in scientific issues, and that science is difficult (Bang & Baker, 2013). Female science learners' underperformance in science can be influenced by stereotypical stereotypes of them. Instructors who deal with Korean learners would need to spend more time with female learners in order for male and female learners to learn equally. Instructors will create more chances for female learners to get interested in science by recognizing the gender disparity in Korean culture. This will assist them in developing favourable sentiments toward scientific knowledge and increasing their scientific awareness, which will motivate them to excel.

Teachers must recognize that whenever female learners take part in technology (Gmail, apps, digital video collection, Google, photo story, and podcast software), their science learning output increases (Incantalupo et al., 2014). As a result, recognizing gender gaps across cultures aids instructors in better understanding cultural diversity and providing accommodations for learners to develop science learning. Learning in science is also influenced by cultural relations. Learners from other cultures encounter challenges such as disconnecting their own ethnic knowledge from scientific fields, as well as fundamental dialogue in families, in the neighbourhood, and in school (McCollough& Ramirez, 2012). Instructors, too, face difficulties such as taking into account learners' linguistic and cultural backgrounds, as well as maintaining high academic expectations.

Since TAM is used as a guide, the review of literature is often linked to this thesis. Despite the fact that many studies on the use of TAM have been found, there are few studies on instructor adoption of classroom technologies (Ursavas et al., 2014). There is a paucity of research on educators' views on the employment of biological technology in particular. It is vital to evaluate both educators' attitudes about instructional technology use and educators' opinions on the application of technology in Biology lessons in order to examine the effect of technological advances on scientific learning for Nigerian students. Furthermore, present study on teachers' perspectives on

students' use of technology will be augmented by a greater knowledge of instructors' preconceptions about the usage of technology in biology lessons.

Literature Review on the impact of technology in Biology lessons in Nigeria in the face of COVID-19. In the study area in Nigeria, little or nothing has been written. In light of the fact that the COVID-19 pandemic is a relatively new pandemic. The researcher got his hands on a few papers about the impact of technology in Nigerian teaching and learning. Following this research, some data on the effect of technology in Biology classes in the face of COVID-19 will be analysed and released for further research.

Despite the fact that Nigeria lagged behind the aspirations and preferences of technology use, information communication technology has been recognized as a priority in global education (Owate, et al., 2014). The Federal Government of Nigeria acknowledges ICT as a result of technological progress and advancement in education in its National Policy on Education (FRN, Revised 2014). Professional training should be required for all teachers in educational institutions. Teacher preparation programs must be designed to prepare instructors to perform their duties effectively. Teacher education programs must provide information technology. It was discovered that the majority of Nigerian teachers lack the necessary knowledge to effectively use technical tools for teaching or do not use technology at all in their teaching process (Onasanya, et al., 2010). There has been a lot of research done about how instructors feel about using technology in the classroom. In a survey, seasoned instructors with little to no professional advancement in application of technology in a classroom were reluctant to apply it and reluctant to see the benefits of using it in the lesson (Sabzian, et al, 2013).

Technological services were not available in the schools, according to reports. They concluded that technology has not been used successfully in instruction because usability and use of any resource is dependent on availability. Despite the critical roles and specific needs for ICT in learning and teaching, several factors limit their use at all levels of education in Nigeria, factors such as, electricity shortages across the region, as well as limited and inadequate ICT facilities. In Nigeria, a shortage of basic ICT

facilities, computers, internet connectivity, and educational software has become an obstacle to the growth of successful and skilled teachers (Garba&Alademerin, 2014).

According to a survey, instructors' use of ICT in the classroom is still limited, even though the majority of teachers (88.76 percent) believe that incorporating ICT into teaching and learning practices has improved their learners' learning abilities. In order for Nigeria to have successful technology-based instructors at all levels, technology training courses should be included in teacher institutions so that trainers can learn both teaching and ICT skills. According to a review, such an approach has been found to result in better instructors' achievement in managing technical resources (Garba, &Alademerin, 2014). The use of technology in schools is solely dependent on the instructors' preparation, interest, and complete implementation of ICT. This will increase teaching and learning, as well as instructor effectiveness and the ability of students to use technology. Many research have been undertaken to determine the impact of
Incorporating technology, into teaching and learning environments. Abannikanda in his research noted that, few students use technological tools in learning of biology, and these tools in turn affect their interest and learning of Biology. The research in its findings also observed that learning was fun with these tools, which made it more interesting and fun to use, but for some challenges such as internet cost, power supply and more. (Abanikannda.M, 2019).

A Research involving Biology Mobile Learning Applications (BMLAs), which explored it as a pedagogical tool and its efficacy. Findings from this research revealed that in-service Biology teachers had good perceptions of the instructional use of BMLAs.Teachers play a critical role in the successful adoption and implementation of mobile learning instructional pedagogy. Hence, activities relating to the evaluation of mobile applications should be incorporated in teacher education programs and professional development programs. This will enhance teachers’ skills and knowledge in the integration of mobile learning applications into classroom practices (Udeani. U &Nosakhare J. 2020).

Few studies have looked at instructors' perceptions of the training they got and how they applied the skills they learned. With the constant advancement in technology, researchers want to know how teachers feel about training and putting what they've learned in the classroom into practice. The results would benefit the government and other educational support donors, such as the UKaids/DFID-funded Teacher Development Programme (Department of International Development). With the introduction of ICT into learning and teaching, a paradigm change from a traditional instructor approach to a modern learner-centred approach is needed (Sabzian, et al, 2013). Instructors must keep up to date with which technologies are available and how they work in order to incorporate technology into their classrooms. Technology application is becoming more integrated into the teaching and non-teaching activities of instructors than it has ever been before, according to research and learning theories of teacher training. To see major improvements in educator technology use, professional development programs should focus on educators as the primary beneficiaries (Hammond, 2013).

Enhancing learning opportunities, transforming teaching, contributing to knowledge-based development, making teaching more student-centred, constructivist in nature, promoting personalized learning, and focusing on higher-order learning are some of the rationales for integrating technology into the classroom (Hammond, 2013). Technology integration is practiced by student teachers in elementary classrooms with the intention of enhancing their instructions, according to a study conducted with student teachers on technology integration in elementary classrooms (Liu, 2016). He went on to say that more research is required to see how teachers can successfully incorporate technology into their daily teaching practices. Importantly, the problem does not seem to be which technology to use, but rather how to use the technology to achieve the best possible learning outcomes. Several factors will affect how they choose and implement technology in their classrooms.

Instructional Materials are in no doubt a very important tool in teaching and learning, the impact of audio visuals as a technological tool in teaching and learning of Biology also cannot be over emphasized. It not only

enhances teaching and learning but also brings the class to life. A recent study on the impact of audio visuals as a good technological tool to enhance biology lessons showed that audio visuals are present in most urban schools in the country but few in the sub urban schools, but they are barely utilised by the teachers. Most of them are faced by technical know-how, large class size and also poor monitoring by the school administration (Suraj J et al, 2021).

CHAPTER III
Research Method

This chapter is about the research method used to conduct this study. It includes the research design, the sample population, data collection tools, data collection procedure, data analysis procedure, and the reliability of the study.

Research Design

This research employs a qualitative approach with a single case study design.

Yin (2014) described a case study as an empirical investigation that examines a current phenomenon in-depth and detailed context, particularly when the boundaries between the phenomenons may not be clearly apparent.

Researchers using a case study design really like to learn about a real-world phenomenon, and they believe that learning about it would entail learning about important contextual factors relevant to the case at hand (Yin, 2014). Since a case study contributes to improving individual knowledge, the researcher used a case study research design because it is appropriate for this study; it enables the researcher to focus on individual biology teachers and Nigerian students. Furthermore, the aim of a case study is to explain or investigate a holistic and real-world viewpoint of small-group action, and the researcher’s goal was to describe how Nigerian students use technology to learn Biology in the face of COVID-19.

Moreover, Yin (2014) claims that questions concerning "why" and "how" are explanatory and contribute to the selection of a case study research design. In this case, a case study is fitting because the researcher wanted to know why Nigerian students struggled to learn during the COVID-19 pandemic and how technology advancement was used in biology classes during that period. In the face of COVID-19, a case study design enabled the researcher to investigate a complex phenomenon like the influence of technology developments used by teachers in a high school biology course on science learning for Nigerian students. Many ideas are involved in this

phenomenon, including teacher and student perceptions of educational technology and biology technology use. Furthermore, the specific characteristics of a case study research design allowed the researcher to draw on a variety of data sources to investigate this phenomenon, including individual student and teacher interviews.

Participant Selection

Seventy (70) high school biology students and Thirty (30) high school biology teachers, from Ten (10) high schools in Abuja, Nigeria's capital took part in this research. The participants were chosen using a simplerandom sampling method from these high schools. This sampling method was used putting into consideration that the researcher was not there in person and it was a straight forward method, hence each member of the population had a chance at being selected. A total of one hundred (100) participants took part in this research. Ten students and three biology teachers were selected from each school.

Summary of students and teachersdemographic information

Name of school	**No of Teachers**	**no of students**	**gender**	**class**
Army Day Secondary School Maitama	3	10	7 boys 3 girls	SS2 &3
Model Secondary School Maitama	3	10	5 boys 5 girls	SS2 &3
Government Day Secondary School Wuse	3	10	4 boys 6 girls	SS2&3
Government Science Technical School Garki	3	10	7boys 3 girls	SS1,2&3
Government Girls Science School Kuje	3	10	10 girls	SS1,2&3
Government Girls Secondary School Dutse	3	10	10 girls	SS1,2&3
Government Secondary School Pyakasa	3	10	5boys 5 girls	SS1,2&3

Government Secondary School Bwari	3	10	5boys 5 girls	SS1,2&3
Regina PacisCollege,Garki	3	10	10 girls	SS1,2&3
St Augustine's College, New Karu	3	10	5 boys 5girls	SS1,2&3

The following inclusion requirements had to be met by teachers: (a) must be a full-time biology instructor with a valid state credential at one of the research sites, (b) must have taught a biology course for at least one year, and (c) must have taught Biology during COVID-19. The following conditions had to be met in order for students to be considered: (a) for more than one year, you must be a biology student at one of these institutions. (b) Must have spent at least one year studying biology. (c) Had to take biology classes during the pandemic.

Data collection tools

Two interview query forms were used to collect data for this report. The first is for Biology students, and the second is for Biology teachers. Two sessions were used to create these interview question shapes. Section A is the demographic section, and Section B is the study-related questions section. These questions were developed with the concern of some of my lecturers and expertise in the domain of qualitative. The proposed questions were about 20 in each segment. This was narrowed down to six with the help of my supervisor. Also the questions were vetted by some of my lecturers selected by my supervisors, whose corrections and views were considered and used to make adjustments before being sent out for our research.

Students Interview Questions

1. In your biology class, what kinds of technologies do you use during this Pandemic period?
2. What makes you think these technological gadgets are useful or not during this period?
3. Why do you think these technologies are easy to use or not?
4. How do you think your interactions with these developments have influenced your biology class learning during this period?
5. How do you think your embrace of technology in biology class has influenced your understanding during this period?

6. What factors do you believe affect your use of technology to learn biology content?(Power supply, internet connection, availability of the materials, the time factor, etc).

Teacher's Interview Questions.

1. How can you incorporate technology into your biology class during this covid-19 period?
2. What makes you think these technologies are useful or not during this period?
3. Why do you think these technologies are easy to use or not?
4. How have your interactions with these technologies influenced Nigerian students' biology learning during this period?
5. Do you think there are many factors that affect Nigerian students' acceptance of technology in biology classes during this period?
6. What factors do you think affect Nigerian students' biology content learning when they use technology in their lessons during this period?

Data collection procedure

To ensure the reliability of this report, the researcher followed detailed protocols for recruitment, attendance, and data collection. The researcher chose the different schools in which the analysis would be performed using random sampling. The researcher contacted the different concepts and requested their assistance. This was simply because the principals had already worked with the researcher and had confirmed their cooperation. To get a sense of the analysis, the researcher sent a sample of interview questions to these principals.

The high school Biology students and teachers were approached by the principals, and teachers who met the requirements were chosen for the exercise. Minors who were interested in carrying out a survey were given a consent form to sign with their parents. The participants were then given the link to the Google interview form by the principals. The forms were received by the research team as soon as they were submitted by the participants. The Google form was also used to ensure that the COVID-19 laws and degree were not disrupted during the data collection process. The researcher

began the study as soon as all the forms were completed. It took two weeks to complete this operation. This time gap fell within the allotted amount of time for this exercise.

Data Analysis procedures

Due to the nature of this research and the process of data collection, the content data analysis method was put into use. Content Analysis is a research tool used for categorizing, tagging and thematic analysis. It combines results of analysis with behavioural data. Content analysis is however used to identify patterns that emerge from texts and groups them into words, concepts and themes. In this research however, it was the best choice because it helped to ascertain attitudinal and behavioural responses from both teachers and students method. In content data analysis type of qualitative research, a code is typically a word or a brief phrase that figuratively assigns a cumulative, prominent, actual fact, and/or evocative feature to a segment of speech or audio-visual data. Interview questions, observational memos, journals, papers, artifacts, pictures, video, webpages, e-mail communications, and other types of data can be included in the data (Miles and Huberman, 1994). This was done to permit the researcher contrast, compare, analyse and bestow patterns. Also during this coding process, significant parts of obtained data were selected and conceptual meaning of each part was found (Miles and Huberman, 1994). This was achieved with consideration for the different classes of respondents, namely students and teachers. Following that, categorising was done in relation to the research questions with confirmation of the various responses from the teachers and students who participated in the research.

Reliability and Validity

To ensure that qualitative research is performed ethically and to deliver accurate and credible information or findings that are true to readers, professionals, and other investigators, trustworthiness is critical (Merriam, 2009).

The careful design of a report by a researcher is a technique for ensuring the study's credibility and acceptance. The constructs of

dependability, credibility, transferability, and conformability can be used to improve the trustworthiness of qualitative research. This section discusses the basic techniques used by the researcher to enhance the reliability of this qualitative study.

Credibility. Merriam (2009) described credibility in qualitative research as to how research results fit reality to provide a holistic view of what is going on between the real world and the researcher or as internal validity. To boost the credibility of qualitative studies, Merriam suggests using the following strategies: member checks, researcher's status or reflexivity, triangulation, sufficient participation in data collection, and peer analysis or peer review.

The researcher took advantage of his or her status or versatility. The participants were given time to feel the interview form by the researcher. The researcher was able to obtain pure knowledge from the participant without being affected by any conditions thanks to the use of the Google form. Since the researcher wanted to know how biology lessons are given during COVID as the researcher, he was versatile.

Transferability. Merriam (2009) characterized transferability in qualitative research as external validity, which is concerned or concerned with the degree to which the results of one study can be extended to other situations. To increase the transferability of qualitative research results to other settings or individuals, Merriam suggested the following strategies: rich thick explanation and broad variation.

The researcher used a rich broad overview in this study by including a highly detailed explanation of the study's environment and respondents. Rich thick description, according to Merriam, means providing enough explanation to contextualize the analysis so that readers can decide if their circumstances fit the study area, and therefore whether results can be transmitted.

Dependability. Merriam (2009) defines dependability, the qualitative equivalent to reliability, as the degree to which research results can be repeated. To put it another way, dependability refers to a study's ability to be replicated and produce the same results, or results that are credibly obtained, allowing the study to be deemed dependable.

To ensure dependability, the researcher ensured that the data gathered was accurate and that the same findings would be obtained if the

analysis were repeated. This was accomplished by encouraging the respondent to freely respond to the interview questions.

Confirmability. The qualitative alternative to objectivity is confirmability. According to Merriam (2009), a researcher's desires and values affect the study's behaviour and conclusions. As a result, employing the reflexivity technique, defined by Merriam as “the process of critical self-analysis by the researcher about theoretical orientation, assumptions, worldview, prejudices, and relationship to the research that could influence the investigation,” will improve the validity of a qualitative study.

The researchers’ assumptions, prejudices, and dispositions about the research were demonstrated using the reflexivity approach, allowing the researcher to make assumptions, perspectives, and biases clear to the reader. The researcher created an analysis process that was followed so that my biases would not influence the results.

Ethical Procedures. The reliability of qualitative research is determined by how ethical protocols are followed by researchers. As a result, ethical behaviour in this analysis represents my own beliefs and ethics as a researcher. The researcher's choices on how to manage data and come up with conclusions had no bearing on the study's credibility. Merriam (2009) recommended that researchers consider such ideas as the safety of subjects from injury, the protection of individuals, the concept of informed consent, and issues of manipulation in order to protect both respondents and their societies in order to ensure that this research was conducted out with credibility.

The researcher followed Near East guidelines to ensure that the researcher followed ethical standards while conducting this research, as the researcher had a duty to protect my participants and their environment. The researcher adopted ethical procedures for this research by sending an application for approval to the ethics committee with all the necessary requirements stating how the research has to be carried out. With all the interview questions and relevant instruments presented. This was analysed and an authorization with application number NEU/ES/2021/713 was granted on the 30th of July 2021.

There will be no harm done. The participants in this study were not affected in any way. The entire exercise was completed online. The participants were not humiliated or dehumanized in any way as a result of the research. Participants were not required to do something special or out of the ordinary. ***Maintain the privacy and anonymity of the respondents.*** The confidentiality of the interview was protected by not asking for the names of the teachers and students on the interview form. To avoid revealing participant names explicitly or indirectly, the results section did not contain any information that could be used to identify specific participants. To account for all students, pseudonyms were made up of the word Student followed by a letter, such as Student X, Student Y, and so on. All instructor participants were also given pseudonyms. The names of the students and teachers were kept hidden, and their answers were kept private. Furthermore, the school's identity was kept a secret.

CHAPTER IV

Findings and Discussion

This chapter deals with the findings and the discussing of the results. This is done respecting the various Research Questions. That is the Related Research Question One and Two, and the Main Research Question. Discussions on the results respecting these Research Questions are better clarified following the conceptual framework of this research which is built on TAM (Gu, Zhu. &Guo, 2013).

Views of students regarding the simplicity of use and value of technological developments in Biological classes Research Question one. For research findings to be obtain the various interview questions were analysed from the student's point of view.

THEMES	CODE
Technological gadgets used for Learning during the pandemic	It was quite inefficient because of the distractions prompted by the platform in use and the classes didn't seem helpful for people that lacked mobile devices. They were useful because they made learning easier It was quick For the purpose of teaching and learning. They are useful Lessons were easier to understand The projector is useful because it improves the learning system and interaction between lectures and the students. The public address system is useful because it helps the lectures

	keep social distance and still communicate effectively with the students. There was no physical contact
Usefulness of Technological Gadgets for learning.	It was quite inefficient because of the distractions prompted by the platform in use and the classes didn't seem helpful for people that lacked mobile devices. They were useful because they made learning easier It was quick For the purpose of teaching and learning. They are useful Lessons were easier to understand The projector is useful because it improves the learning system and interaction between lectures and the students. The public address system is useful because it helps the lectures keep social distance and still communicate effectively with the students. There was no physical contact There was no contact They are useful not just during the COVID pandemic, but in every topic taught in school, we need them because biology needs to feel real when thought in our classes, so we can better understand our lectures.
Simplicity of use of technological gadgets for	I find them easy because of repeated use, but others may not. They are easy to use It is modern

learning.	It is not easy It is easily accessible Because we are already familiar with these technologies, they are simple to utilize. Requires internet connection They are easy to use because most topics already exist online, but not all students have access to internet connection, so if these things are available in schools, it would be great! They are easy to use because most students have prior info on how to use computers It is easy to operate
Effect of the use of Technology during the pandemic.	I didn't see much of a change. It has made me understand that biology can be learnt anywhere and anytime. It made it easy It was good I had more access to information and facts It has influenced my learning positively because I can hear the lecturer from any angle in the lecture hall and I can see also. It Is interactive I have always found it difficult to recognize the different body parts in humans because I was too lazy to check text books, but with the new improvement I am now a different person In biology It made me understand better, especially the lab simulations. Because these apps also include time lapse presentations I was able to understand things like ecological succession

	and fertilization better It needs more time to assimilate.
Impact of technology to students understanding of Biology.	Use of videos and simulations gave a clearer explanation to the topic. Technology made it easier for me to learn. Made the understanding easy. It impacted more knowledge because of different scholars. It has improved my knowledge. It has helped in a lot of ways It has influenced my understanding positively because I get to hear and see clearly in every class. It has greatly improved. It is the same It made me perform better in the subject.
Factors affecting effective use and adoption of technology for learning during the pandemic.	Internet connection, lack of power supply Unavailability of the required materials. Power supply, internet connection Availability of materials

From the responses, it has been proven that most of the students used computers, laptops, mobile phones during this COVID-19 period to have biology lessons. Just one student talked about a microscope. This student did not indicate whether this was done during online lessons or not.

Most of the students revealed that the use of technology during this period was useful. They stated that it maintained social distancing that was

required. They On the other hand, Aisha Mohammed a student of Model secondary School Maitama Abuja was of a different view, “it was useful only to those who could afford computers, mobile phones” mentioned that it was also good because they could have some hands- on activities and watch videos relating to their topics.

These students had contradicting opinions about simplicity of use of technology. The first is that most of them said they were easy to use because they were already familiar with them; while a few of them said it was not easy to use because it was new to them and they needed more time to get familiar with it.

Furthermore most of the students were happy using technology during this period. They indicated that they could understand better. Some stated that topics like body systems, which as difficult to understand when reading the textbooks, was well assimilated during this COVID-19 period with the aid of technology. Others stated that they could have access to more information from the internet during this period due to the drastic turn to technology. Besides, a student in the suburb school said “using technology was hard for me because I don’t have the Smart phone and had to borrow from a friend each time I had a class”.

Majority of the students approved that the embrace of technology into their lessons during this coronavirus pandemic improved on their learning. They could do things and see videos that improved their understanding.

Finally, all the students complained of not having an internet connection all the time. This may be due to power failure or lack of getting access to the materials like computers, mobile phones, etc. So the standard of economy had an impact in the implementation of technology in Biology lessons in the face of COVID-19.

These results were reviewed and interpreted in light of the study's core and relevant research issues, as well as the literature review and conceptual context. The interview questions employed in this study were pertinent to the research topics and the central research issue. Students were asked interview questions based on Related Research Question 1.

The key finding from the examination of literature and conceptual context in regard to this topic was that the use of technologies in teaching and learning of Biology by Nigerian students in the face of COVID-19 led to positive experience for the students. The results of the data analysis supported the idea that technological advancements in biology lessons were advantageous to Nigerian students during this time period. According to Nigerian pupils, technology is advantageous in two ways. To begin with, it provides them with beneficial active biology learning experiences while also assisting them in improving their understanding. Second, by offering a venue for students to conduct lessons, technology has a favourable impact on students' biology learning during lockdown times. In terms of valuable science adventures, the results of the interviews revealed that technology was successful in giving Nigerian students hands-on science encounters. With the utilization of technology for hands-on involvement with science instruction, students may see science in real time. As a result, using technology during the COVID-19 pandemic gives these students a text-to-reality experience. Furthermore, students stated that using technology, especially the visual aspect of it, helps them to understand better. As a result, students felt that they would be unable to have lessons during lockdown if they did not have access to technology. As a result, the utility of technology is having a positive effect on students' biology lessons during this pandemic.

Furthermore, results from data analysis, confirmed that Nigerian students thought it was easy to use technology advances in high school biology classes during this pandemic. Most of the students said pedagogical technology, such as laptops, cell phones, and Whatsapp, was easy to use. They were able to access computers, computer applications, and lab technologies with ease since they are familiar with computers, cell phones, tablets, and other technology. Some of them, on the other hand, stated that using unique lab peripherals was challenging at first but that with further practice, they were able to grasp it. These students indicated they were able to solve the difficulties of utilizing various devices by asking their friends and instructors questions, studying the instruction booklets thoroughly, being cautious, and experimenting on their own when they weren't sure how to do

it. During the COVID-19 pandemic, every student had a good experience with technology in their biology classes.

Teacher's views regarding the simplicity of use and value of technological developments in Biological classes

Table 4.2

THEMES	CODE
Technological tools used to enhance learning during the Covid-19 pandemic.	○ Use of Google classroom ○ I used Whatsapp most times to teach and give assignments ○ By making use of YouTube videos of biological origin. ○ Online teaching through zoom meeting. ○ Using electronic gadgets, like projector, internet, and social media ○ I did that through the use of zoom-class and Google classroom. ○ The use of Edpuzzle, ○ Edmodo ○ Instant text messages such as telegram ○ I use PowerPoint to teach ○ With the use of smartphones, ○ Use of computer.
Impact of the use of Technology during this pandemic	○ It's useful because it's void of person-to-person contact. ○ Learners learn at their own pace since the learning materials are retained. ○ Integrative and collaborative learning is promoted as Learners

	collaborate with each other irrespective of geographical boundaries by integration students learn across the borders of their discipline. ○ Promoted interaction and active participation between learners and the teachers. ○ Gives room for questions and answers either from the learners or the teacher, which may not be in the normal classroom due to time constraints ○ They make learning easier and interesting to both students and teachers. ○ They are very useful because they provide an interface for the interaction between my students and I while still protecting ourselves ○ To reduce physical contacts. ○ The online lessons were the only Media used to easily disseminate information. ○ Easy learning without any intimation and to help the slow learners to catch up with the fast learners. ○ They are useful but we still have electricity and internet issues. ○ Learning settings become more concrete, real, and effective when

	technology is used. It also aids learners in learning and remembering information more effectively and for longer periods of time.
Simplicity of use of Technological gadgets.	○ They are not that easy to use. ○ WhatsApp was easy to use. Google classroom and meet was not ○ Easy because you learn at your pace, promote personal study and discipline. Difficult because it's expensive plus the incessant supply of electricity in Nigeria as these technologies require electricity to operate ○ You can get any topic taught in different ways ○ They are easy first and foremost because of the training I have had as a 21st century teacher. They are also useful because of the existence of the internet. ○ It is very easy to use ○ It is used globally ○ Mobile phones are commonly used in every society. ○ For me, they are easy but for the student I don't know, because I wish to employ other methods like Google classroom. ○ The technologies may not be easy to use as some biology teachers

	are not computer literate.
Impact of technology on Students learning outcomes.	○ For those of my students who were able to use it, it was actually very helpful to them as they did not miss anything when school resumed ○ I cannot say as I barely used them except for WhatsApp. ○ For those who have access to the technologies, online class participation was easy, interesting, and learning worthwhile. But for those who couldn't join the class as a result of not being able to lay hands on any of the gadgets, learning was halted ○ Students learn and study even at home. Students also enjoy learning to use these technologies ○ Students become capable of navigating through the tough terrain of learning biology in this period. ○ During the lockdown, I was still having lessons with my students. ○ Access to various other books online, positive response to questions in the class Problem/project based learning becomes accessible. ○ Effect is very minimal. ○ My interactions with this technology have yielded a positive

	result because I observed that visual information register easily in their brains and it builds interest and motivation towards learning.
Factors affecting the use and adoption of technology for effective teaching of biology lessons	○ High cost of internet ○ High cost of these technologies ○ Inadequate supply of electricity. ○ Poor internet supply ○ Hunger and lack of motivation from the government. ○ Not all students have phones or laptops and light to charge their gadgets. ○ Poverty ○ Lack of training on use of technology for teachers. Unequipped schools. ○ If there is easy and cheap access to the internet, I am sure they will accept it more. ○ Factors like ignorance, poor network, and cost may affect Nigerian students' acceptance of technology in biology classes during Covid-19.

From the data coding and analysis, the following points was obtained from the teachers views.

All of the teachers incorporated technology in their lessons during this COVID-19 pandemic. They could use whatsapp, Google classroom, YouTube and some advanced teachers used Edpuzzle and Edmodo. This shows they could either use desktop computers, laptop computers, projectors, tablets, mobile phones etc. to offer lessons.

Most of the educators affirm with the fact that the involvement of technology was very useful as it increased the students' knowledge on technology. It also permitted teachers to have lessons during this lockdown period.

They were of the fact that the technology they used in their lessons during this period was easy to use. This is because most of them used familiar technology to render their lessons. Besides, that was the best option to have classes during the lockdown period.

Most of these teachers accepted the fact that technology involvement was useful. Some said it was not really useful because not all students could afford it. So when they reopened schools, face-to-face teaching, and those students were left behind.

According to the teachers, most Nigerian students were willing to accept the involvement of technology in Biology lessons during this coronavirus period, but due to the fact that they could not afford these gadgets; internet connection and electricity power supply, made them not participate. This could communicate the idea that the student did not accept the technological innovation, which is false.

The teachers noticed that during their lesson in the face of COVID-19, their students could not afford internet connections. Some of the teachers suffered from poor salaries. The teachers had many students to teach due to the lack of Biology teachers.

In the context of COVID-19, the examination of literature, structural framework, and educator interview forms showed that perceived beneficial and ease of use and perceived usefulness attitudes toward the use of technology in Biology courses. During the coronavirus epidemic, high school biology instructors evaluated the usefulness of technological developments in high school biology courses for Nigerian students as good, according to the findings of the educator interview analysis of data. Educators saw technological involvement as a constructive tool for engaging students in learning and preparing them for higher education. They say that technology exposes students to more advanced technological science. Using technology to teach biology will help to activate teaching and learning during pandemics

like that of the coronavirus pandemic. It may also be useful in areas where students are unable to attend school due to conflict. Some instructors argue that using technology and effectively employing it improves learners since it allows them to use equipment, get experience through visualization, and use practical learning skills instead of just listening to lectures. Teachers believe that, while Nigerian learners have limited access to technology, employing it during this time allows learners to learn about various technologies besides computers, cell phones, and tablets. Students learn science skills that can be applied at home through the use of technology. According to some educators, when learners get more aware about science and the relevant skills they obtained in class using technology throughout this period, they become more interested in pursuing health occupations.

During the COVID-19 pandemic, the results of the teacher interview data analysis supported the claim that Nigerian students found it easy to employ technological innovations in biology classes. The ease of use is a plus since teachers agree that students could use some biology software during this period without difficulty. Students found the technology to be simple to use. One explanation why biological tools are simple for students to use, according to some instructors, is that they come with handbooks and video tutorials. As a result, students can independently operate, run, and manage complex biology related technologies. All of this occurred as a result of the reliance on technology during this COVID-19 pandemic.

Additionally, both students' and teacher's analyses were in line also with the Basic Research Question. This section began with an examination of the two sub Research Questions, followed by a synthesis of the main Research Question.

Research Question. In the face of COVID-19, how do technological advances in biology lessons affect the teaching and learning of biology among Nigerian students?

The key research issue was supported by findings from both the student and teacher interviews. The study's main finding is the impact of technology in the teaching and learning of Biology in the face of COVID-19.

The favourable impact is owing to technology's utility, simplicity of use, and acceptability during this time period. In terms of the beneficial benefits of technology's utility, all of the interviewees think that during the COVID-19 epidemic, technology should be incorporated in the biology curriculum. Hands-on training, enhanced learning and comprehension were three of the three positive uses of technology listed by students during this pandemic. Students thought the technologies they used in biology lessons during the lockdown were useful because they got to see it first hand and it helped them understand what they were doing. Students have claimed that they will learn about biology and scientific ideas from textbooks, but that they will not understand the subject if they do not apply what they have studied. Teachers, on the other hand, argued that technology was intentionally employed to allow pupils to study and experience science equipment.

As a result, students reported that just being able to perform it and observe how science works improved their knowledge of the topics. Teachers also agree that students grasp concepts better because they are not completely reliant on the teachers for support and are able to use computers for data collection and interpretation as well as internet searches on their own. When it came to lessons during lockdown in the face of COVID-19, both teachers and students said that technology helped them keep their classes going. As the students became more comfortable with the technology, they began to enjoy the lessons. Teachers also feel that technology is important since learners would be unable to complete their curriculum now without.

Finally, when it comes to knowledge and understanding, learners feel that technology is helpful since it helps them understand scientific processes. Students believed that they would be unable to comprehend science concepts like the operations of the human organism without the help of technology. Teachers have stated that pupils' use of technology exposes them to higher-level occupations and prepares them for more advanced information. Educators believe that exposing pupils to advanced technology helps them to grasp the equipment and how science pertains to them. The usage of electronics in biology class, according to Nigerian students and instructors, has been effective during the COVID-19 pandemic.

CHAPTER V
Discussion

Students view of simplicity of use of technology in the face of Covid-19. Nigerian students witnessed a positive advancement of technology and the internet in biology lessons during the COVID-19 pandemic. Some of the important points were as follows:

(a) the ease of using technology in biology lessons during the pandemic;
(b) Improved comprehension, studying, availability of knowledge at any time, and task completion were all impacted by technology in Nigerian students' learning.
(c) Relevance, performance, productivity, and usefulness influence Nigerian students' acceptance of technology during this period;
(d) Nigerian students support the use of technology in biology because of its usability, increased comprehension and learning, encouragement, and social pressure during this pandemic.

Teachers views of the simplicity of use of technology in the face of Covid-19. In the face of COVID-19, biology instructors were hopeful about the utility of technology and how easily it might be applied in biology curriculum for Nigerian students. The following were some of the main points:
(a) The use of technology in Biology lesson by teachers during the COVID-19 pandemic;
(b) Teachers feel that students' adoption of technology was influenced by their acquaintance with technology, enforcement, and eagerness to learn.
(c) Teachers feel that Nigerian students' embrace of technology is influenced by commitment, relevance to life and profession, the necessity for teachings during the lockdown, outmoded tools, increased comprehension, and deliberate usage of technology.

Main Research Question. In the face of COVID-19, how do technological advances in biology lessons affect the teaching and learning of biology among Nigerian students? During the coronavirus pandemic, technology

advances had a positive effect on Nigerian students' Biology learning. Usefulness, ease of use, the need for lessons during the lockdown, and technology acceptance all affect the positive effect. The following were some of the main points:

(a) Biology class technologies are useful during the lockdown;

(b) Hands-on expertise, which is crucial for task completion and boosting understanding and expertise, had an impact on the applicability of technology;

(c) Biology class technology are straightforward to employ; and

(d) The usefulness of computers was influenced by achievement goals, personal variables, and other considerations.

In all, both Nigerian teachers and students in this research thought technology affected Nigerian students' biology learning in the face of COVID-19 positively, and the data analysis results backed up the TAM.

The TAM changes introduced by GU et al (2013) were used to interpret the outcomes of this investigation. The four TAM frameworks used to further demonstrate the effects of science learning were social power, outcome expectation, TTF, and personal characteristics. Social impact, outcome expectations, TTF, and personal characteristics were discovered to have an effect on Biology courses for Nigerian students during the coronavirus outbreak, as indicated in a TAM.

Outcome Expectancy. During the COVID-19 pandemic, the use of technology in Biology lessons had an outcome expectation for Nigerian students. The user's adoption of technology is based on its observed usability or practical use, while result anticipation is how a person perceives technology should be utilized (GU et al., 2013). According to GU et al. (2013), the technology's utility, simplicity of use, comparative advantage, and efficiency affected result expectancy. Furthermore, result expectancy is critical since technological acceptability is influenced by its utility, simplicity of use, productivity, and comparative advantage (Venkatesh et al., 2003). The value and convenience of use of outcome expectations were demonstrated in interviews with students and teachers. However, the research findings did not support or expand the technology's relative advantage or efficiency. Like

other studies, this research has shown that using technology to improve writing, thought, and problem-solving skills has a positive outcome expectation (Incantalupo et al., 2014; Neufeld &Delcore, 2017). As a result of the data, Nigerian students recognize the value of technology when they see the outcome or advantage of using it to help their education.

Nigerian biology students and teachers were happy with the use of technology in the innovative biology courses, based on their favourable experiences with it during the COVID-19 pandemic. Furthermore, based on the beneficial effects of technology for Nigerian students, teachers are delighted with the usage of technology in their classrooms. This conclusion backs up Yusoff et al. (2011) results that a technology's success is defined by how much students like it, how easy it is to use, and how profitable it is.

Teachers said that once the technology was introduced to Nigerian students, they found it simple to use. Teachers found it simple to use the technology during the COVID-19 pandemic and explained it to Nigerian students. The observed ease with which Nigerian instructors and students use technology supports the observed ease with which Nigerian teachers and students utilize technology. Aypay, et al., (2012) evaluated teachers' levels of technology acceptability in Turkey, finding that technical complexity had the biggest effect on observed simplicity of use. As technical products are easy to use, teachers develop favourable attitudes toward their use.

One conclusion drawn from this research is that when technology is seen as complex, it can make it difficult for people to embrace it. While this extension was not included in the study, it is likely that if it was hard to use technology, Nigerian students would develop negative ease of use. Nigerian students, on the other hand, said that their acquaintance with technology, as well as the availability of instructional materials and video tutorials, made technology use easier. Overall, opinions of the degree of ease associated with technologies have a beneficial impact on students' and instructors' evaluations of its utility and adoption. Overall, the findings of this study suggest that Nigerian students' real usage of technology in biology corresponds to what they are expected to acquire and is beneficial based on expected outcomes. During the COVID-19 pandemic, both Nigerian students and teachers assumed that technological advancement in biology was useful

and successful in improving students' comprehension of biological skills, and concepts. According to the research, how Nigerian students evaluate the outcome and rewards of utilizing technology determines its utility. The result expectancy of technology's usefulness and simplicity of use covered both emotive and cognitive outcomes. The cognitive aim in a biology class is to promote student students ’ understanding, while the emotive aim is to provide practical learning experience, activity completions, vocation choice, and meeting their educational needs. As a result, the adoption of technology by Nigerian students is predicated on their anticipation of a favourable outcome.

Task-Technology Fit. The utilization of electronics in biology classes is TTF for Nigerian students, and it has an impact on biology lessons during the epidemic lockdown. According to Gu et al. (2013), TTF is the ability of technology to assist learners in accomplishing their activities, as well as learners' readiness to use technology as a way of increasing performance and completing assignments. The TTF of task effectiveness and performance enhancement was matched by the findings of this investigation. During this pandemic, the TTF of success is linked to the impacts of computers as a match for the educational demands of Nigerian students. The findings of the researchers in terms of performance enhancement are comparable with El-Gayer et al (2011) studies of the influence of iPad computers, which revealed that achievement anticipation had a direct impact on Midwest learners'' adoption of tablet computers. In the perspective of TTF, the results of my research on technology's suitability for relevant courses support the TTF of task completion. The use of Moo by north eastern American adolescents was discovered by Gao and Wu (2015). According to the study, the usability of technology is determined by how Nigerian students judge the outcomes and benefits of using it. Both cognitive and emotional outcomes were covered under the result expectancy of technology's usefulness and ease of use. In a biology lesson, the cognitive goal is to increase student knowledge, while the emotional goal is to provide practical learning experience, activity completions, career selection, and supporting their educational goals. As a reason, Nigerian students' use of technology is based on their expectation of a positive outcome, because it is a helpful tool and simple to use. It helped

them keep on pace with schoolwork by reconfirming the TTF, for completing chores.

Nigerian students suggested that technology is an expansion of learning for better comprehension of the biology material and is an expansion of learning from the textbook to practical experiments when it comes to technology as a match for their learning needs during the COVID-19 pandemic. This result backs up Gungoren et al. (2014)'s findings that mobile devices are a good match for students' learning needs in terms of motivating them, facilitating mobile learning in the classroom, and allowing for proper time management. The fit for Nigerian students is that during the coronavirus pandemic, Nigerian students reported improved results while using technology to gain a better understanding of the topic, make it simpler, have a clearer understanding of the concepts, and make learning more engaging. As a direct result, as seen above, TTF has had an impact on Nigerian pupils' embrace of technology during the COVID-19 pandemic.

Social Influence. Nigerian school children have said that they will not utilize technology, if their instructors and classmates do not. This supports Addo (2014)'s findings with Taiwanese and Ghanaian students, respectively, and expands peer influence's effect on technology acceptance and use. As a result, the social influence of instructors and friends on Nigerian students' intents to use computers during the coronavirus pandemic has an impact.

According to Kumar, S., StetcherG., Li, M., Knyaz C., and Tamura K.(2018), students build competence through participating in relevant learning activities in loving and encouraging student learning . External cues that students believed influenced the usability of technology included a lack of computers in the house and social roles. Looking at scarcity of technology in their houses, Nigerian students stated that their views about the utility of technology were influenced by their lack of access to technology at home. Students initially stated that they did not believe that technology would be beneficial since they are used to performing tasks at home without it. However, students later indicated that using technology during the lockdown also supported them in comprehending what they're learning and doing in biology lessons. As a result, a shortage of equipment at residence may

diminish the utility of computers for Nigerian students; but, once they learn the worth and benefits of what computers can do for them, they acquire an awareness of the technology that is not available in their residential environment.

Environmental stimuli are one of the factors that influence the acceptance and adoption of tablets for Palestinian students, according to the findings of the researchers' report (Khalaif, 2018). This result is in line with my analysis in that providing technological and instructional assistance resources in the classroom increased tablet acceptance and adoption. Furthermore, Khlaif's research supports this study by demonstrating that the classroom environment, combined with the availability of technological resources, facilitates tablet acceptance and adoption. Nigerian students claimed that the widespread use of technology in their community produces an environment in which technology has become an accepted part of how society operates. Furthermore, teachers agree that environmental stimuli have a social effect on technology's usefulness.

Consequently, despite the fact that the majority of Nigerian students are not exposed to technology, their exposure to it contributes to positive technology use during the COVID-19 pandemic. While Nigerian students had limited access to technology at home, this did not prevent them from adopting and using technology in biology lessons during this period. Nigerian students believed peer pressure, external stimuli, willingness to experience, and interpersonal interactions affected their acceptance of electronics in science lessons during the COVID-19 epidemic. Furthermore, teachers claimed that due to the lockdown period, social impact affected Nigerian students' technology acceptance in biology lessons. As a result, social factors affect Nigerian students' adoption of technology.

Personal Factors. During the COVID-19 pandemic, Nigerians' use of electronics in biology lectures was influenced by a number of personal reasons. Personal aspects include technology assurance and ability to fulfil a specific task, as well as a desire to accept new technologies, according to Gu et al. (2013). Nigerian students assumed that their self-efficacy against technology increased as their awareness and use of technology grew.

Furthermore, Nigerian students indicated that their technical maturity or experience influenced the utility of technology even though it is simple to use and available to them if they understand how much technology is all about. Having had positive experiences with technology, it would be beneficial to their learning. As a result, students feel that their prior exposure to technology is what helps them to embrace it. Furthermore, Nigerian students indicated that their technology experience has increased their interest in using technology, which is important during the COVID-19 shutdown. This finding indicates that learners' consciousness in terms of trust motivates them to use technology Chen et al. (2013). Nigerian students indicated they are comfortable utilizing biological technology even if their instructor does not demonstrate how to use it. Nigerian pupils said their ability to use technology boosted their academic performance and involvement during the COVID-19 shutdown.

Nigerian students said that their capacity to use or be receptive to using computers in biology has affected their education and the usefulness of technologies in biology programs during the pandemic in terms of personal ingenuity. This research supports the findings of Ngafeeson and Sun (2015), which discovered that technological innovation had a significant beneficial influence on observed utility in the deployment of e-textbooks.

The digital distance between home and school is narrowing, according to McCollough and Ramirez (2018), and instructors should exploit cultural differences and similarities to help minority students translate their digital talents in indigenous knowledge in the classroom. Furthermore, teachers confirmed that Nigerian students are cooperative in class, and that they have never encountered any cultural opposition to using technology during the pandemic. While Nigerian students have had limited exposure to bio technology, teachers believe that with guidance and practice, students can use the technology in biology lessons. In a related study, Meyer and Crawford (2015) found that Latino pupils' original lack of connection between their regarding school scientific coaching and the science based sector led them to believe that the science they mentioned performing in college was totally opposite from their current beliefs. Teachers have mentioned that

Nigerian students are eager to learn and willing to try new things. Nigerian students' ability to use technology demonstrates their individual inventiveness. Since they were able to try out new technologies to have classes during the COVID-19 lockout, Through the use of technology, Nigerian students promote technology and practical learning activities. Personal variables such as technology consciousness and personal ingenuity, according to Nigerian students, influenced their adoption of electronics in biology classes. As a result, personal variables play a part in the acceptance of technologies by Nigerian students during the COVID-19 pandemic.

CHAPTER VI

Conclusion and Recommendations

In this final chapter of the researcher's study, the researcher presents the summary of the work done, the implication of the work, and some recommendations for further researchers.

Conclusion

In the face of COVID-19, the usage of technological appliances may affect the teaching and learning process of biology in Nigeria. Understanding the concept of TAM is also critical to comprehending the acceptance of using technology in learning and teaching biology by the Nigerian students and teachers respectively during this pandemic. The opportunity for students in Nigeria to come in contact with technological didactic materials that isn't important to their society or culture is one way to ensure that they succeed in biology classes during the COVID-19 pandemic. Improving on strategies to enhance the presentation of biological knowledge through the involvement of technological appliances is an essential skill which is important for the development of a community in the face of COVID-19 to help all learners in the classroom.

No studies had looked into the effects of technological advances in biology teaching and learning for Nigerian students in the face of COVID-19 before this one. Moreover, no research examined the effect of technology acceptance on biology learning during the pandemic by analysing social influence, outcome expectancy, TTF, and personal influences. This study adds to the bulk of knowledge on how Nigerian biology educators view changes in the results of using technology in the classrooms. Likewise, it also contributes to the information on how the students studying biology in Nigeria consider the involvement of technology in their lessons.

Centered on a TAM, the objective of this study was to explain how learning and teaching of biology has been affected by technology during this COVID-19 pandemic. TAM model revealed that Nigerian students' adoption of technological appliances in biology lessons relates to the outcome expectancy, TTF, personal variables and construct of social influence (Gu et al, 2013). Furthermore, in the face of COVID-19, the outcomes of this study

demonstrated a positive; usage of technology, easy to use abilities technology, and a favourable effect of technology in biology lessons for Nigerian students.

As an outcome of the students and teacher's positive experiences with technology being ease of use, utility, and availability of biology lessons, Nigerian students were more accepting of technological advances during the pandemic. It is crucial that education providers assist biology educators in developing and applying technology in order to give efficient and motivate teaching to their students during this COVID-19 period. During this coronavirus pandemic, technological advances in Biology boosted teaching and learning in Nigerian students.

Recommendations according to findings; The findings of this research work have indicated good changes on students, teachers, individuals, organizational, and the community as a whole during this period of COVID-19. There are also implications for academic studies on this subject that could be conducted in the future.

Firstly, the findings of this study have consequences on the person level and the education community. The importance of this study is decided in terms of enhancing technological application of teaching and learning of Biology to bring meaningful educational and social change in the face of COVID-19. The findings are useful for educators and learners in general, and especially for biology educators in Nigeria and their students themselves during this pandemic. This research contributed significantly to task fit studies of the effect of technology in biology classes. These were discovered during the PLTW high school science course's literature review. Before today, no one had ever looked at this occurrence. This study examined the TTF of technology in biology in order to aid the understanding of biology lessons by Nigerian students during the coronavirus outbreak. In the face of COVID-19, this study raised consciousness of Nigerian students' embrace of technology in biology instruction.

The main implications of students in Nigeria to embrace technology in biology lessons during this pandemic are; usefulness, outcome expectancy, easy to use, task-fit, personal factors, and most of all technology is vital in understanding biological concepts during this COVID-19 pandemic to

maintain the requested social distancing. As a result, teachers may use these results to improve their teaching skills with Nigerian students during this period. Teachers' increased knowledge on technology for the purpose of teaching Nigerian students may result in greater learning for Nigerian students in this pandemic.

Secondly, the study's conclusions have institutional implications. This research could help biology educators customize hands-on, relevant instruction for their learners by utilizing technology. During the epidemic, students can also get extra help from their lecturers on how to use technology efficiently in Biology classes. In addition, educators can incorporate technology into biology lessons to help learners learn the content. In the face of COVID-19, the schools and state officials may give more effective teacher retraining on how to use technology into science education. During a pandemic, school officials would need to revise their sciences to incorporate technology and focus on assisting instructors and learners become familiar with new technologies.

In terms of community development, this research has the potential to improve on the experiences of learning biology by Nigerian students as well as other science subjects, in terms of technology use in science classrooms during the pandemic. Nigerian students can gain a better understanding of how technology has been applied to resolve some scientific problems that seem to be difficult. Due to this pandemic, biology students in Nigeria can improve their problem-solving skills by recognizing issues, generating solutions, and putting them to the test employing creative thinking.

Increased technology engagement in biology lessons may result in more learning opportunities, increasing both Nigerian students' and teachers' adoption and acceptance of technology while also improving biology content learning during the coronavirus pandemic. Incorporating new technologies can provide students with wider and deeper interactions in the science area, as well as aid in strengthening students' science learning through technology during the pandemic.

Additionally, the outcomes of this study can be utilized to provide assistance to Nigerian learners or supplementary learning resources for educators who have never taught biology to Nigerian students during COVID-

19. Despite the small number of Nigerian students who participated in the research, their voices provided a strong context for understanding what biology lessons could imply for Nigerian students during the pandemic. The findings suggest that using technology in the classroom can provide biology students in Nigeria the opportunities to engage in genuine science learning while also providing them with useful tools for science comprehension and learning. In the face of COVID-19, this can be critical.

Third, the findings of this study have broader social consequences. In the light of the COVID-19 pandemic, an increase in literacy is also a development for the community. Increased knowledge and understanding, which led to higher student achievement and results throughout the pandemic, were among the positive effects of technology on biology learning for Nigerian learners. Technological advancements benefit biology students in Nigeria. The influence of technology on biology students in Nigeria in this research could lead to a stronger impact of technology on the Nigerian population during the COVID-19 pandemic.

One issue raised by the researcher as a reason for conducting this study is that Nigerian students continue to lag behind their peers in science results, and science degree attainment remains lower than in other content areas. As a result, technology developments may boost Nigerian students' performance in biology classes throughout the pandemic. The improved results show that Nigerian biology students are adequately equipped to pursue higher education and pursue their dreams and profession in the scientific domain during this time. As a conclusion, in the face of COVID-19, Nigerian biology students are putting their freshly acquired scientific and technological abilities to good use to help themselves and their neighbourhoods. During this pandemic, the performance gap between Nigerian students and students in other countries may narrow as more Nigerian students demonstrate superior science academic performance. In this case, an increase in Nigerian student success often means a reduction in the achievement gap in Nigeria, which benefits the Nigerian community and the country as a whole. During this pandemic, an improvement in the Nigerian students in Biology lessons is also an improvement in society as a whole. In the face of COVID-19, high-achieving Nigerian students will be able

to go to university, continue their education, and contribute to their cities the knowledge they have learned. A better education for Nigerian students will ensure a better society, as social development is related to better education, with good schools producing good students who are intellectually equipped to take on the world's problems and be able to effect changes in their environment.

School preparedness and accomplishment, on the other hand, are linked to the kinds of employment and incomes available to people. As a result, as Nigerian students' socioeconomic status increases, so does society's socioeconomic status in the face of COVID-19. Furthermore, the researcher is convinced that during this pandemic, the success or failure of a community is determined by its people. In order for Nigerian students to have a better science experience, they must be able to develop their learning in the face of COVID-19 with technology. Improvement in learning indicates that their intellectual, social and civic skills have grown during this period. Similarly, society's success or failure is determined by its pupils. Improved people are needed in order to create a sustainable society. An enhanced citizen in this circumstance is somebody who is willing to keep themselves responsible for the well-being of the wider society in order to develop a person's aptitude to be conscientious and communal builders (Block, 2008). In the face of COVID-19, Nigerian biology students should be able to make informed judgments and operate as physician problem solvers in their communities, because technology can transform their thinking, when they gain new information, so that they can change things and continue improving the world's behaviour.

As a result, the aim of education is to properly educate students so that they can make educated decisions about the state of society. In the face of COVID-19, authentically innovative campuses, according to the researcher, do much more than educate children; they also empower instructors, promote communities, involve parents, and develop students' brains and hearts towards that common objective.

. There are other consequences for academic studies on this subject that could be conducted in the future. This research sheds light on the parts of TAM's relevant notions applicable in describing Nigerian students' TTF,

outcome expectancy, personal factors, social impact in the face of COVID-19 while using the impact of introducing technological appliances in biology lessons. Results of this research indicated that the conceptual structure was adequate and applicable in an innovative biology lesson during the pandemic. Furthermore, the results suggest that during the COVID-19 pandemic, pedagogues and educational experts should combine the benefits of using technology in biology lessons with the expectation and desire of the students. During this pandemic, decision-making frameworks for technology education use in biology classes should consider the effects of learners' technological ingenuity. Further, because it is likely to regulate students' acquiescence of technology use throughout the face of COVID-19, technological exposure should really be explored.

Recommendations for further research;

The report's advantages and shortcomings, as well as the literature analysis in Chapter 2, are used to make recommendations for future studies. Despite the fact that the review of the literature supports learners' technology acceptance and usage in biology during the pandemic, seven shortcomings were discovered.

The first is that little is known about biology education among Nigerian schoolchildren during the COVID-19 outbreak. This research offered light on how technology affects the teaching and learning of biology in Nigeria during the COVID-19 pandemic, but additional research is needed to acquire a better and deeper comprehension of how Nigerian students learned during this period.

The second shortcoming is that there has been very little study done on how Nigerian Biology learners use and embrace technology during this COVID-19 period. The study's results suggested some factors that influenced Nigerian students to embrace and use technology in biology, but more research is needed to gain a better comprehension of the educators’ and learners’ perspectives.

The third shortcoming is that more research into the learning styles of Nigerian learners during the pandemic is needed. According to this study, Nigerian students generated pleasant feedback in the face of COVID-19 by

engaging in hands-on and spatial learning styles v. However, because this study only gave a limited perspective of Nigerian students' learning styles, more research is required to acquire a deeper understanding of different learning styles that may influence Nigerian biology students' learning in the face of COVID-19.

The fourth shortcoming is that there is no study about how high school biology students accepted technology during the pandemic. While the results of this study presented an idea of Nigerian biology students' adoption of technology in their lessons during the outbreak, they only represent a small portion of the whole population, and more research is essential to enhance the validity.

The fifth shortcoming states that there are few studies on TTF school Biology students during this COVID-19 pandemic. Despite the fact that this research yielded a good TTF for Nigerian biology learners, further studies are needed to improve this work.

The sixth shortcoming is because there are limited accounts on how biology students used technology during the epidemic and how it affected their social lives. While this study discovered that social influence has a favourable and significant impact on students' technological usage during this period, it was performed on a limited sample size in Abuja, and further research is needed to confirm this idea.

Finally, personal variables can determine Nigerian biology students' utilisation technology throughout the pandemic, which is the seventh shortcoming. While this study discovered that personal characteristics influence Nigerian biology students' adoption of digital in biology classes, more research is needed to confirm that the results are transferable and reliable.

Overall, this research offers perspectives from both Nigerian biology students and biology educators on the usage of advanced technologies in biology lessons in the face of COVID-19, as well as correcting errors in the review article, but more research is needed to understand the impact of technological advancements in school biology lessons in other institutions and cities. Even though outcomes of this analysis agree with those of the review article, the sample size was small, and the results cannot be extended

to all Nigerian biology students and educators who used technology in biology classes during the COVID-19 pandemic. As a result, more research is needed to better comprehend the impact of technology in biology classes on Nigerian biology students' ability to cope with Covid-19.

References.

Abe, T., Mollicone, D., Basner, M., &Dinges, D. F. (2014). Sleepiness and safety: Where biology needs technology. Sleep & Biological Rhythms, 12(2), 74–84. doi:10.1111/sbr.12067

Adeleke R.(2021)Digital divide in Nigeria: The role of regional differentials African Journal of Science, Technology, Innovation and Development 13 (3) (2021), pp. 333-346, 10.1080/20421338.2020.174833

Adetimirin, A. (2015). An empirical study of online discussion forums by library and information science postgraduate students using technology acceptance model 3. Journal of Information Technology Education,14, 257–269. Retrieved from http://www.jite.org

Al-Azawei, A., &Lundqvist, K. (2015). Learner differences in perceived satisfaction of an online learning: An extension to the technology acceptance model in an Arabic sample. Electronic Journal of E-Learning. Retrieved from http://www.ejel.org

Attuquayefio, S. N., &Addo, H. (2014).Using the UTAUT model to analyze students' ICT adoption. International Journal of Education and Development using Information and Communication Technology, 10(3), 75–86. Retrieved from 300https://files.eric.ed.gov/fulltext/EJ1059042.pdf

Aypay, A., Celik, H. C., Aypay, A., & Sever, M. (2012). Technology acceptance in education: A study of pre-service teachers in Turkey. Turkish Online Journal of Educational Technology, 11(4), 264–272. Retrieved from https://files.eric.ed.gov/fulltext/EJ989276.pdf

Bang, E., & Baker, D. R. (2013). Gender differences in Korean high school students' science achievements and attitudes toward science in three different school settings. Online Submission, 3(2), 27–42. Retrieved from https://files.eric.ed.gov/fulltext/ED543596.pdf

Beckman, K., Bennett, S., &Lockyer, L. (2014). Understanding students' use and value of technology for learning. Learning Media and Technology, 39(3), 346–367. doi:10.1080/17439884.2013.878353

Bigler, A. M., &Hanegan, N. L. (2011). Student content knowledge increases after participation in a hands-on biotechnology intervention. Journal of Science Education and Technology, 20(3), 246–257.

doi:10.1007/s10956-010-9250-7

Blundell, C., Lee, K.T., Shaun. 2015. Digital learning in schools: Conceptualizing the challenges and influence on teacher practice. Journal of Information Technology Education: Research, 15, 535-560

Cahill, J. (2016). Project Lead The Way - Bridging the college and career prep divide. Young Adult Library Services, 14(4), 26–29. Retrieved from http://yalsdigital.ala.org/i/698748-vol-14-no-4-summer-2016/2

Cakir, M. (2011). Enhancing Mendelian genetics concepts using a guided computer mediated inquiry. Journal of Baltic Science Education, 10(3), 156–167. Retrieved From https://www.researchgate.net

Çakır, M., & İskar, S. D. (2015).The interplay between biology teachers' interpersonal behavior and students' perceptions of the classroom learning environment.International Journal of Science, Mathematics & Technology Learning, 21(2), 1– 9. doi:10.18848/2327-7971/cgp/v21i02/49058

Childers, G., & Jones, M. G. (2015). Students as virtual scientists: An exploration of students' and teachers' perceived realness of a remote electron microscopy investigation. International Journal of Science Education, 37(15), 2433–2452. doi:10.1080/09500693.2015.1082043

Çıldır, S. (2016).Physics teacher candidates' opinions on fiber optics and new technologies in this field. Eurasia Journal of Mathematics, Science & Technology Education, 12(3), 539–547. doi:10.12973/iser.2016.2002a

Cornacchione, E. B., Githens, R. P., Johnson, S., &Lawanto, O. (2012). The role of students' professional experience in online learning: Analysis of asynchronous participation. Journal of Online Learning and Teaching, 8(2), 88.

Courtois, C., Montrieux, H., De Grove, F., Raes, A., De Marez, L., &Schellens, T (2014). Student acceptance of tablet devices in secondary education: A three-304 wave longitudinal cross-lagged case study. Computers in Human Behaviour, 35, 278–286. doi:10.1016/j.chb.2014.03.017

Dhawan S. (2020) online learning: A panacea in the time of COVID-19 crisis Journal of Educational Technology Systems, 49 (1) (2020), pp. 5-22,

10.1177/0047239520934018

Dayagbil, F. T., Palompon, D. R., Garcia, L. L., &Olvido, M. M. J. (2021). Teaching and learning continuity amid and beyond the pandemic.Frontiers in Education, 6, 678692. 10.3389/feduc.2021.678692

Davis, F. (1985). A technology acceptance model for empirically testing new end-user information systems: theory and results. Unpublished Doctoral dissertation, MIT Sloan School of Management, Cambridge, MA. Retrieved from https://dspace.mit.edu/handle/1721.1/15192

Dkeidek, I., Mamlok-Naaman, R., &Hofstein, A. (2011). Effect of culture on High school students question-asking ability resulting from an inquiry-oriented chemistry laboratory. International Journal of Science and Mathematics Education, 9(6), 1305–1331. doi:10.1007/s10763-01092610

El-Gayar, O., Moran, M., & Hawkes, M. (2011).Students' acceptance of tablet PCs and implications for educational institutions. Journal of Educational Technology & Society, 14(2), 58–70. Retrieved from https://eric.ed.gov/?id=EJ930222

Fleming, L., Motamedi, V., & May, L. (2007). Predicting preservice teachers competence in computer technology: Modeling and application in training environments. 306 Journal of Technology and Teacher Education, 15(2), 207–231. Retrieved from http://www.deltastate.edu/PDFFiles/DJE/fall2014/ms5f2014spaulding-final.pdf

Fonseca, M. J., Costa, P., Lencastre, L., & Tavares, F. (2012).Multidimensional analysis of high-school students' perceptions about biotechnology. Journal of Biological Education, 46(3), 129–139. doi:10.1080/00219266.2011.634019

Gao, Y., & Wu, X. (2015). User acceptance of learning technology: The case of using Moodle. International Journal of Learning: Annual Review, 21, 1–8. Retrieved from http://eds.a.ebscohost.com/eds/pdfviewer/pdfviewer?vid=0&sid=a50f2b60-b62c-4c1e-a0f5-55bfa82218ae%40sessionmgr4009

Garba, S.A., Alademerin, C.A. 2014.Exploring the readiness of Nigerian Colleges of Education toward Pre-service Teacher Preparation for

Technology Integration. International Journal of Technology and Inclusive Education (IJTIE)

Gehlbach, H., Brinkworth, M. E., King, A. M., Hsu, L. M., McIntyre, J., & Rogers, (2016). Creating birds of similar feathers: Leveraging similarity to improve teacher–student relationships and academic achievement.Journal of Educational Psychology, 108(3), 342. Retrieved from https://scholar.harvard.edu/files/todd_rogers/files/creating_birds_0.pdf

George, F., &Ogunniyi, M. (2016).Teachers' perceptions on the use of ICT in a CAL 307 environment to enhance the conception of science concepts. Universal Journal of Educational Research, 4(1), 151–156. doi:10.13189/ujer.2016.040119

Giannakos, M. N. (2014). Exploring students' intentions to study computer science and identifying the differences among ICT and programming based courses. The Turkish Online Journal of Educational Technology, 13(3). Retrieved from https://files.eric.ed.gov/fulltext/EJ1034229.pdf

Gu, X., Zhu, Y. &Guo, X (2013). Meeting the "digital natives": Understanding The acceptance of technology in classrooms. Educational Technology & Society, 16 (1), 392–402. Retrieved from https://eric.ed.gov/?id=EJ1016300

Güngören, Ö. C., Bektaş, M., Öztürk, E., &Horzum, M. B. (2014).Acceptance of TPC scale - validity and reliability study.Education & Science / EgitimveBilim, 39(176), 69–79. doi:10.15390/EB.2014.3497

Horzum, M. B., Öztürk, E., Bektaş, M., Güngören, Ö. C., &Çakır, Ö. (2014). Secondary school students tablet computer acceptance and readiness: A structural equation modeling. Education & Science / EgitimveBilim, 39(176), 81–93. doi:10.15390/EB.2014.3500

Hsu, L. (2015) An empirical examination of EFL learners' perceptual learning styles and acceptance of ASR-based computer-assisted pronunciation training, Computer Assisted Language Learning, 29(5), 881–900. doi:10.1080/09588221.2015. 1069747

Hsu, M. W. (2016). An analysis of intention to use in innovative product development models through TAM Model. Eurasia Journal of Mathematics, Science & Technology Education, 12(3), 487–501.

Retrieved from https://eric.ed.gov/?id=EJ1089894

Hsu, T. C. & Hwang, G .J. (2017). Effects of a structured resource-based web issue-quest approach on students' learning performances in computer programming courses. 309 Educational Technology & Society, 20(3), 82–94. Retrieved from https://eric.ed.gov/?id=EJ1146998

Huang, Y. C. (2010). Taiwanese Teachers' Beliefs about Professional Growth in Shin-Ju District.International Journal of Education, 2(2), 1. doi:10.5296/ije.v2i2.545

Huffcutt, M. (2010). American Hmong youth and college readiness: Integrating culture and educational success (Unpublished Master Thesis). University of Wisconsin, Stout. Retrieved from http://www2.uwstout.edu/content/lib/thesis/2010/2010huffcuttm.pdf

Hannarelli, C. M. (2014).Stressing Success: Examining Hmong student success in career and technical education. Hmong Studies Journal, 15(1), 1–22. Retrieved from http://hmongstudies.org/IannarelliHSJ15.pdf

Hsu, S., &Kuan, P. Y. (2013). The impact of multilevel factors on technology integration: The case of Taiwanese grade 1–9 teachers and schools. Educational Technology Research and Development, 61(1), 25-50

Incantalupo, L., Treagust, D. F., &Koul, R. (2014).Measuring student attitude and knowledge in technology-rich biology classrooms. Journal of Science Education and Technology, 23(1), 98–107. Retrieved from https://eric.ed.gov/?id=EJ1038

Ifinedo E, Rikala J, Hämäläinena T. (2020) Factors affecting Nigerian teacher educators' technology integration: Considering characteristics, knowledge constructs ICT practices and beliefs. Retrieved from https://doi.org/10.1016/j.compedu.2019.103760

Januszewski, A., &Molenda, M. (2010). Educational Technology: A definition with commentary [DX Reader version]. Retrieved from https://books.google.com

Juhary, J. (2014). Perceived usefulness and ease of use of the Learning Management System as a learning tool. International Education Studies, 7(8). doi:10.5539/ies.v7n8p23

Jung, H.-J. (2015). fostering an English teaching environment: Factors

influencing English as a foreign language teachers' adoption of mobile learning. Informatics in Education, 14(2), 219–241. Retrieved from https://files.eric.ed.gov/fulltext/EJ1079012.pdf

Kelly, S., & Zhang, Y. (2016). Teacher Support and Engagement in Math and Science: Evidence from the High School Longitudinal Study. The High School Journal, 99(2), 141–165. doi:10.1353/hsj.2016.0005

Khalil, M., Lazarowitz, R., & Hertz-Lazarowitz, R. (2014).Biology high school science curricula for the 21st century. Journal Plus Education / Educatia Plus, 10(2), 177–200. doi:10.4236/ce.2014.516164

Khlaif, Z. (2018). Teachers' perceptions of factors affecting their adoption and Acceptance of mobile technology in K-12 settings. Computers in the Schools: Interdisciplinary Journal of Practice, Theory, and Applied Research, 35(1), 49–67. doi:10.1080/07380569.2018.1428001

Kim, M. (2018). Understanding children's science identity through classroom interactions. International Journal of Science Education, 40(1), 24–45. doi:10.1080/09500693.2017.1395925

Klopfer, E. (2008). Augmented learning: Research and design of mobile educational games. Cambridge, MA: MIT Press.

Klopfer, E., & Squire, K. (2008). Environmental detectives: The development of an augmented reality platform for environmental simulations. Educational Technology Research & Development, 56(2), 203–228.

Kubiatko, M., Haláková, Z., Nagyová, S., & Nagy, T. (2011). Slovak high School students' attitudes toward computers. Interactive Learning Environments, 19(5), 537–550.doi:10.1080/10494821003612232

Kumar, S., Stecher, G., Li, M., Knyaz, C., & Tamura, K. (2018). MEGA X: molecular evolutionary genetics analysis across computing platforms. Molecular biology and evolution, 35(6), 1547.

Li, Y., Duan, Y., Fu, Z., & Alford, P. (2012). An empirical study on behavioural intention to reuse e-learning systems in rural China: A study on intention to reuse E-learning in rural China. British Journal of Educational Technology, 43(6), 933–948. doi:10.1111/j.1467-8535.2011.01261.x

Lin, S.-F., & Lin, H. (2016).Learning nanotechnology with texts and comics: the impacts on students of different achievement levels. International

Journal of Science Education, 38(8), 1373–1391. doi:10.1080/09500693.2016.1191089

Liu, P. 2016. Technology Integration in elementary Classroom: Teacher practices of student teachers: Australian Journal of Teacher Education, 41 (3) doi:10.14221/aje.2016v41n3.6

Lopes-Murphy, S. A., & Murphy, C. G. (2016). The Influence of cross-cultural experiences& location on teachers' perceptions of cultural competence. Journal of the Scholarship of Teaching & Learning, 16(3), 57–71. doi:10.14434/josotl.v16i3.19331

Mac Callum, K., Jeffrey, L., &Kinshuk.(2014). Factors impacting teachers' adoption of mobile learning. Journal of Information Technology Education: Research, 13,141–162. doi:10.28945/1970

Machluf, Y., &Yarden, A. (2013). Integrating bioinformatics into senior high school: design principles and implications. Briefings in Bioinformatics, 14(5), 648–660. doi:10/1093/bib/bbt030

McCollough, C., & Ramirez, O. (2012). Cultivating culture: Preparing future teachers for diversity through family science learning events. School Science & Mathematics, 112(7), 443–451. doi:10.1111/j.1949-8594.2012.00158.x

Merriam, S. B. (2009). Qualitative Research: A Guide to Design and Implementation. San Francisco, CA: Jossey-Bass.

Meseguer-Artola, A., Aibar, E., Lladós, J., Minguillón, J., &Lerga, M. (2015).Factors That Influence the teaching use of Wikipedia in higher education. Journal of the Association for Information Science and Technology, 1–6. doi:10.1002/asi.23488

Meyer, X. S., & Crawford, B. A. (2015). Multicultural Inquiry toward Demystifying Scientific Culture and Learning Science. Science Education, 99(4), 617–637.

Miles, M. B., &Huberman, A. M. (1994). Qualitative data analysis: An Expanded Sourcebook (Second Edi). Sage Publications

Moses, P., Wong, S., Bakar, K., & Mahmud, R. (2013). Perceived usefulness and perceived ease of use: Antecedents of attitude toward laptop use among science and mathematics teachers in Malaysia. Asia-Pacific Education Researcher (Springer Science & Business Media B.V.), 22(3),

293–299. doi:10.1007/s40299-012-0054-9

Murtala A. Norazrena A. (2019) Teachers Perception onthe Use of Technology in Teaching and Learning in Associate Schools Zamfara State, Nigeria. DOI:10.26480/ess.02.2019.01.04

Mueller, A. L., Knobloch, N. A., & Orvis, K. S. (2015).Exploring the effects of active learning on high school students' outcomes and teachers' perceptions of Biotechnology and genetics instruction. Journal of Agricultural Education, 56(2), 138–152. doi:10.5032/jae.2015.02138

Mutegi, J. W. (2013). "Life's first need is for us to be realistic" and other reasons for examining the sociocultural construction of race in the science performance of African American students. Journal of Research in Science Teaching, 50(1), 82–103. doi:10.1002/tea.21065

Neufeld, P. G., &Delcore, H. D. (2018).Situatedness and variations in student adoption of technology practices: Toward a critical techno-pedagogy. Journal of Information Technology Education: Research, 17(1), 1–38. doi:10.28945/3934

Ngafeeson, M. N., & Sun, J. (2015).The effects of technology innovativeness and system exposure on student acceptance of E-Textbooks. Journal of Information Technology Education: Research, 14, 55–71. doi:10.28945/2101

Nistor, N., Lerche, T., Weinberger, A., Ceobanu, C., &Heymann, O. (2014).Toward the integration of culture into the Unified Theory of Acceptance and Use of Technology. British Journal of Educational Technology, 45(1), 36–55
Retrieved from
https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-8535.2012.01383.x

Nugraini, S. H., Choo, K. A., Hin, H. S., &Hoon, T. S. (2013). Impact of e-AV Biology Website for Learning about Renewable Energy. Turkish Online Journal of Educational Technology, 12(2), 376–386. Retrieved from https://files.eric.ed.gov/fulltext/EJ1015407.pdf

Odcházelová, T. (2015).Beliefs of the biology teachers about using multimedia.Problems of Education in the 21st Century, 63, 71–83. Retrieved from http://oaji.net/articles/2015/457-1430294397.pdf

Onasanya, S.A., Shehu, R.A., Oduwaiye, R.O., Shehu, L.A. 2010. Higher Institutions Lecturers' Attitudes towards Integration of ICT into Teaching and Research in Nigeria. Research Journal of Information Technology, 1-10.

Oon, C., &Sorooshian, S. (2013). Mini literature analysis on information technology definition.Information and Knowledge Management Journal, 3(2).Retrieved from http://www.iiste.org/Journals/index.php/IKM/article/viewFile/4287/4355

Owusu, K. A., Conner, L., &Astall, C. (2015).Assessing New Zealand high school teachers' technological pedagogical content knowledge. Journal of Computers inMathematics and Science Teaching, 34(3), 345–373. Retrieved from https://eric.ed.gov/?id=EJ1071151

Patten, B., Arnedillo-Sanchez, I., & Tangney, B. (2006).Designing collaborative,constructionist and contextual applications for handheld devices. Computers &Education, 46(3), 294–308.

Peterman, K., Pan, Y., Robertson, J., & Lee, S. G. (2014).Self-report and academic factors in relation to high school students' success in an innovative biotechnology program. Journal of Technology Education, 24(2), 25–51. doi:10.21061/jte.v25i2.a.3 PLTW. (2016). PLTW biomedical science: Engage students, one medical mystery at a time. Retrieved from https://www.pltw.org

Preston, J. P., Wiebe, S., Gabriel, M., McAuley, A., Campbell, B., & MacDonald, R. (2015). Benefits and challenges of technology in high schools: A voice from educational leaders with a Freire Echo. Interchange, 46(2), 169–185. doi:10.1007/s10780-015-9240-z

Puhek, M., Perše, M., Perše, T. V., &Šorgo, A. (2013). Perceived usability of information and communication technology and acceptance of virtual field trips by lower secondary students, undergraduate students and in-service teachers. Journal of Baltic Science Education, 12(6), 803–812. Retrieved from http://www.academia.edu

Rafalow, M. H. (2018). Disciplining Play: Digital Youth Culture as Capital at School. American Journal of Sociology, 123(5), 1416–1452. doi:10.1086/695766

Ramalingam B, Prabhu J (2020) Innovation, development and COVID-19: Challenges, opportunities and ways forward OECD Tackling Coronavirus (COVID-19): Contributing to a Global Effort (2020), pp. 1-14

Ruggirello, R. M., Balcerzak, P., May, V. L., & Blankenship, R. E. (2012). Measurement of solar spectra relating to photosynthesis and solar cells. Biochemistry and Molecular Biology Education, 40(4), 241–245. doi:10.1002/bmb.20599

Sabzian F., Gilakjani, A.P., Sodouri, S. 2013. Use of Technology in Classroom for Professional Development. Journal of Language Teaching and Research, 684-692. doi:10.4304/jltr.4.4.684-692.

Sadeghi, K., Saribagloo, J. A., Aghdam, S. H., &Mahmoudi, H. (2014).The Impact of Iranian Teachers Cultural Values on Computer Technology Acceptance.TOJET, 13(4). Retrieved from https://files.eric.ed.gov/fulltext/EJ1043199.pdf

Staudt, C., Hanzlick-Burton, C., Williamson, C., & McIntyre, C. (2015).The learning portal. Science Teacher, 82(9), 57–63. Retrieved from https://eric.ed.gov/?id=EJ1118602

Jemila Mohammed Suraj, Maryam Sule Yusuf, GamboBukar, Mohammed Tijjani andAdamuMallam Ibrahim.(2021). The impact of instructional aids on academic achievement of biology students in higher institutions of learning in Potiskum Local Government Area, Yobe State. Retrieved from: https://doi.org/10.30574/gscarr.2021.9.1.0244

Svendsen, G. B., Johnsen, J.-A.K., Almås-Sørensen, L., &Vittersø, J. (2013). Personality and technology acceptance: the influence of personality factors on the core constructs of the Technology acceptance model. Behaviour & Information Technology, 32(4), 323–334. doi:10.1080/0144929x.2011.553740

Teacher Development Programme. 2014. TDP In-Service Teacher Training (INSET) Strategy Report.

Thompson, C. J. (2012). Improving instructional decision-making by Observing technology integration in the classroom: A case study. Journal of Technology Integration in the Classroom, 4(1), 5–13. Retrieved from Academic Search Premier. (Accession Number: 98040313)

Tsai, H.-C.(2015). A senior teacher's implementation of technology integration.International Education Studies, 8(6) doi:10.5539/ies.v8n6p151

Udeani U, Nosakhare J (2020) "In-Service Biology Teachers' Perceptions and Pedagogical Rating of Two Mobile Learning Applications Recommended for Learning Biology in Nigerian Secondary Schools, " The African Journal of Information Systems: Vol. 12 : Iss. 1, Article 5.

Ursavaş, Ö. F., Sahin, S., &McIlroy, D. (2014). Technology acceptance measure for teachers: T-TAM. Journal of Theory and Practice in Education., 10(4), 885–917. Retrieved from http://www.academia.edu

Van De Bogart, W., &Wichadee, S. (2015). Exploring students' intention to use LINE for academic purposes based on technology acceptance models. The International Review of Research in Open and Distributed Learning, 16(3). Retrieved from http://www.irrodl.org

Varelas, M., Kane, J. M., & Wylie, C. D. (2011). Young African American children's representations of self, science, and school: Making sense of difference. Science Education, 95(5), 824–851. doi:10.1002/sce.20447

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478.doi:10.2307/30036540

Wu, H.-K., Hsu, Y.-S., & Hwang, F.-K. (2008). Factors affecting teachers' adoption of technology in classrooms: Does school size matter? International Journal of Science & Mathematics Education, 6(1), 63–85. doi:10.1007/s10763-006-9061-8

Yang, K.-T., Wang, T.-H., & Chiu, M.-H. (2015). Study the effectiveness of technology-enhanced interactive teaching environment on student learning of junior high school biology. EURASIA Journal of Mathematics, Science &Technology Education, 11(2), 263–275. Retrieved from https://eric.ed.gov/?id=EJ1059254

Yapici, I. U., &Akbayin, H. (2012).The effect of blended learning model on high school students' biology achievement and on their attitudes toward the internet. Turkish Online Journal of Educational Technology 11(2), 228–237. Retrieved from https://files.eric.ed.gov/fulltext/EJ989031.pdf

Yarden, H., &Yarden, A. (2011).Studying biotechnological methods using

animations: The teacher's role. Journal of Science Education & Technology, 20, 689–702. doi:10.1007/s10956-010-9262-3 Yin, R. K. (2014). Case Study Research: Design and Methods, 5th edition. Thousand Oaks, CA: Sage. 328 Yusoff, R. C. M.,

Yin, C., Song, Y., Tabata, Y., Ogata, H., & Hwang, G.-J.(2013). Developing andImplementing a Framework of Participatory Simulation for Mobile Learning Using Scaffolding. Educational Technology & Society, 16 (3), 137–150.

Yusoff, M. S. B., Rahim, A. F. A., Baba, A. A., Ismail, S. B., & Pa, M. N. M. (2013). Prevalence and associated factors of stress, anxiety and depression among prospective medical students. Asian journal of psychiatry, 6(2), 128-133.

Zaman, H. B., & Ahmad, A. (2011).Evaluation of user acceptance of mixed reality technology. Australasian Journal of Educational Technology, 27(8), 1369–1387. doi:10.14742/ajet.899

Zacharia, Z. C., Manoli, C., Xenofontos, N., De Jong, T., Pedaste, M., Van Riesen, S. A. N., &Tsourlidaki, E. (2015).Identifying potential types of guidance for supporting student inquiry when using virtual and remote labs in science: a literature review. Educational Technology Research and Development, 63(2), 257–302. doi:10.1007/s11423-015-9370-0

Zamani, B. E., &Shoghlabad, R. G. (2012).Experience of applying technology acceptance model (TAM) in using ICT. Journal of Education Research, 6(2), 241–255. Retrieved from https://www.tandfonline.com/loi/vjer20

NAER EAST UNIVERSITY

SCIENTIFIC RESEARCH ETHICS COMMITTEE

30.07.2021

Dear Ejimadu Linda Ugonna

Your application titled **"The influence of technology on the teaching and learning of biology in the face of COVID 19"** with the application number NEU/ES/2021/713 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

Assoc. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

Direnç Kanol

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document.

NEAR EAST UNIVERSITY
QUESTIONS FOR DATA COLLECTION

CONSENT FORM FOR PARENTAL PERMISSION
THE INFLUENCE OF TECHNOLOGY ON THE TEACHING AND LEARNING OF BIOLOGY IN THE FACE OF COVID-19.

Introduction. This form's aim is to provide you (as the parent of a potential research study participant) with information that will influence your decision about whether to allow your child to participate in this study. Before deciding whether to allow your child to participate, please read the details below and go through the interview questions. This form will be used to obtain your permission if you wish to allow your child to participate in this study.

The Study's Purpose. If you agree, your child will be asked to take part in a study called Examining the Influence of Technology on Biology Teaching and Learning during the Covid-19 Pandemic. The aim of this research is to see how technology influences biology learning and teaching during the Covid-19 pandemic. At this time, this will help to improve the teaching and learning of Biology through the use of technology.

What is my child going to be asked to do? If you choose to let your child take part in this research, he or she will be asked to complete the interview forms that are attached.

What are the possible benefits of this study? Participating in this study will provide no direct benefit to your child; however, the findings will assist teachers and educators in improving the teaching and learning of biology using technology during the COVID-19 era.

Does my child have to participate? No, your child's involvement in this research is entirely voluntary. Your child has the right to refuse or withdraw from the program at any time. Withdrawal or refusal to participate would have no impact on their relationship with the school.

What if my child does not want to participate? Your child must consent to participate in the study in addition to your permission. If your child refuses to participate, he or she will not be included in the study and will not face any consequences. If your child initially decides to participate in the research, they are free to change their mind at any time.

Will there be any compensation? You and your child will not be compensated for participating in this report.

4

How will your child’s privacy and confidentiality be protected if s/he participates in this research study?

Your child's privacy and the protection of his or her data would be covered by not writing the child's or parents' names or anything else that can be used to identify the child.

Signature. You're deciding whether to encourage your child to take part in this research. Your signature below acknowledges that you have read the above details and have agreed to allow them to participate in the report. A copy of this document will be given to you.

Name of Child: ----------
Signature and Name of parents or legal Guardian: ---------- Date ----------

5

STUDENTS INTERVIEW QUESTION.
THE INFLUENCE OF TECHNOLOGY ON THE TEACHING AND LEARNING OF BIOLOGY IN THE FACE OF COVID-19.
Dear Potential Student Participants,
My name is EJIMADU LINDA UGONNA, and I am a master's student at Near East University's Department Of Education Program And Teaching in the Turkish Republic Of North Cyprus. 'The Influence of Technology on the Teaching and Learning of Biology In The Face Of the Covid-19 Pandemic,' is the subject of my study. Since you are a student enrolled in a biology course in any of Nigeria's high schools, I am honored to invite you to participate in this study.
Teaching and learning during the COVID-19 using technology has been the talk of the day in Nigeria. Your responses to this interview questions shall be of great use to me for my Master's degree requirement. It will also contribute to improving the learning and teaching of biology with the use of technology during this period of COVID-19.
The interview form is made up of two parts; SECTION A: Demographic Assessment of the Participants and SECTION B. Open-Ended Questions related to the topic.
If you are under the age of 18, a consent form for parental permission to participate in the study is attached, to get permission from your parents or guardians if you are interested.
I will have access to information that is confidential and should not be revealed during my activity of transcribing collected data for this study. I understand that the information must be kept private, and that unauthorized disclosure of such information may be harmful to the individual. I would not reveal or share any sensitive details with someone else, including my friends and relatives. The information gathered will be used exclusively for this and related exercises.
I'll work with the first four students from your school who fill out interview forms to express their interest.
Thank you for your interest in taking part in this research report.
Yours Sincerely,
Ejimadu Linda Ugonna
Department Of Education Program and Teaching, Near East University,
Turkish Republic Of North Cyprus

6

SECTION A: Demographic Assessment of the Participants.(Mark an X on the appropriate letter and fill the spaces in question 4 and 5)
1. Gender: (A) Male. (B) Female.
2. Age: (A) 12to14. (B) 15to16. (C) 17to18 (D) 19andabove. 3. Institution. ----------
4. Nationality. ----------

SECTION B. Questions related to the topic.
1. In your biology class, what kinds of Educational technologies do you use during this covid period?
2. What are the uses of technological gadgets (edmodo, twitter, facebook, etc) that are currently functioning in your biology class?
3. Why do you think these educational technology gadgets (edmodo, twitter, facebook, etc) are easy to use or not?
4. In Your own opinion. Are there any useless sides of these gadgets?
5. How do you think your interactions with these developments have influenced your biology class learning during this period?
6. How do you think your embrace of technology in biology class has influenced your understanding during this period?
7. What factors do you believe affect your use of technology to learn biology content (limitation) (power supply, internet connection, availability of the materials, time factor, etc)

7

TEACHERS INTERVIEW QUESTIONS.
THE INFLUENCE OF TECHNOLOGY ON THE TEACHING AND LEARNING OF BIOLOGY IN THE FACE OF COVID-19.
Dear Potential Teacher Participants,
My name is EJIMADU LINDA UGONNA, and I am a master's student at Near East University's Department Of Education Program And Teaching in the Turkish Republic Of North Cyprus. 'The Influence of Technology on the Teaching and Learning of Biology In The Face Of the Covid-19 Pandemic,' is the subject of my study. Since you are a biology or life science teacher in Nigeria, I am honored to invite you to participate in this study. Teaching and learning during the COVID-19 using technology has been the talk of the day in Nigeria. Your responses to these interview questions shall be of great use to me for my Master's degree requirement. It will also contribute to improving the learning and teaching of biology with the use of technology during this period of COVID-19.
The interview form is made up of two parts; SECTION A: Demographic Assessment of the Participants and SECTION B. Open-Ended Questions related to the topic.
I will have access to information that is confidential and should not be revealed during my activity of transcribing collected data for this study. I understand that the information must be kept private, and that unauthorized disclosure of such information may be harmful to the individual. I would not reveal or share any sensitive details with someone else, including my friends and relatives. The information gathered will be used exclusively for this and related exercises.
I'll work with the first four students from your school who fill out interview forms to express their interest.
Thank you for your interest in taking part in this research report.
Yours Sincerely,
Ejimadu Linda Ugonna
Department Of Education Program and Teaching, Near East University,
Turkish Republic Of North Cyprus

8

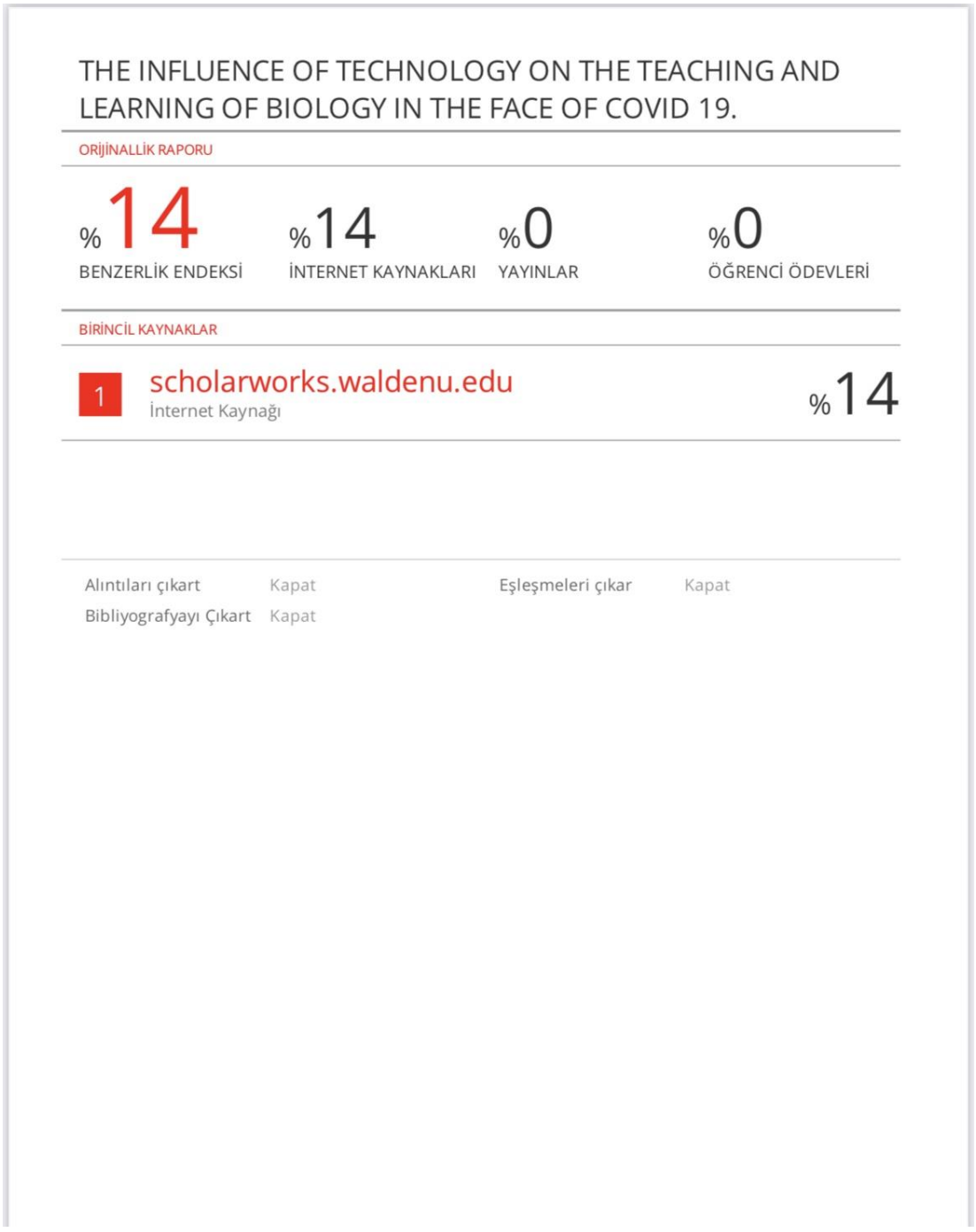
SECTION A: Demographic Assessment of the Participants.(Mark an X on the appropriate letter and fill the spaces in question 4 and 5)

1. Gender: (A) Male. (B) Female.
2. Age: (A) 21 to 30. (B) 31 to 40. (C) 41 and above.
3. Year of experience: (A) 0 to 5. (B) 6to 10. (C) 11 to 15. (D) 16 and above. 4. Institution. ----------
5. Nationality. ----------

SECTION B. Questions related to the topic.

1. How can you incorporate Educational technologies (edmodo, twitter, facebook, etc) into your biology class during this covid-19 period?
2. What are the uses of technological gadgets (edmodo, twitter, facebook, etc) that are currently functioning in your biology class?
3. Why do you think these educational technology gadgets (edmodo, twitter, facebook, etc) are easy to use or not?
4. In Your own opinion. Are there any useless sides of these gadgets?
5. How have your interactions with these technologies influenced Nigerian students' biology learning during this period?
6. Do you think there are any factors that affect Nigerian students' acceptance of technology in biology classes during this period?
7. What factors do you think affect Nigerian students' biology content learning when they use technology in their lessons during this period (limitations)?(power supply, internet connection, availability of the materials, time factor, etc)
8. How do you assess your students online during the evaluation of the teaching process?

TURNITIN REPORT



THE INFLUENCE OF TECHNOLOGY ON THE TEACHING AND LEARNING OF BIOLOGY IN THE FACE OF COVID 19.

ORİJİNALLİK RAPORU

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