

**BIOLOGY TEACHERS' PERCEPTION ON AVAILABILITY AND UTILIZATION OF
INFORMATION AND COMMUNICATION TECHNOLOGY FOR TEACHING AND
LEARNING BIOLOGY IN SECONDARY SCHOOLS, KWARA STATE**

BY

**IBRAHIM, Hameedat Omowumi
2015/1/58463BT**

**DEPARTMENT OF EDUCATIONAL TECHNOLOGY
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA**

APRIL, 2023

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**A PROJECT SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL
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FEDERAL UNIVERSITY OF TECHNOLOGY MINNA IN PARTIAL FULFILMENT OF
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ABSTRACT

This study examined biology teachers' perception on availability and utilization of information and communication technology for teaching and learning biology in public senior secondary schools, Kwara state. The study had three objectives, three research questions, and three null hypotheses. Relevant literature was reviewed based on the study objectives, and the Unified Theory of Acceptance and Use of Technology was adopted as the theoretical framework. The study employed a descriptive survey design, and sample size of 50 biology teachers was selected. Questionnaire was used as the instrument for data collection, and its reliability was validated using Cronbach's alpha at 0.981. The data collected were analyzed using descriptive statistics of frequency counts, percentages, mean and standard deviation. The findings of the study revealed that information and communication technology devices are not adequately available and utilized for teaching and learning of biology. Finding also revealed that the use of information and communication technology in teaching biology can make learning more effective and improve the performance of students in biology examinations in Kwara State. Based on the findings, the study recommends amongst others that there should be adequate provision of information and communication technology devices, and necessary infrastructural facilities for its use in schools.

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Science is the methodical study of the organization and behaviour of the social, physical, and natural worlds through observation and experimentation. It is essential for innovation, increased global competition, and societal growth (Badmus & Omosewo, 2018). Science is one of the most significant subjects in senior secondary schools due to its relevance to students' lives and the widely applicable problem-solving and critical thinking abilities it fosters. These are abilities that students can use throughout their lives to come up with ideas, make informed decisions, and pursue new interests (Abanikannda, 2018; Badmus & Omosewo, 2018).

In Nigerian senior secondary schools, there are three basic scientific disciplines offered, with biology being one of them. According to Mulkah and Femi (2020), biology is a natural discipline that studies the living world. It provides explanations for the composition, operation, growth, and existence of living entities as well as explanations for how they interact with their surroundings. The biology curriculum taught in senior secondary schools in Nigeria seeks to prepare students for the theoretical and practical aspect of biology. It enable students acquire meaningful and pertinent information in biology, and develop a rational and practical scientific attitude (Federal Republic of Nigeria, 2009).

Biology is developing more rapidly than it did in the past. The traditional method of teaching should therefore be replaced by more recent or contemporary educational approaches that call for the use of information and communication technology. In order to function at their best, biology teachers today must make use of information and communication technology. This means that in order to execute tasks, teachers must learn how to explore information, analyze it, make

decisions, and gain new knowledge. The teacher's lessons will be designed to incorporate the use of information and communication technology in the classroom, and they will take a more student-centered approach to delivery which will actively involve the students in the creation of knowledge (Farhana & Chowdhury, 2019).

It is well acknowledged that information and communication technology is a potent tool for transforming education. The emergence of fresh and creative technological applications opens up new avenues for science education. This rapid expansion has increased the expectations on educational professionals such as curriculum developers, evaluators, and teachers to keep up with 21st-century information technology tools (Ihejiamaizu & Ochui, 2019). It is undeniable that information and communication technology integration is crucial for raising the standard of instructional delivery both inside and outside of the classroom (Obielodan *et al.*, 2020). The use of technology in education has the potential to enhance school management and effectiveness, teacher and student subject areas, and the standard of teaching and learning (Bhattacharjee & Deb, 2016).

The use information and communication technology (ICT) in education increases the ability of users to retain information and also, their level of engagement. Students are more interested in their work when information and communication technology is included into the classroom. This is due to the fact that technology offers several chances to make it more engaging and exciting to teach the same thing in various methods. It is therefore against this background that this study seeks to assess biology teachers' perception on availability and utilization of information and communication technology for teaching and learning biology in secondary schools, Kwara state.

1.2 Statement of the Problem

Information and communication technology is one of the tools that be greatly used to enhance the teaching and learning of biology. Information and communication technology tools can help to make biology instruction more interactive, engaging, and visually stimulating, leading to better understanding and retention of biological concepts. However, despite the potential benefits of information and communication technology in enhancing teaching and learning of biology, much attention is still given to the traditional method (chalkboard and textbook) in teaching in the classroom, rather than the use of ICT. This development raises questions about the extent to which biology teachers in Kwara State are effectively incorporating ICT tools into their teaching process. Thus, it is important to examine biology teachers' perception on availability and utilization of information and communication technology for teaching and learning biology in secondary schools, Kwara State.

This development calls for further improvement through the inclusion and integration of information and communication technology in teaching and learning of Biology to enhance the performance of students in the subject. While technology is often seen as a way to make learning easier for both teachers and students, many teachers are not prepared to use it due to their perceptions, and most school buildings are not equipped for its integration, especially in public senior secondary schools. This highlights a gap in the use of technology for teaching biology. The study seeks to address the following objectives.

1.3 Aim and Objectives of the Study

The aim of this study is to assess biology teachers' perception on availability and utilization of information and communication technology for teaching and learning biology in secondary schools, Kwara state. The specific objectives of the study are to;

- i. determine the level of availability of information and communication technology for teaching and learning of biology in secondary schools of Kwara state.
- ii. find out the level of utilization of information and communication technology for teaching and learning of biology in secondary schools of Kwara state.
- iii. examine the perception of biology teachers' on the benefits of using information communication technology for teaching biology in secondary schools of Kwara state.

1.4 Research Questions

The following research questions were raised to guide the study;

1. What is level of availability of information and communication technology for teaching and learning of biology in secondary schools of Kwara state?
2. To what extent are information and communication technology utilized for teaching and learning of biology in secondary schools of Kwara State?
3. What is the perception of biology teachers' on the benefits of using information communication technology for teaching and learning of biology in secondary schools of Kwara state?

1.5 Research Hypotheses

The following null hypothesis was formulated and will be tested at 0.05 level of significance;

HO₁: There is no significant relationship between the level of availability of information and communication technology for teaching and learning of biology in secondary schools in urban and rural areas of Kwara State.

HO₂: There is no significant relationship between the level of utilization of information and communication technology for teaching and learning of biology in secondary schools in urban and rural areas of Kwara State.

HO₃: There is no significant relationship between the use of information and communication technology for teaching and learning of biology, and the performance of senior secondary school students in biology examinations in Kwara State.

1.6 Significance of the Study

This study explored the perception of biology teacher's on the availability and use of information and communication technology for teaching and learning biology in senior secondary schools in Kwara State. This study is significant as it will reveal the extent of availability and utilization of ICT in senior secondary schools in Kwara State. The study is also important because it will help biology teachers recognize the benefits of using information and communication technology and encourage them to incorporate appropriate resources to improve biology education. Additionally, the study will benefit students by enhancing their understanding of biology, as well as teacher training institutions, policymakers in the education sector, academics, and future researchers. Overall, this study will contribute to existing knowledge and serve as a reference for future investigations.

1.7 Scope of the Study

This research is concerned with biology teachers' perception on availability and utilization of information and communication technology for teaching and learning of biology in senior secondary schools, Kwara state. The research covers public senior secondary schools in Kwara state. It focuses mainly on biology teachers in selected public senior secondary schools of Kwara state.

1.8 Operational Definition of Terms

Availability: It implies that something is simple to utilize or used. In order to use information or resources for teaching or learning, a teacher must be able to access them at school and in the appropriate format.

Biology: Biology is known as the science of life. It is the study of living things and essential functions that deal with every facet of life. It is broken down into a variety of specialist areas such as morphology, physiology, anatomy, behaviour, origin, and distribution.

Information Communication Technology (ICT): ICT refers to the use of technologies like personal computers, CD-ROMs, cable TV, cellular phones, and the internet to create, collect, combine, share, manage, and manipulate information in various digital formats. These technologies facilitate the creation, storage, and exchange of multimedia content for a variety of purposes.

Learning: Learning is the process of changing or adapting behaviour or response as a result of acquired experience. It involves learning something new through study, practice, instruction, or experience.

Perception: It is the way in which something is perceived or understood. It describes how a teacher or student accepts sensory stimuli and gives them meaning based mostly on prior experience.

Teacher: A teacher is someone who has received pedagogical training as well as training in a subject area to provide him the information and skills he needs to instruct students effectively. A

teacher with this kind of training serves as the main facilitator of instruction, inspiration for information acquisition, and knowledge assessor.

Teaching: It is defined as interaction with students to facilitate their comprehension and application of facts, ideas, and procedures. It is the structured, concerted exchange of experiences and knowledge within a discipline and, more broadly, the provision knowledge, intellectual and psychological development by one person to another person.

Utilization: Utilization is described as the act of using materials and services to make things function. It is the capacity to use resources and services in an efficient and independent manner.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

In this section, the researcher attempts to locate the research within the mainstream of previous related studies with a view to making a useful contribution, and to further understand the research problem. The literature reviewed dwells on overview of biology as a discipline, conceptualizing information and communication technology (ICT), benefits of information and communication technology to teaching and learning, nexus between utilization of information and communication technology and teaching and learning of biology, empirical studies, overview and critique of reviewed literature and the theoretical framework in which this study is situated.

2.1 Literature Review

2.1.1 Overview of biology as a discipline

Biology is a distinct field of the natural sciences. However, just like other fields of natural sciences, it is concerned with the pursuit of a comprehensive understanding of natural phenomena and events. Two main subfields make up the biology discipline. One is functional biology, and the second historical biology, otherwise referred to as evolutionary biology (Mulkah & Femi, 2020). The functional aspect of biology is concerned with the physiological processes that make up the natural principles of physical sciences, particularly at the cellular and molecular levels. Historical biology on the other hand serves as a platform for advancements in the study of extinct species, the history of life across geological time and seeks to promote a diversity of perspectives in this quickly developing discipline. There are three main recognized branches of biology which include botany, zoology and microbiology. Biology is the science aspect that

deals with the study of life and living organisms (Ihejimaizu & Ochui, 2019). Abanikannda (2018) sees biology as the field of science that deals with physiochemical aspects of life.

The main objective of studying biology as a discipline is spelt out in the West African Examination Council Syllabus (2020). The syllabus is designed to assess candidates;

understanding of the structure and functions of living organisms as well as appreciation of nature;

acquisition of adequate laboratory and field skills in order to carry out and evaluate experiments and projects in Biology;

acquisition of necessary scientific skills for example observing, classifying and interpreting biological data;

acquisition of the basic relevant knowledge in Biology needed for future advanced studies in biological sciences;

acquisition of scientific attitudes for problem solving;

ability to apply biological principles in everyday life in matters that affect personal, social, environmental, community health and economic problems; and

awareness of the existence of interrelationships between biology and other scientific disciplines (WAEC, 2020).

Through the use of information and communication technology (ICT), which has immense benefits in the teaching and learning process, the aforementioned objectives might be accomplished by students offering Biology at the end of the three-year course. However, this heavily depends on the competence of teachers in implementing teaching methods that use instructional aids that are driven by information and communication technology to achieve lesson the objectives at the classroom level (Ihejimaizu & Ochui, 2019).

2.1.2 Conceptualizing information and communication technology (ICT)

Various definitions have been proposed by scholars to describe information and communication technology (ICT). Bas (2016) has suggested that ICT is a commonly used term that encompasses computers, programs, networks, satellite connections, and other related technologies that allow people to access and exchange information in various formats. The term is also commonly used to refer to computer use and related activities. Meanwhile, Bamidele (2016) has described ICT as the use of computers, the internet, and other telecommunications technologies across all aspects of human activity.

According to Ojo and Adu (2018), information and communication technology facilities encompass all available resources that enable the identification, creation, processing, storage, packaging, preservation, conservation, and transfer of information, without being restricted by time and location. These tools are used for creating, storing, processing, distributing, and exchanging information. Bayo (2016) defines information and communication technology as a means for students to observe real-life events. Chassignol *et al.* (2018) suggest that information and communication technology refers to a range of activities and materials that are enabled by electronic methods for processing, transferring, and displaying information. All types of technology that make it easier to communicate, process, and transmit information electronically are therefore collectively known as information and communication technology.

Khan (2016) in his own terms defines information and communication technology (ICT) as the utilization of electronic computers and software to gather, process, store, transmit, and retrieve information. This term encompasses the collection, management, storage, and sharing of information, and refers to the tools and advancements that simplify the creation and use of knowledge and ideas across all areas of human activity. Alshmrany and Wilkinson (2017) assert

that ICT involves the ability to fully comprehend and possess a range of skills, including recognizing, identifying, evaluating, and effectively using information. Essentially, it involves the capacity to communicate, conduct research, and access information, as well as a basic understanding of computer usage. According to Eynon (2016), ICT has replaced information technology (IT) as a term because it is more appropriate and commonly used.

Seldon and Abidoeye (2018) defined information and communication technologies (ICTs) in education as a range of rapidly evolving technologies that includes computers, laptops, digital cameras, local area networks (LANs), the internet, the World Wide Web (WWW), CD-ROMs, DVDs, and software such as spreadsheets, tutorials, simulations, electronic mail, digital libraries, computer-mediated conferencing, video conferencing, and virtual reality. The use of ICTs in education has made it possible to overcome the limitations of time, distance, and learning activities. Different information and communication technology tools such as computers, the internet, PowerPoint, television, overhead projectors, cameras, radio cassettes, videotapes, audio cassettes, audio CDs, the World Wide Web (WWW), telephones, and other devices are employed in teaching and learning.

In this research, information and communication technology refers to all digital devices that can be utilized for teaching, learning, and process improvement within and outside the school, including desktop or laptop computers, projectors, printers, scanners, video conferencing systems, interactive whiteboards such as SMART Boards, smart gadgets like iPods, Galaxys, digital cameras, video cameras, MP3 players/iPods, and DVD players.

2.1.3 Benefits of information and communication technology to teaching and learning

Studies have demonstrated that there are measurable benefits to utilizing information and communication technology in education that are superior to traditional teaching methods. The optimum utilization of information and communication technology tools by teachers and learners, for example, would lead to enhanced outcomes and efficacy in teaching and learning, as well as foster a learner-centric environment. This is due to the fact that information and communication technology tools enable students to obtain information from a diverse range of sources and present it in various formats. Furthermore, it allows students to work independently and collaboratively (Ayikoye, 2017; Bhattacharjee & Deb, 2016).

According to du Boulay (2016), information and communication technologies are essential tools in education that can be utilized to meet the unique learning needs of individual students, promote educational equity, provide high-quality learning materials, enhance students' self-confidence and independence, and facilitate professional development for teachers. The integration of information and communication technology in education improves the learning environment by increasing engagement and reducing indifference towards individual differences (Fabunmi & Awoyemi, 2017).

Daudi and Nzilano (2019) argue that if used appropriately, various information and communication technologies can enhance access to education in the increasingly digital workplace by distributing information, utilizing learning management systems, managing educational services, and making them accessible at a reasonable cost whenever and wherever required. Online learning platforms such as e-learning and blended learning now provide access to higher education and other adult learning opportunities for individuals and groups who were previously unable to enrol in traditional academic institutions.

Coleman *et al.* (2016) argue that the appropriate implementation of information and communication technology in the classroom changes the role of the teacher to that of a facilitator, knowledge navigator, and co-learner, and promotes a more interactive and engaging learning environment for both teachers and students. Yunus *et al.* (2021) suggest that information and communication technology provides users with the ability to participate in the library and information service process and access information in a flexible, cost-effective, and up-to-date manner. The use of information and communication technology tools is necessary, not optional, to promote economic, technological, and educational growth at all levels of schooling. Ghavifekr *et al.* (2016) assert that effective use of information and communication technology in schools ensures wider access to knowledge and experience in this era of globalization. According to Amusa and Atinmo (2016), institutions that encourage the use of information and communication technology by both teachers and students are more effective and productive in teaching and learning. Information and communication technology supports teaching and learning by providing dynamic, interactive, flexible, and engaging content that enhances the pedagogical activities of teachers.

Information and communication technology can contribute to creating a more inclusive education system by aiding with assessment, evaluation, teaching, and learning processes. It has the potential to increase access to educational resources, improve learning outcomes, enhance teacher productivity, and close the digital divide between different socioeconomic groups. Furthermore, it can enhance student engagement, leading to improved academic achievement (Naji, 2017). Students who make use of information and communication technology are more likely to comprehend complex ideas and concepts, retain information better, and apply it to real-world situations beyond the classroom (Cantoni & Danowski, 2015). As a result, the integration

of information and communication technology has enhanced the accessibility and relevance of quality education, making it available anytime and anywhere.

2.1.4 Nexus between utilization of information and communication technology and teaching and learning of biology

Due to the rising usage of electronic teaching methods, textbooks are quickly going out of date and the use of digital tools fosters students' interest, motivation, and success (Ihejiamaizu & Ochui, 2019). Lawler (2016) observes that using digital tools can make biology lessons more engaging for some students. However, Ugbaja and Okeke (2020) noted that high school students may not always perceive biology learning to be more fascinating with the usage of technology tools, with the exception of particular topics that they find acceptable learning through technology tools. Farhana and Chowdhury (2019) states that the use of digital tools in biology teaching and learning aids teachers and students in identifying learning topics, resolving issues, and offering answers to issues that arise during the learning process. Involving students in the use of digital tools also makes learning more accessible and ensures that concepts in subject areas are mastered. Additionally, technological tools aid in student-centered and independent learning.

2.1.5 Factors affecting the availability and utilization of information and communication technology in teaching and learning

The full integration of technology in education is crucial to enhance teaching and learning, however, various barriers impede their utilization in the educational system. A study by Mulkah and Femi (2020) reveals that information and communication technology resources are inadequately available in schools for use by biology for teaching and learning. In a similar vein, Nwana *et al.* (2017) contends that the factors hindering the efficient integration of information and technology tools into education are inadequate resources, technical support, and inadequate

teacher preparation, as well as lack of teachers' encouragement to technology tools in lesson delivery.

Study by Alshmrany and Wilkinson (2017) also found that a major barrier to teachers' adoption of information technology tools was their resistance to change. Some teachers face difficulties in adjusting or adapting to the use of technological innovation, and as a result, they consistently reject anything that can cause them to feel a little stressed. Haji *et al.* (2017) argues most teachers are unable to practice independently because they are unfamiliar with the information and communication technology tools and gadgets used to make teaching simpler. This may not be unrelated to the lack of information and communication technology training, expertise and experience on the part of the teachers (Amusa & Ainmo, 2016; Nkoyo & Egbe, 2016; Ani *et al.*, 2016). Mulkah and Femi (2020) found that biology teacher's perception of information and communication technology capacity building workshops was low because they are not aware of the significance the capacity building workshop may afford them.

Ghavifekr *et al.* (2016) argues that there are technical assistance challenges, low network connectivity and limited accessibility in using information and communication technology in teaching and learning. Khokhar and Javaid (2016) stated that inadequate instructional time affect the utilization of information and communication technology in the classroom teaching. Therefore, additional instructional time is required in order to use information and communication technology in education. Ayikoye (2017) list the following as additional barriers to the usage of information communication technology in teaching and learning:

Poor funding: Most secondary schools lack the necessary information and communication technology tools and resources for teaching and learning. This is due to the high cost of

information and communication technology materials and equipment. Thus, the acquisition of all necessary technological facilities as well as their installation and utilization become exceedingly challenging. Lack of access to fund does not allow the schools to purchase computers and its hardware and software. It also makes it difficult to connect to the internet and maintain those technological tools that have been purchased. Funding is therefore inadequate due to the high cost of purchasing materials and equipment for information and communication technology.

Poverty: Most people in Nigeria live in poverty and this prevents them from acquiring these modern technologies. Given Nigeria's current economic situation and the poor working conditions teachers are subjected to, the expense of information and communication technology hardware and software may be burdensome for the average teacher. The teacher's ability to learn information and communication technology skills and knowledge acquisition is therefore challenged as they will not have easy access to the internet or other information and communication technology resources.

Inadequate Electricity (i.e. Power) Supply: Lack of electricity or insufficient power supply to schools is a major challenge affecting the utilization of information and communication technology in the acquisition of knowledge and skills. Adequate, regular, and stable power supply is necessary for the efficient functioning of technological tools utilized for teaching and learning. In Nigeria, most electronic devices are damaged as a result of power failures. Unfortunately, only a few Nigerians can afford to purchase standby generators to guarantee a steady power supply when the public power supply is disrupted. According to Nkoyo and Egbe (2016), some schools still lack access to electricity due to Nigeria's developmental status and the government's inability to connect the entire nation to the national electricity grid. Consequently, many schools, particularly those in rural areas, face limitations and may not be able to

incorporate computers into their teaching and learning practices. Episodic power supply issues also remain a challenge in urban areas.

There are other challenges affecting the effective use of information and communication technology that have been discussed by scholars. These include online and virtual crimes, copyright challenges, unclear organizational structures, disregard for potential users cultural backgrounds, and lack of information and communication technology policies, etc. (Barathi *et al.*, 2017; Shivakumar, 2017). Others include lack of political will on the part of the government to the school management (Onwukanjo & Joseph, 2017); lack of facilities and available facilities that are lying dormant (Nwana *et al.*, 2017). Osakwe (2017) posits that teachers could experience cyber bullying or feel extremely insecure while looking for educational resources online. Additionally, internet failure can occasionally result in troublesome circumstances. For instance, a lesson may need to be cancelled or postponed if the internet connections to the information and communication technology devices are disrupted.

2.1.6 Strategies to enhance the availability and utilization of information and communication technology in teaching and learning

According to Ojo and Adu (2018), using information and communication technology can enhance the quality of education by increasing student motivation and engagement, improving the acquisition of foundational skills, and enhancing teacher preparation. Scholars have suggested several strategies to improve the use of information and communication technology in teaching and learning in Nigeria. Udeani and Akhigbe (2020) recommend that relevant and culturally responsive digital tools be available to teachers and students, and that teachers be equipped with the necessary knowledge and abilities to use them to support students in achieving academic standards.

Scholars such as Bhattacharjee and Deb (2016), Bas (2016), Daudi and Nzilano (2019), Dinc (2019), and Belay (2020) suggest that strategies such as good maintenance of technology, positive attitudes toward its relevance, provision of adequate facilities, and well-equipped laboratories can improve the use of technology in education. Professional development and training for teachers are also essential for successful integration of technology in schools (Onwukanjo & Joseph, 2017). It is important for both teachers and students to receive foundational training in information and communication technology to effectively use the resources in the classroom (Onwukanjo & Joseph, 2017; Kolog *et al.*, 2018). If students lack the skills to employ information and communication technology resources in their learning process, its availability is also useless. As a result, the school should provide the students with a foundational training. Just as teachers must receive training, students must also receive adequate information and technology training (Onwukanjo & Joseph, 2017).

Sherpa (2017) maintains that institutions and school management must offer teachers and technical support staff enough support and training in order to promote the use of information and communication technology in teaching and learning. Also, all information and communication technology parts, including software and hardware, should be kept up to date, and technical help should be provided for teachers who have trouble using it (Shivakumar, 2017). Kolog *et al.* (2018) submits that the school needs a suitable information and communication technology policy in order to achieve the integration of information and communication technology in teaching and learning. The policy or handbook will serve as a guide, blueprint for the school to design and manage its information and communication technology tools for teachers and students in a systematic and progressive manner.

2.2 Empirical Studies

Previous related efforts have been made on examining the availability and utilization of information and communication technology for teaching and learning. Such studies include:

Mulkah and Femi (2020) examined “biology teachers’ perception of information and communication technology capacity building workshop in Oyo State secondary schools”. The research used a descriptive survey approach and surveyed 147 biology teachers from Iseyin and Iwajowa Local Government Area. The study was guided by a research question and two hypotheses, and the data was collected using a questionnaire. The questionnaire’s reliability was measured using Cronbach’s alpha coefficient, which showed a score of 0.86. The research question was analyzed using mean and standard deviation, while the hypotheses were tested using t-tests at a 0.05 level of significance. The study found that most biology teachers had a low perception of information and communication technology capacity building workshops, as they lacked a clear understanding of the benefits that such workshops could offer them. Additionally, the facilities available for equipping biology teachers with knowledge of information and communication technology were inadequate. The results also revealed that the duration of the workshop, which was once a year was not sufficient for meaningful utilization of any technologies among learners. The study recommends that capacity building workshops on information and communication technology should be organized more frequently in the state to update biology teachers’ knowledge for effective lesson delivery.

Dinc (2019) examined pre-service teacher’s perception about technology integration and their possible barriers to technology integration in education. The study included 76 participants who were enrolled in an Elementary Teacher Education program and took a course called ‘Integrating Technology in Education’. Descriptive analysis was used to evaluate the data collected. The

results showed that pre-service teachers have concerns about effectively using technology, integrating it into the curriculum, increasing student engagement, visualizing course material, collaborating with administrators to integrate technology, and teaching with unfamiliar technology. The research also revealed that a lack of funding, equipment, capability, and time are internal and external barriers to integrating technology in education.

Ihejiamaizu and Ochui (2019) conducted study on the “utilization of electronic instructional materials on secondary school three (SS3) biology students in Calabar, Education Zone Cross River State, Nigeria”. The study employed an Expost facto-research design and developed a hypothesis to guide the research. A total of 490 students were sampled, and data were collected using checklists and achievement tests. The data was analyzed using one-way analysis of variance and tested at a 0.05 level of significance. The results revealed that the utilization of electronic instructional materials had a significant impact on students’ academic achievement in biology. Based on the findings, the study recommended that the government should ensure the adequate provision of electronic instructional materials to all public secondary schools to enhance effective teaching and learning of biology.

Abanikannda (2018) investigated “the effect of technology tools on Osun state high school students’ interest in Biology”. The study used a descriptive survey method and involved a sample of 300 science students from ten high schools in the state. A questionnaire was used to collect data, which was analyzed using descriptive statistics. The study found that technology tools have a positive effect on students' interest in learning Biology, but their availability is limited. Therefore, the study recommends that the government and other education stakeholders should support the use of technology in teaching and learning Biology to improve students' academic performance.

Ajayi *et al.* (n.d.) investigated the “effect of information and communication technology (ICT) in teaching of biology on students’ academic performance in SS2 in Jos North Area of Plateau State”. The study generated three research questions and three hypotheses. The sample comprised 50 students from two secondary schools in Jos North selected through purposive sampling technique. Data was collected using a validated instrument with a reliability index of 0.85 and analyzed using mean, standard deviation, and t-test. The study found low usage of ICT in teaching Biology in the area but showed that its use can improve students’ academic performance. Based on the findings, the study recommends reducing or eliminating the challenges hindering the effective integration of ICT in teaching and learning at all levels to enhance the process.

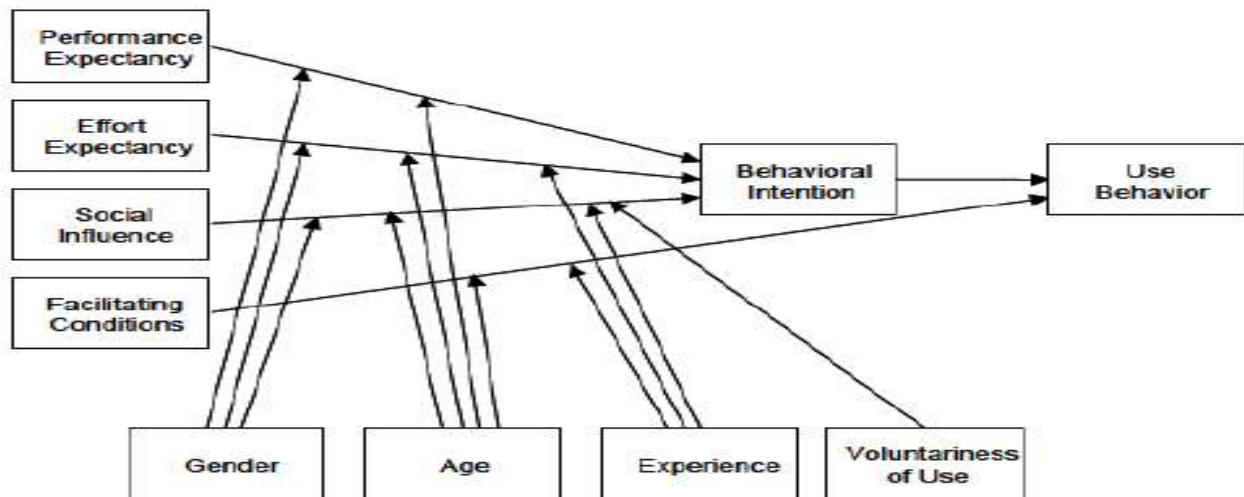
2.3 Theoretical Framework

The present work is based on the Unified Theory of Acceptance and Use of Technology (UTUAT), which was initially proposed by Venkatesh *et al.* (2003) and subsequently revised by Rana *et al.* (2017) and Weerakkody *et al.* (2017). This theory has been widely used by researchers to explain the acceptance and use of information systems and technology. The UTAUT consolidates elements from eight individual models, including the “Theory of Reasoned Action, the Theory of Planned Behaviour, the Technology Acceptance Model, the Model of Personal Computer Utilization, the Diffusion of Innovation Theory, the Social Cognitive Theory, and the Motivational Model”.

The Unified Theory of Acceptance and Use of Technology consolidate various models of technology adoption to provide a more comprehensive understanding of how users accept and use technology. This information systems model has been found to explain a significant amount of variability in the behavioural intention and usage behaviour of technology. The theory consists

of four main constructs, which include performance expectancy, effort expectancy, social influence, and facilitating conditions. These constructs are believed to influence the user's intention to use technology, which in turn affects their usage behaviour. Facilitating conditions are assumed to have a positive relationship with technology usage and a direct influence on its use. The theory is utilized in this study to investigate biology teachers' acceptance and use of information and communication technology for teaching and learning. The theory is an appropriate tool to identify critical factors and contingencies in the perceptions of biology teachers in public senior secondary schools in Kwara State. Additionally, it serves as a baseline model to examine the research problem in this study.

Figure 2.1: Unified Theory of Acceptance and Use of Technology (UTAUT)



Source: Venkatesh *et al.* (2003).

Although the Unified Theory of Acceptance and Use of Technology (UTUAT) did not directly include self-efficacy, attitude, and anxiety as determinants of intention, it is still considered a valuable model for analysis in this study. The theory does not assume that attitude towards

technology use has a direct impact on intention (Venkatesh *et al.*, 2003). However, despite this limitation, the theory is still regarded as relevant for the purpose of this research.

2.4 Summary of reviewed literature

Based on the reviewed literature, it is clear that most studies have focused on the effectiveness of information and communication technology (ICT) on the teaching and learning of biology, with an emphasis on students. However, there has been less attention given to the perception of biology teachers regarding the availability and utilization of ICT for teaching and learning in senior secondary schools. Furthermore, there have been only a few studies conducted on this topic in Kwara state, and the time period covered in these studies differs from the one examined in this research. Lastly, while previous studies have touched on this topic, they have not provided detailed strategies for improving the effective provision and utilization of ICT in the teaching and learning of biology in senior secondary schools as this study seeks to accomplish.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The study uses a descriptive research design method, specifically the survey research method, to investigate the views of biology teachers on the availability and use of information and communication technology in teaching and learning biology in secondary schools in Kwara state. Survey research involves collecting data systematically through interviews and questionnaires from a sample or the entire population, depending on its size and characteristics. This method was chosen because of the diverse and large size of certain parts of the population.

3.2 Population of the Study

Kwara State is the Area of Study and has 16 local government areas. The total number of public senior secondary schools in Kwara State is 389 and it has 150 Biology Teachers (Kwara State Teaching Service Commission, 2021).

3.3 Sample and Sampling Techniques

A multi-stage sampling method which involves simple random, systematic and stratified random sampling was used to select the name of schools from the sixteen (16) local government areas of Kwara state. The method involves writing the name of all the sixteen local government areas in a container. The container was then shaken thoroughly and continuously after which the samples were selected from the container. The procedure was to pick, unfold and record the selected names of local government areas. After the name of a local government is sampled and recorded, it was folded again and put back into the container, shake thoroughly and pick another slip until five different local governments areas were selected. First, a slip containing Ilorin South local government area was picked; second, Moro local government area was picked and third Ilorin

West local government area was picked. Fourthly, Irepodun local government area was picked and fifth, Ilorin East local government area was picked.

At the second stage, the names of the schools in the two local government areas were also written out and put in a container. The container was then shaken thoroughly and continuously after which the samples were selected from the container using simple random sampling technique. Thereafter, the schools were further divided into different strata of rural and urban using stratified sampling techniques. Two (2) public secondary schools each were picked from the selected five (5) local government areas of Kwara State. Thus, a total of ten (10) public secondary schools in Kwara State were selected for this study. The selected schools are indicated in Table 3.1. Hence, the sample size of this study is 50 biology teachers from the selected sample public secondary schools in Kwara State.

Table 3.1: Sampled Respondents from each Sampled Public Senior Secondary School

S/N	Name of Schools	No. of Biology Teachers
Ilorin South Local Government		
1	Government Secondary School, Kulende, Ilorin	4
2	Government Secondary School Oke Adini, Sango, Ilorin	2
Moro Local Government		
3	Government Secondary School, Olooru	3
4	Government Secondary School, Bode Saadu	3
Ilorin West Local Government		
5	Government High School, Ilorin	5
6	Ilorin Grammar School, Ilorin	6
Irepodun Local Government		
7	Government Secondary School, Omu Aran	5
8	Oro Grammar School, Oro	4
Ilorin East Local Government		
9	Government Secondary School, Ilorin (A)	8
10	Community Secondary School, Oke Oyi	10
Total		50

Source: Kwara State Teaching Service Commission, 2021.

3.4 Research Instrument

The instrument for data collection in this study is a researcher structured questionnaire in which set of statements that are related to the objectives of the study were made. It is close-ended and worded unambiguously in order to elicit the correct responses from the respondents. It consisted of four (4) sections (sections A-D). Section A consists of four (4) items designed to obtain information on the demographic characteristics of the respondents. Section B contains ten (10) items on the availability of information and communication technology for teaching and learning biology in public senior secondary schools in Kwara State. Section C contains ten (10) items on the utilization of information and communication technology for teaching and learning biology in public senior secondary schools in Kwara State. Section D contains ten (10) items on biology teachers' perception on the benefits of using information and communication technology in teaching and learning of biology in public senior secondary schools in Kwara state. Therefore, for this study, 4 point Likert scale was used as follows;

SA - Strongly Agree	4
A - Agree	3
D - Disagree	2
SD - Strongly Disagree	1

3.5 Validity of the Research Instrument

The content of the questionnaire was validated by experts to ascertain its validity. The instrument was validated by three experts, one (1) expert from the Department of Education Technology, School of Science and Technology Education, Federal University of Technology, Minna, and the second expert from the Kwara State Ministry of Education. The third expert is a Biology Teacher

from a Public Senior Secondary School in Kwara State. These experts made some recommendations for adjustments before the final drafts were made.

3.6 Reliability of the Research Instrument

The test-retest method was used to test the reliability of the instrument. The questionnaires was administered to sample of 25 Biology Teachers within the population but outside the sample to collect their responses and after one week, the same test was also administered on them again and their responses were correlated with the previous one. The value of the reliability test of the questionnaire was .981, which was determined using Cronbach's alpha. According to Cronbach's output interpretation rule by George and Mallery (2003), .9 is regarded as an excellent output. This shows that the research instrument is very reliable.

3.7 Method of Data Collection

In this study, the researcher employed quantitative methods of data collection. The quantitative data were obtained through survey by administering questionnaires. Three Research Assistants were engaged by the researcher for data collection.

3.8 Method of Data Analysis

Responses from the questionnaire were analyzed using the IBM SPSS Statistics 25. Descriptive statistics of frequency counts and percentages were used in analyzing the demographic characteristics of the respondents while Mean and Standard Deviation were used to analyze the research questions. A cut-off point of 2.50 mean was adopted for decision making. Strongly Agree and Agree were merged and Disagree and Strongly Disagree were also merged. Thus, items with mean ratings of 2.50 and above were regarded as "Agree" while those below 2.50

were regarded as “Disagree”. All analysis for the hypothesis was done at the 0.05 level of significance using independent samples t-test. The decision rules set for the hypothesis are;

1. If the p-value obtained is $<$ (less than) the set significance level, reject the null hypothesis (H_0). This implies acceptance of the alternative hypothesis (H_a).
2. If the p-value obtained is $>$ (greater than) the set significance level, retain the null hypothesis (H_0). This implies rejection of the alternative hypothesis (H_a).

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

This chapter present analysis and interpretation of the data collected and information gathered in the course of conducting the research work. In other words, it presents explanation for the result obtained in the study. It also discusses the major findings of the research.

4.1 Presentation of Results

This section gives detailed descriptions of the personal data of the respondents which include their gender, educational qualification, teaching experience and area.

Table 4.1: Socio-Demographic Characteristics of Respondents

Gender	Frequency	Percent
Male	21	42
Female	29	58
Total	50	100
Educational Qualification	Frequency	Percent
PhD	2	4
M.Sc./M.A./M.Ed	15	30
B.Sc/ B.Ed/ B.Tech/ HND/PGDE	29	58
NCE	4	8
Total	50	100
Teaching Experience	Frequency	Percent
1-10 Years	13	26
11-20 Years	20	40
21-30 Years	14	28
31-35 Years	3	6
35 Years and above	-	-
Total	50	100
Area	Frequency	Percent
Urban	28	56
Rural	22	44
Total	50	100

Source: Researcher's Field Work, 2022

Table 4.1 reveals the socio-demographic characteristics of the respondents. The gender distribution show that 21(42%) of the total population were male and 29 (58%), which

constitutes a larger population were female. Hence, both genders were adequately represented in the study. The educational qualification of the respondents was also considered. It indicate that 2 (4%) of the respondents obtained a PhD, 15(30%) of the respondents possess a Master Degree, 29 (58%) hold a Bachelor's Degree/HND/PGDE and 4(8%) has NCE. This show that majority of the respondents were adequately educated. The teaching experience of the respondents shows that 13(26%) have 1-10 years teaching experience, 20(40%) with 11-20 years' teaching experience, 14(28%) with 21-30 years teaching experience, 3(6%) with 31-35 years teaching experience. None of the respondents fall within the 35years and above. This finding show that majority of the respondents have adequate experience. On the urban-rural area distribution of the respondents, results show that 28(56%) are from urban area and 22(44%) are from rural area. The relevance of studying the educational qualification and teaching experience of the sampled respondents is vital as it would assists the researcher to obtain a better and clearer assessment on the basic variables under investigation in this study.

4.2 Response to Research Questions

Research Question One: What is level of availability of information and communication technology for teaching and learning of biology in secondary schools of Kwara state?

Table 4.2: Mean Rating and Standard Deviation of Respondents on the level of Availability of ICT for Teaching and Learning of Biology in Public Senior Secondary Schools of Kwara State

S/N	Items Statement	N	Mean \bar{x}	Std. Deviation	Decision
1	There is a computer lab in the school for teaching and learning	50	2.46	1.129	Disagree
2	Computers are adequately available in the class rooms and labs	50	1.96	.903	Disagree
3	The internet is available and stable for effective teaching and learning	50	1.80	.728	Disagree
4	Interactive whiteboards and overhead projectors are available to enhance and aid teaching and learning	50	1.28	.454	Disagree
5	Computer based software's and platforms are available for teaching to improve students' performance	50	1.38	.530	Disagree
6	Computer based software's and platforms are available to assess students' academic performance during continuous assessment tests and examinations	50	1.46	.542	Disagree
7	Video conferencing tools are available for tutorials and simulations to enhance effective teaching and learning	50	1.22	.418	Disagree
8	Recorders, CD-ROM, flash drive and memory cards are available in the classrooms for storing information to enable students revisit them for further clarifications	50	1.34	.479	Disagree
9	There is a school website, repository and digital library for storing information and materials for learners	50	1.56	.541	Disagree
10	There is a functional email address and online chatting platform to support teaching and learning	50	1.62	.530	Disagree
Grand Mean		50	1.608		Disagree

Table 4.2 shows the level of availability of information and communication technology for teaching and learning of biology in secondary schools of Kwara state. The mean responses of the all items listed in the table ranged from 1.28 – 2.46, with grand mean standing at 1.60. Since the cut-off point mean is 2.50, it can be concluded that the respondents disagree on all the items. Therefore, this finding shows that information and communication technology devices are not

adequately available for teaching and learning of biology in the selected public senior secondary schools of Kwara state.

Research Question Two: To what extent are information and communication technology utilized for teaching and learning of biology in secondary schools of Kwara State?

Table 4.3: Mean Rating and Standard Deviation of the level of Utilization of ICT for Teaching and Learning of Biology in Public Senior Secondary Schools of Kwara State

S/N	Items Statement	N	Mean \bar{x}	Std. Deviation	Decision
1	The computer lab in the school is used for teaching and learning	50	2.34	1.099	Disagree
2	Computers are adequately used in the class rooms and labs	50	2.42	1.108	Disagree
3	The internet is used for effective teaching and learning	50	1.76	.870	Disagree
4	Interactive whiteboards and overhead projectors are used to enhance and aid teaching and learning	50	1.56	.611	Disagree
5	Computer based software's and platforms are used for teaching to improve students' performance	50	1.82	.873	Disagree
6	Computer based software's and platforms are used to assess students' academic performance during continuous assessment tests and examinations	50	1.68	.741	Disagree
7	Video conferencing tools are used for tutorials and simulations to enhance effective teaching and learning	50	1.54	.503	Disagree
8	Recorders, CD-ROM, flash drive and memory cards are used in the classrooms for storing information to enable students revisit them for further clarifications	50	1.70	.614	Disagree
9	The school website, repository and digital library are effectively used for storing information and materials for learners	50	1.56	.501	Disagree
10	The functional email address and online chatting platform are utilized to support teaching and learning	50	1.78	.815	Disagree
Grand Mean		50	1.816		Disagree

Table 4.3 above shows the level of utilization of information and communication technology for teaching and learning of biology in secondary schools of Kwara state. The mean responses of the all items listed in the table ranged from 1.54 – 2.42, with grand mean standing at 1.81. Since the cut-off point mean is 2.50, it can be concluded that the respondents disagree on all the items. The finding shows that information and communication technology devices are not adequately used

to enhance the effective teaching and learning of biology in the selected public senior secondary schools of Kwara state.

Research Question Three: What is the perception of biology teachers' on the benefits of using information communication technology for teaching and learning of biology in secondary schools of Kwara state?

Table 4.4: Mean Rating and Standard Deviation of the Perception of Biology Teachers' on the Benefits of using ICT for Teaching and Learning of Biology in Senior Secondary Schools of Kwara State

S/N	Items Statement	N	Mean \bar{x}	Std. Deviation	Decision
1	Information and communication technology plays a big role in instructional environments	50	3.50	.544	Agree
2	The use of information and communication technology in teaching of biology can improve the performance of students in examinations	50	3.08	.944	Agree
3	Information and communication technology make learning more effective	50	3.54	.676	Agree
4	The use of information and communication technology in teaching biology allows for new ways of learning for students and teachers	50	3.48	.580	Agree
5	The use of information and communication technology in teaching of biology improves engagement and knowledge retention	50	3.58	.499	Agree
6	Information and communication technology increases the ability of teachers and learners to retain information	50	3.44	.541	Agree
7	Information and communication technology use in the teaching of biology motivates learners	50	3.54	.503	Agree
8	Usage of information communication technology makes it easier to prepare teaching materials (assignments, lesson notes etc.).	50	3.36	.598	Agree
9	Information and communication technology helps teachers to interact with students without any barrier	50	3.10	.931	Agree
10	Information and communication technology enable teachers to provide feedback and support to learners	50	3.56	.501	Agree
Grand Mean		50	3.418		Agree

Table 4.4 above indicates the perception of biology teachers' on the benefits of using information communication technology for teaching and learning of biology in secondary schools of Kwara state. The mean responses of the all items listed in the table ranged from 3.08 –

3.58, with grand mean standing at 3.41. Since the cut-off point mean is 2.50, it can be concluded that the respondents agreed on all the items. The finding shows that the use of information and communication technology by biology teachers makes the teaching and learning of biology more effective (\bar{x} 3.50), allows for new ways of learning for students and teachers (\bar{x} 3.48), improves engagement and knowledge retention (\bar{x} 3.58), motivates learners (\bar{x} 3.54) and enable teachers to provide feedback and support to learners (\bar{x} 3.56).

4.3 Hypothesis Testing

Three hypotheses were formulated and tested at 0.05 level of significance for this study. The results of the hypotheses are as follows:

Hypothesis One (HO₁): There is no significant relationship between the level of availability of information and communication technology for teaching and learning of biology in secondary schools in urban and rural areas of Kwara State.

Table 4.5: Independent Sample t-Test of Relationship Between the Level of Availability ICT for Teaching and Learning Biology in Secondary schools in Urban and Rural Areas of Kwara State

Group	N	Mean \bar{x}	SD	Df	t-value	Sig. (2-tailed)/ p-value	Decision
Urban	28	2.50	.793	48	6.868	.000	Significant
Rural	22	1.27	.456				

Table 4.5 above shows the independent sample t-test results for the first hypothesis. The analysis reveal that there is a significance difference in the scores for urban (\bar{x} 2.50, SD .793) and rural (\bar{x} 1.27, SD .456), while $t(48) = 6.868$, $p\text{-value} = 0.000$. Therefore, going by the decision rule, since the p-value (0.000) is < (less than) the significance level (0.05), the null hypothesis (HO₁) is rejected. This suggests the acceptance of the alternative hypothesis (Ha) which states that there is a significant relationship between the level of availability of information and communication

technology for teaching and learning of biology in public senior secondary schools in urban and rural areas of Kwara state.

Hypothesis Two (HO₂): There is no significant relationship between the level of utilization of information and communication technology for teaching and learning of biology in secondary schools in urban and rural areas of Kwara State.

Table 4.6: Independent Sample t-Test of Relationship Between the Level of Utilization of ICT for Teaching and Learning of Biology in Secondary Schools in Urban and Rural Areas of Kwara State

Group	N	Mean \bar{x}	SD	Df	t-value	Sig. (2-tailed)/ p-value	Decision
Urban	28	2.93	1.086	48	5.775	.000	Significant
Rural	22	1.59	.503				

The table above shows the independent sample t-test results for the second hypothesis. The analysis reveal that there is a significant difference in the scores for urban (\bar{x} 2.93, SD 1.086) and rural (\bar{x} 1.59, SD .503), while $t(48)= 5.775$, $p\text{-value}= 0.000$. Therefore, going by the decision rule, since the p-value (0.000) is < (less than) the significance level (0.05), the null hypothesis (HO₂) is rejected. This suggests the acceptance of the alternative hypothesis (Ha) which states that there is a significant relationship between the level of utilization of information and communication technology for teaching and learning of biology in public senior secondary schools in urban and rural areas of Kwara State.

Hypothesis Three (HO₃): There is no significant relationship between the use of information and communication technology for teaching and learning of biology, and the performance of senior secondary school students in biology examinations in Kwara State.

Table 4.7: Correlation Result of Relationship Between the use of ICT in Teaching and Learning of Biology and the Performance of Senior Secondary School Students in Biology Examinations in Kwara State

Variables	N	Mean \bar{x}	SD	Df	r-value	Sig. (2-tailed) p-value	Decision
Use of ICT	50	1.96	.903	48	.698	.000	Significant
Performance	50	3.08	.944				

The table above shows the correlation result for the third hypothesis. Pearson product-moment correlation coefficient was computed to determine the relationship between the use of information and communication technology for teaching and learning of biology, and the performance of public senior secondary school students in biology examinations in Kwara State. The results revealed that was a correlation between the two variables. The two variables have a statically significant relationship ($r= 0.698$, $p < 0.000$). As the p-value of Pearson correlation is 0.000, which is less than the set significance value of 0.05, the decision rule is to reject the null hypothesis. This implies the acceptance of the alternative hypothesis which states that there is a significant relationship between the use of information and communication technology for teaching and learning of biology, and the performance of public senior secondary school students in biology examinations in Kwara State. The Pearson correlation, $r= 0.698$ suggests a strong positive relationship between the two variables.

4.3 Discussion of Findings

This study investigated the views of biology teachers on the availability and use of information and communication technology in teaching and learning biology in public senior secondary schools in Kwara state. Finding on the first objective of the study revealed that there is a shortage

of information and technology devices for teaching biology in the selected public senior secondary schools in Kwara state. This finding is consistent with Mulkah & Femi (2020) and Abanikannda (2018), who found that several required information and communication technology resources for teaching are unavailable. On the second objective, finding revealed that information and communication technology devices are not being used adequately to improve the teaching and learning of biology in the selected public senior secondary schools in Kwara state. This finding agrees with Nwana *et al.* (2017) and Ajayi *et al.* (n.d), who discovered that most of the necessary information and communication technology resources for teaching are not being utilized by teachers.

On the third objective of the study, finding revealed that utilizing information and communication technology in teaching biology in public senior secondary schools in Kwara state can make learning of biology more effective and improve senior secondary school students' performance in biology examinations in Kwara state. This finding is similar to the results obtained by Amusa & Atinmo (2016), who discovered that the use of ICT in teaching and learning can make the process more interactive, engaging, and effective. This study also confirms the finding of Naji (2017) who posits that ICT increases student engagement, which raises their success rate. This finding is further corroborated by Cantoni & Danowski (2015) who submits that through the use of ICT tools such as multimedia presentations, virtual simulations, online educational resources, discussion forums, students can have a better understanding of the subject matter, which can lead to improved performance in examinations.

The result of hypothesis one indicate that there is a significant correlation between the level of availability of information and communication technology devices for teaching biology in public senior secondary schools in urban and rural areas of Kwara state. This finding aligns with Nwuke

& Ucheju (2021), who reveals that “there is a significant difference in the extent of ICT availability for teaching in secondary schools located in urban and rural areas”. This finding suggests that, the availability of ICT resources in schools is influenced by factors such as geographical location, funding, and government policies. Similarly, the result of hypothesis two shows that there is a significant correlation between the level of utilization of information and communication technology for teaching and learning biology in public senior secondary schools located in urban and rural areas of Kwara State. This finding supports Nwuke & Ucheju (2021) who found that there is a significant difference in the level of ICT utilization by teachers in secondary schools situated in urban and rural areas.

The outcome of hypothesis three indicates that there is a correlation between the use of information and communication technology in teaching and learning biology and the performance of senior secondary school students in biology exams in Kwara State. This implies that the use of ICT can enhance the academic achievement of public senior secondary school students in biology in Kwara State. This finding is consistent with the research of Ihejiamaizu & Ochui (2019) who discovered that the use of electronic instructional materials has a significant impact on students’ academic achievement in biology. Furthermore, this finding supports Zubairu (2016) research which showed that using internet-based learning tools can significantly improve learners’ performance in biology compared to the traditional teaching method.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.4 Summary

The aim of this research was to examine biology teachers' perception on availability and utilization of information and communication technology for teaching and learning biology in public senior secondary schools, Kwara state. The study had three objectives, three research questions, and three null hypotheses. Relevant literature was reviewed based on the study objectives, and the Unified Theory of Acceptance and Use of Technology (UTAUT) was adopted as the theoretical framework. The study employed a descriptive survey design, and the population consisted of biology teachers in public senior secondary schools in Kwara state. In this study, a multi-stage sampling method was used to select respondents. At the first stage, simple random sampling technique was used to select five (5) out of the sixteen (16) local government areas. At the second stage, two (2) public senior secondary schools were selected from the five (5) local government areas selected for the study based on rural and urban category. Sample of 50 biology teachers were selected from the 10 chosen public senior secondary schools in Kwara State. Questionnaire was used as the instrument for data collection, and its reliability was validated using Cronbach's alpha at 0.981. The data collected were analyzed using descriptive statistics of frequency counts, percentages, mean and standard deviation. The hypotheses were analysed using independent samples t-test, and Pearson product moment correlation at 0.05 level of significance. The findings of the study showed that information and technology devices are not adequately available and utilized for teaching and learning of biology in the selected public senior secondary schools in Kwara State. Finding also revealed that the use of information and

communication technology in teaching biology can make learning more effective and improve the performance of students in biology examinations in Kwara State.

5.2 Conclusion

Based on the findings, the study concludes that information and communication technology (ICT) has a significant impact on effective teaching and learning of biology. However, the availability and utilization of ICT facilities by teachers and students in public senior secondary schools in Kwara state are inadequate. Therefore, the government and other stakeholders should provide the necessary ICT devices and training for teachers and students to adopt and effectively use ICT for teaching and learning of biology. This will ultimately improve the performance of senior secondary school students in biology subject in both internal and external examinations.

5.3 Recommendations

Based on the findings of the study, the following suggestions are made:

1. There should be adequate provision of information and communication technology devices to public secondary schools in Kwara state by the state government and other stakeholders.
2. The state government should provide adequate funding, regular supply of electricity and other infrastructural facilities to public senior secondary schools in Kwara state.
3. There is need to ensure that both teachers and students of biology in public senior secondary schools in Kwara state are adequately trained in the use of information and communication technology tools. This can be achieved through short-term courses, seminars, workshops and conferences.
4. The curriculum for teaching biology in public senior secondary schools in Kwara state should be reviewed to integrate the use of ICT in the teaching and learning process. This

will ensure that students are better equipped with the skills and knowledge needed for success in the digital age.

5. The school management, educationists and other critical stakeholders should encourage the use of ICT for teaching and learning of biology in public senior secondary schools in Kwara state.

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