# PERCEPTION OF PRE-SERVICE TEACHERS ON THE USE OF MOBILE-PHONE IN TEACHING SENSE ORGANS IN BIOLOGY IN SENIOR SECONDARY SCHOOLS IN MINNA METROPOLIS

BY

SULEIMAN, Saidat Omolola

2016/1/59128BT

DEPARTMENT OF EDUCATIONAL TECHNOLOGY

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA,

NIGER STATE

APRIL, 2023

**PERCEPTION OF PRE-SERVICE TEACHERS ON THE USE OF MOBILE-PHONE IN TEACHING SENSE ORGANS IN BIOLOGY IN SENIOR SECONDARY SCHOOLS IN MINNA METROPOLIS**

**BY**

**SULEIMAN, Saidat Omolola**

**2016/1/59128BT**

**A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL TECHNOLOGY FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE. NIGERIA IN PARTIAL FULFILLMENT OF THE AWARD OF DEGREE OF BACHELOR OF TECHNOLOGY (B. TECH) IN EDUCATIONAL TECHNOLOGY**

**APRIL, 2023**

**ABSRACT**

The study investigated the ''perception of pre-service teachers on the use of mobile-phone in teaching sense organs in Biology in Senior Secondary School in Minna metropolis Niger State.'' Three research questions were raised and one hypothesis stated and tested at 0.5 level of significance. A sample of 40 pre-service teachers was randomly selected from five different public secondary school which made up of both male and female pre-service teachers in senior secondary school teaching Biology in Minna metropolis. The design of study was descriptive design, using questionnaire as the research instruction, the content validity and reliability coefficient of 0.83 was obtained. The major findings of the study include: The finding of the study revealed that lack of conducive environment for the teaching process affect learning and also the problems encounter by pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School affect teaching learning process. It was concluded that pre-service teachers are aware of using mobile-phone for teaching and learning, and they are willing to teach using mobile-phone provided with the necessary equips and appropriate techniques.

# TABLE OF CONTENTS

**Title**                  **Page**

**CHAPTER TWO**

**CHAPTER THREE**

**CHAPTER FOUR**

**CHAPTER FIVE**

# LIST OF TABLES

# LIST OF APPENDIX

**Appendix**                                                                        **Page**

## CHAPTER ONE

## 1.0                                          INTRODUCTION

1.1     Background to the Study

Educators have been trying to provide a better education to the youth for a better future. A better education lies in motivating students and involving them in the process of learning. Developing individual creativity at the heart of continuous innovation, and encouraging students to use this skill in shaping their lives should be defined as the foremost goals of today's education (Marchaim,

2011). Science educators have made studies for meaningful understanding of science disciplines. It has been exposed that science education should enable pupils to understand the nature of science and to think like scientists (Roberts, 2011).

Science has since the dawn of civilization been a potent tool for finding solutions to the never

ending human problems, or at least, help man to manage his challenges well. Science as a field of

study and endeavour will always be an important aspect of human lives. Science involves all

conscious activities that man engages in to understand nature and its components. Science,

according to Abimbola (2013), can be seen as a body of knowledge; it could also mean a way or

method of investigation and a way of thinking in an attempt to understand nature. Amongst

others, the scientific process involves particular skills of inquiry that include: observing,

classifying, experimenting, measuring, inferring and organizing data.

The nature of science according to Gess-Newsome (2018) is defined as the epistemological foundations of science, which include its empirical basis, tentativeness, subjectivity, creativity, unification, and its cultural and social embedded characteristics. The nature of science encapsulates the characteristics of science that make people understand scientific endeavours with less acquisition of cumbersome scientific knowledge. The preceding descriptions of the nature of science cannot be wholesome because science is viewed from different points of view and perspectives by researchers and scientists the world over. If there is a list that attempts to reveal all the values, processes, usefulness, prospects and products of science, the list will be endless. With this statement, many years before, Johnson (2016) pointed out the importance of biology which will have a profound impact on our lives through advances for the next few decades.  Biology is one of the fundamental sciences that medicine students and other medical professionals need. It teaches different forms of organic life and their interrelated relations with environment and other science. Biology can tell us about the physical makeup of our bodies,

which enables us to produce cures and treatments for many diseases. Biology also helps us know the different body systems of different animals and also ourselves. Also, biology can help us know more about the organisms in our bodies. Biology can also tell us why animals act the way they do, also why humans act the way we do. Biology is the science of living things among which human has the strongest place. Biological sciences stimulate human interest to find the truth with an intellectual rigor therefore have important cultural and educational functions. Accordingly, the purpose of science is "to discover the laws that govern the natural world and so increase our understanding of it" (Liras, 2017).

Everyone accepts that "biology is the science of twenty-first century". There have been many developments which form an important base for both medicine and health issues. In the past few years many issues have been biology-based such as biodiversity, genetically modified organisms, reproductive technologies, the prolongation of life (Reiss, 2017). All of these improvements meet human needs and so these times have been considered as 'the Age of Biology' (Jarman, Ruth,

McClune and Billy; 2016). Kara (2015) sees biology as the field of science that deals with physiochemical aspects of life. Biology according to Wikipedia (2015) is a science which is concerned with the study of life and living organisms including their growth, structure, functions, distribution, taxonomy and their evolutionary trends.

A sense is a biological system used by an organism for sensation, the process of gathering information about the world and responding to stimuli. (For example, in the human body, the brain receives signals from the senses, which continuously receive information from the environment, interprets these signals, and causes the body to respond, either chemically or physically). Sensory systems, or senses, are often divided into external (exteroception) and internal (interoception)

sensory systems. Human external senses are based on the sensory organs of

the eyes, ears, skin, nose, and mouth. Internal sensation detects stimuli from internal organs and tissues. Internal senses possessed by humans include the vestibular system (sense of balance) sensed by the inner ear, as well as others such as spatial orientation, proprioception (body position) and nociception (pain) (Khalsa, Sahib 2017). These system correspond to a respective visual system (sense of vision), auditory system (sense of hearing), somatosensory system (sense of touch), olfactory system (sense of smell), and gustatory system (sense of taste).

Those systems, in turn, contribute to vision, hearing, touch, smell, and the ability to taste (Campbell & Neil 2017).

The increasing number of mobile applications in education and its availability calls for the need to evaluate the efficacy of these applications as learning tools in formal education in order to validate the feasibility of their development and their use in an educational context (Teri et al., 2016). Hence, there is an attempt to standardize the mobile applications evaluation procedure and to develop a common language structure for their evaluation. The effort to achieve

standardization calls for the utilization of mobile application evaluation rubrics (Green, Hechter, Tysinger, & Chassereau, 2014).

Egbo (2017) stated that to achieve this goal as well as to stem the tide of teachers under

Performance, building teachers' capacity is not only critical to successful teaching and learning; it should also be the starting point for reconstituting the education system. Building teacher quality using mobile learning will go a long way in actualizing this goal.

1.2     Statement of the Research Problems

The solution to these problems is that Pre-service teachers should be encourage in the use of mobile technologies for teaching purposes because it will influence in classroom management and student-teacher communication and also make efficient element which enhances and enriches the lesson and attracts the student and increases student attendance in the teaching environment. Therefore, technology integration with the use of mobile-phone in teaching should become a primary focus in teacher education programs so that pre-service teachers will be trained with appropriate and necessary technological skills. Thus the study sought to know the perceptions, attitude and problems encounter by pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School in Minna Metropolis.

1.3     Aim and Objectives of the Study

The aim and objectives of the study are to assess the perception of pre-service teachers on the use of mobile-phone in teaching sense organs in Biology in Senior Secondary Schools in Minna metropolis Niger State. The following objectives are stated;

1.  To ascertain the perception of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School in Minna Metropolis.

2.  To ascertain the attitude of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School in Minna Metropolis.

3.  To ascertain the problems encounter by pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis.

1.4     Research Questions

The following research questions were formulated to guide the study.

1. What is the Perception of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School in Minna Metropolis?

2. What is the Attitude of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School in Minna Metropolis?

3. What is the Problems encounter by pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School in Minna Metropolis?

1.5     Research Hypothesis

The following research hypotheses are answered at 0.05 level of significant.

$Ho_1$: There is no substantial variation in the perception of pre-service teacher of Male and Female teachers in the use of mobile phone in teaching sense-organ in Biology in Senior Secondary School.

$Ho_2$: There is no substantial variation in the attitude of pre-service teachers of Male and Female teachers in the use of mobile phone in teaching sense-organ in Biology in Senior secondary school.

Ho3: There is no substantial variation in the problems encounter by pre-service teachers of Male and Female teachers in the use of mobile phone in teaching sense-organ in Biology in senior secondary school.

1.6     Significance of the Study

This study will be useful to students, educational administrators and faculty staff.

To the students, it will help them to be aware of the task ahead of them during the course of learning from the pre-service teacher on the use of mobile learning in Biology, thereby making learning more engaging and interesting.

To the educational administrators, it with help in informing them about the usefulness for planning and implementation of mobile learning services and support. It will also provide information on pre-service teachers' readiness of mobile learning, actual usage of mobile devices, level of expected support for using mobile learning, and methods to address pre-service teachers'

resistance.

To the faculty staffs, it will help with additional knowledge and information on mobile learning of pre-service teachers. It will offer information from both archival survey data and interviews conducted by this researcher to explain how students currently use mobile devices and pre-service teachers' opinions about the mobile learning acceptance. Faculty staff may develop teaching strategies according to the mobile learning. They will use it to plan and organize their course of teaching.

Therefore, this study will contribute to the literature by filling the gap for pre-service teachers on the use of mobile learning in teaching sense-organ in Biology in senior secondary school and the factors that have effect on these. It will also provide information about perceptions of pre-service teacher in teaching sense-organ in Biology in senior secondary school that can be used in further research as well as by researchers and education policy makers.

1.7        Scope of the Study

This study was being carried out in Bosso local government of Niger state, in some selected four

Senior Secondary School, all public schools, which are; Government Girls Science School, Government Day Secondary School Bosso, Ahmadu Bahago Secondary School, and Government Science Secondary School Tudun Fulani. This study interest is focused on the Perception of preservice teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School in Minna Metropolis.

1.8        Operational Definitions of Terms

**Biology:** the study of living organisms, divided into many specialized fields that cover their

morphology, physiology, anatomy, behavior, origin, and distribution.


**Mobile learning:** is regarded as any sort of learning that happens when the learning is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies. And that mobile learning focuses on the learner interacting with portable technologies.

**Perception**: is the ability to see clearly and understand a particular phenomenon.


**Pre-service Teacher**: is the student teacher that undergoes training before untaken any teaching.


**Senior secondary:** this is a post primary school in which learners have acquired basic education and now exposed to a more mature form of learning. It elapses for the duration of three years and in which senior secondary school leaving certificate is awarded to the students in Nigeria.

**Sense-Organ:** a bodily structure that receives a stimulus and is affected in such a manner as to initiate excitation of associated sensory nerve fibers which convey specific impulses to the central nervous system where they are interpreted as corresponding sensations.

**Teaching**: is the concerted sharing of knowledge and experience, which is usually organized within a discipline and, more generally, the provision of stimulus to the psychological and intellectual growth of a person by another person or artifact.

# CHAPTER TWO

## 2.0 LITERATURE REVIEW

2.1    Conceptual Framework

### 2.1.1   Pre-service Teachers' Teaching and Learning

Pre-service teaching is a period of guided and supervised teaching. Students are gradually introduced into teaching roles for certain classes by a mentor or teacher who works together. Teachers who work together work with and encourage pre-assignment teachers to assume greater responsibility in classroom management and teaching when the experience takes place (Plodkaew

& Tanamai, 2014).


Preparing pre-service teachers for teaching requires capacity building to facilitate the interaction process between their ideas about transformation teaching and their experiences and exposure to the reality of teaching (Klerk et al., 2012). All these things can help teachers to prepare themselves for the pre-teaching before going to the classroom and so that their observations can be attempted to make according to the plans prepared. He added that a means of autonomy and directing their teaching in a further direction, and it looks like the university is the place to do that preparing students to function independently. That way, we will get debriefing about how to teach well, be a good teacher, and overcome all obstacles.

Teacher autonomy is important for students to be more discussion about, to get more views about the teaching concept. Benson (2017) states that teacher autonomy is one of the most essential and problematic concepts which have often emerged for years from the field of teaching autonomy. The importance of a prospective teacher to explore the meaning of this is based on a sense of wanting to provide the best knowledge with a positive spirit. Benson (2017) added the literature that discusses language; there is an emphasis that is far greater in teacher autonomy as a professional attribute and the relationship between teacher autonomy and student autonomy. The importance of exploring this to achieve the goals or ideals of the teacher as educators who are ready, qualified, and valuable.

Although in other college courses, the activities and practices contribute knowledge and experience to prospective teachers. Pre-service teaching provides an opportunity to experience demanding and satisfying assignments by assuming primary teaching responsibilities. Important considerations underlie service educator's ability to engage in transformational teaching. In doing so it is essential to, analyzing the background of the individual educator and how to conceptualize the role as a teacher of transformation (Klerk et al., 2012). Students' awareness and intention in studying teacher hood play a role in the continuation of self-experienced teacher training so they do not feel lost in the middle of the journey. Motivation is fundamental to it.

This theory appeared with the European Council's modern language project, which led to the publication of Holec's (2016) report where autonomy was defined as 'the ability to take over one's learning. Important work from this period can also be found in the early edition of the journal

*M´elanges P´edagogiques* and a paper presented at a 2015 seminar at the University of Cambridge (Harding-Esch, 2015). This founded that assumes how autonomy's idea comes up at the surface for the first time, and this idea is always to use until this moment. Practical applications that focus on independent learning and lead to the development of self-access centers and student training as a focal point for experiments (Benson, 2017). Dickinson (2016) describes autonomy as a situation where students are fully responsible for all decisions related to their learning and the implementation of those decisions'. This means that autonomy in teaching is everything that needs to be studied with a process that is not momentary.

Klerk et al. (2012) realize what autonomy means and direct their teaching in the next direction, and it appears that the University is the place to do it prepares its students to function independently. In that way, debriefing about how to teach well needed to be taught, and so can overcome any obstacles.

This view is concurrent with Flavell (2018) in Cañada and Arumí (2019) that developing autonomy requires a conscious awareness of the learning process itself and what is involved, not only to increase teaching and learning practices and activities but also to promote a much deeper dimension of 'knowledge'. As part of their teaching practice, the concept of autonomy requires that pre-service teachers be aware of the reasons, time, place, and ways in which they can acquire skills and knowledge (Klerk et al., 2012). Thus, they can understand that their role has a significant impact on their students in the future; this is the role of autonomy that will help them in the classroom.

Learner autonomy has been described as demonstrating initiative to take responsibility or authority, make a choice, and bear responsibility. Students' initiative seems to run counter to teacher control. The 'Learner' initiative, however, does not always conflict with teacher control in terms of job structuring and class management.

### 2.1.2 Mobile Learning

Most of learning theories have been developed and emerged from 2500 years; all of these theories generally depend on the application of learning in a fixed classroom mediated by a teacher. Just a few educational thinkers have developed theories based on out of the classroom environment, including Argyris (Argyris & Schön, 2016), Freire (Freire, 2016), Illich (Illich, 2017), and Knowles (Knowles & Associates, 2014), but none of them have stressed mobility of learners and learning (Sharples, Lonsdale, Meek, Rudman & Vavoula, 2017). Innovations and developments taken place in internet and wireless technology enable learning to be anywhere and anytime instead of fixed place and time.

The term of mobile learning is still developing day by day and its' exact mean is still unclear. In spite of its ambiguity, there are some keywords to explain it. Traxler (2018) offered some

keywords such as personal, spontaneous, situated, private, context-aware, bite-sized, and portable to explain mobile learning. Quinn (2017) also identified mobile learning as the integration of mobile computing and e-learning (electronic learning): "accessible resources wherever you are, strong search capabilities, rich interaction, powerful support for effective learning, and performance-based assessment."

Mobile learning is a popular term and it is commonly used in different purposes in life. Traxler (2018) claimed that mobile learning term covers the individualized, connected, and interactive use of handheld devices in different purposes such as in classroom environment, in collaborative learning, in fieldwork, and in counseling and guidance. Furthermore, Traxler (2019) said that mobile devices support collaborative training for mobile workers and support different fields of daily life such as teacher and nurse training, health education and composition of music.  The mobile learning currently applied through both mobile telephones and some of the other portable devices, which are iPods, tablet PCs, PDAs, iPads MP3 players, e-book readers (Taylor, 2015). With the students' increasing demands to access to internet by using mobile devices causes for increasing demand to mobile learning materials and resources, in addition more participation and synchronize communication in the learning process. Thus, Corbeil and Corbeil (2018) claimed that mobile devices could enhance interaction among learners and instructors; reduce communication barriers between faculty and students by using synchronous and asynchronous communication channels.

2.2     Educational Impacts of Mobile Learning

Mobile learning and its applications are used in different learning types such as formal, informal learning, classroom teaching, distance teaching, and different educational levels such as K-12 and higher education (Park, 2016). Park (2016) also claimed that while popularity of mobile devices is increasing day by day, many practitioners such as researchers or teachers use this improving technology in their teaching and learning environments. Since mobile technologies have brought new changes in working and learning because of some characteristically features such as independence of place and time (Peters, 2017).

Mobile learning provides independency on time and place for learners instead of fixed classroom environment (Valk, Rashid & Elder, 2019). This is a great advantage for students in rural and remote areas that cannot go to school because of environmental challenges and infrastructure challenges. Feasibility of mobile learning in out-of-school settings in rural, underdeveloped areas were examined by Kumar, Tewari, Shroff, Chittamuru, Kam and Canny (2017). They conducted a study that lasted 26 weeks to investigate voluntariness of rural children use of their usage to access instructional content. The result of study showed that academic learning levels and motivation of children towards to the course was increased.

Visser and West (2015) suggested that mobile learning could enhance access in those situations where cost plays a significant role in learning (p. 132). Mobile learning provides effective ways to convey educational programs to large populations (Valk et al., 2018). Mobile learning also allows a method of educational delivery that could be more cost-effective than e-learning methods (Motlik, 2018). Dholakia and Dholakia (2014) wrote that mobile networks could deliver

educational content to regions with difficult geography or poor economic conditions more costeffective ways than fixed networks.

Mobile learning makes education more effective by facilitating both instructional methods and learning process (Valk et al., 2015). Mobile learning provides assessment-centered learning by assessing students during the learning process, provides continual feedback for them and formative guidance about what students learned during the educational process (Geddes, 2014). Furthermore, mobile learning also provides immediate feedback for students so it causes for constant motivation (Valk et al., 2016). Other researchers also investigated immediate feedback characteristics of mobile learning. Islam (2015) investigated how mobile phones could be used to enhance interactivity and thus overcome the problems encountered in distance education in Bangladesh.

Fifty-two students were divided into two groups that were control group and experimental group. While the control group was establishing face-to-face conversation with the teachers, the experimental group watched the instructor with a projection screen and used SMS to communicate with the instructor. According to the results of the study, mobile learning might be attractive way to educational access in Bangladesh. Moreover, students that joined the study liked interactivity of mobile learning and claimed that immediate feedback was the great motivator for them.

2.3    Evolution of Mobile Learning

Communication technologies and mobile information are the two major elements of new social structure. First generation of truly mobile devices was small and portable devices that combined different components such as mobile telephony, data input, diaries, email, and Word (Peters, 2017). Sharples (2018) stated that in early 2018's, as learning began to change to learning centered, collaborative and continuous cause for Information and communication technology

(ICT) has become more personalized, user centered and mobile. In 2018s, the Electronics Revolution related to development of telecommunications industry constituted e learning. In this period, distance teaching, World Wide Web and Internet were evaluated by increasing speed of chips developments in broadband technologies. In 20th century, mobile learning was improved because of the mobile and Wireless Revolution (Lam et al., 2018). Moreover, Keegan (2017) claimed that characteristic features of distance education were altered from electronic revolution to mobile learning. Distance education become face-to-face and group-based by changes in electronic revolution in 2019s.

Furthermore, the mobile revolution in 2018s has ensured learners alternative choices for distance education with mobile technologies instead of traditional college education.

Kukulska-Hulme and Traxler (2015) divided mobile learning into 6 categories;   **Technology-**

**driven mobile learning:** Recent innovations in technology are used in educational settings. For

example, Wireless network technologies like Wi-Fi or 3G can be integrated into mobile learning in this type of mobile learning.

‒ **Miniature but portable e-learning:** Mobile devices are used for flexible and conventional solutions. For example, delivering educational content to the learners who were out of the classroom environment and reaching content via their mobile devices such as tablets or mobile phones.

‒ **Connected classroom learning:** Similar technologies are used in classroom environment for providing collaborative learning or connecting classrooms each other's. For example, students in different classroom in the world may join the webinar services via their tablets. Webinar services bring to classrooms together. Webinar services can help instructors to present web seminars and product demonstrations to students from anywhere in the world at any time.

‒ **Informal, personalized, situated mobile learning:** Mobile technologies are supported for being operational. Location-awareness and video-capture may be given as examples of this feature. For example, FutureLab (2015) declared that mobile devices enhanced the opportunities of informal learning that is students can communicate with their instructors and with each other while they are out of the classroom.

2.4     Theoretical Framework

## 2.4.1   Constructivism Theory

The first person to propose a theory of constructivism was 20th century cognitive psychologist Jean Piaget, a Swiss-born pioneer in educational theory. Piaget emphasized the importance of allowing the child/student to construct an educational environment that is relevant to the individual learner; this is opposed to the traditional classroom where a set group of lessons is presented by a teacher to a group of students who do not have a say in directing their learning (Driscoll, 2015). However, Piaget did not necessarily feel that the teacher had no real role in the classroom. On the contrary, he emphasized the importance of the instructor as the individual with the most important role in constructing a learning environment that could meet the learning needs of every individual student by creating a classroom where students could "discover" the exercises or activities that they themselves want to explore (Driscoll, 2015; Fosnot, 2015; Prater, 2017).

Therefore, "Constructivism can be defined as that philosophical position which holds that any socalled reality is, in the most immediate and concrete sense, the mental construction of those who believe they have discovered and investigated it" (Saunders, 2017, p. 136). Unlike traditional theories of learning in which the learning process is structured mainly to deliver an established body of knowledge to all learners of the same age or grade level, which the learners are expected to retain and then apply as appropriate later in life, constructivism takes the opposite approach and states that the learner should drive the educational process through individual choice. This means the student chooses the learning upon which to focus based on the student's personal interests and likely future work (Reiser & Dempsey, 2014). More simply,

constructivism theory supports the construction of knowledge based on the learner's personal experiences and social environment (Driscoll, 2015).

The constructivism theory of learning is mostly associated with Piaget and Vygotsky. Piaget proposed that knowledge acquisition is a process of continuous self-construction and assumes an interaction between the subject (learner) and object (material world; Driscoll, 2015; Gilakjani et al., 2013). Furthermore, Gilakjani et al. (2013) stated the process of effectively educating students requires that the teacher construct an effective learning environment to engage learners successfully. Since the constructivism concept of learning proposes that learners will guide their own process of acquiring knowledge dependent upon their own individual and social experiences, teachers should therefore provide an instructional environment that allows learners to match what they want to learn with appropriate activities/lessons that will build their knowledge of that chosen topic area (Jonassen, 2019). In addition, instructors must address such factors as students' language, culture, and social practices that guide how individual students learn and acquire knowledge (Matsuda & Bommarito, 2015). Vygotsky heavily focused on the impact of sociocultural factors on learning (Fosnot & Perry, 2016) and, like Piaget, considered learning to be a developmental and constructive process that is essentially an interaction between individuals and their socio-cultural environment (Driscoll, 2015).

### 2.4.2    Jerome Bruner's Learning Theory

Bruner introduced the concept of learning by discovery. Bruner is of the view that learning is effectively engaged in if the learner is giving the opportunity to discover facts by him/herself. Bruner argues that mere presentation of information will not enhance effective solution of a problem. The theory stresses cognitive effectiveness. Because of this, some referred to Bruner's theory of learning as Bruner's theory of cognitive development. Bruner believed that learning by discovery begins when science teacher purposefully (i.e. intentionally) create (present) a problem and present it to the students by introducing some inconsistencies (i.e. contradictions) among source of information which are giving in the process of instruction. According to Bruner such inconsistencies lead to intellectual discomfort that will stimulate (i.e. motivate) the students to initiate individual discoveries through cognitive restructuring (i.e. internal reorganization). The intellectual discomfort created by the inconsistencies makes the learner to attempt to bring order out of this confusion by engaging in mental processes i.e. discovery activities which involve observation, hypothesizing, measuring, stating problem, data collection, classifying, inferring, etc.

Through mental processes, the student can generate facts from his/her desperate experiences.

Experiences gained during the mental processes enable the students to sense the disparity. According to Bruner there are two forms of discovery processes which are:

o   **Assimilation:** This occurs when a student recognizes a new situation that is familiar to one

    of the elements in the existing structure of knowledge (i.e. cognitive structure) and he/she

    easily assimilates it.

o **Accommodation:** This occurs when a new situation (i.e. a new knowledge) is incompatible to the existing structure of knowledge (i.e. cognitive structure) the learner first restructures (i.e. reorganizes) his/her cognitive framework (i.e. cognitive structure) in order to be able to accommodate the new knowledge.

Bruner believes that the students should find out information on their own using mental processes. The theory places great emphasis on the three types of human activity for learning i.e. the three information processing systems which are:

• Physical activity (motor activities) called Enactive representation.

• Imagery called Ionic representation.

Symbolic activities

The three activities coexist with each other and for this reason; the attainment of one does not mean the total abandonment of the others. At enactive stage, the child manipulates the learning materials directly by neuro-muscular activities. At ionic stage, the child deals with mental images of objects, but does not manipulate them directly. At symbolic stage the child uses language. The interpretation of the above is that when a child, say at secondary school level shows deficiencies in his/her learning capacity especially in symbolic representation, it could be that he/she was deficient in early stages (i.e. enactive and ionic stages) which he/she skipped. It is therefore necessary to fill in the missing gap by providing concrete support that will make up for the deficiency.

Discovery learning, when encouraged in science instruction also aids problem solving because learning by discovery starts with problem solving (Aknmoyewa, 2017). Discovery learning also stimulates creativity in the student, which is one of the major objectives of science teaching/learning.

Application of Jerome Bruner's Theory of Learning to Science Teaching/Learning:

The science teacher should intentionally create or present problems to students either in form of apparent contradiction or inconsistency among sources of information which are giving in the process of instruction. Encouraging discovery learning in science class by science teachers will result into aiding problem solving. One of the major objectives of science teaching is creativity. Therefore, discovery learning encourages creativity. Students should be taught concepts in such a way that they have applicability beyond the situation in which they were learned. Retention of science concepts are aided by knowledge acquired through discovery learning. Teachers must encourage students to make intuitive guess more systematically. Bruner supported a radical reorganization of the curriculum across all levels of education. Bruner advocated the fundamental structure of curriculum to begin with simple contents and later graduated to complex contents. That means that learning should proceed from simple to complex, from

concrete to abstract, and from specific to general. Teaching should be inductive. Bruner supported the spiral nature of curriculum as we have in our present science curriculum at all levels of education. Bruner's Constructivist Theory asserts that learning is an active process in which learners construct new ideas based upon their current knowledge. Instruction can be made more efficient by providing a careful sequencing of materials to allow learners to build upon what they already know and go beyond the information they have been given to discover the key principles by themselves.

In relation to the present study: Effect of Students' Produced Improvised Instructional Materials on Senior Secondary Students Achievement in Biology, the application of Bruner's constructivist theory to learning will help the students to have a focused attention on the principles they learn and also increase and sustain students' attitude to learning environment.

Secondly, Bruner's theory of learning by discovery and his theory of cognitive development suggested that instructions at all level should be geared towards the learning maturational development or cognitive operation. Bruner's theory is directly related to the present study: effect of students' produced improvised instructional materials. This is because effective use of students' produced improvised materials involves the learner actively working on his own to find solutions to problems. So, Bruner's theory is in support of the present study.

2.5   Empirical Studies

Demirci (2019) carried out a study on teachers' attitudes towards the use of Geographic

Information Systems (GIS) in Turkey. The study used questionnaire to collect data from 79 Geography teachers teaching in 55 different high schools. The study revealed that though barriers such as lack of hardware and software existed, teachers' positive attitudes towards GIS were an important determinant to the successful integration of GIS into geography lessons. Gaining an appreciation of the teachers' attitudes towards computer use in teaching and learning may provide useful insights into using technology. However, the study, though quite informative, used only a questionnaire to collect data. The use of other instruments would help in revealing more information regarding the phenomenon. Other than using ICT in teaching and learning, teachers would also use ICT as a tool for accomplishing house-keeping tasks, managing their students more efficiently and communicating with parents more easily. The study was confined to the use of ICT in teaching Geography. The current study therefore sought to establish teachers' perceptions in using ICT to perform administrative tasks other than in the teaching of Geography.

Teo (2018) carried out a survey on pre-service teachers' attitudes towards computer use in Singapore. A sample of 139 pre-service teachers was assessed for their 33 computer attitudes using questionnaire with four factors: affect (liking), perceived usefulness, perceived control, and behavioral intention to use the computer. He found that teachers were more positive about their attitude towards computers and intention to use computer than their perceptions of the usefulness of the computer and their control of the computer. The limitation with this study is

that data was collected through self-reports and this may lead to a situation where the true position may be inflated hence resulting in spurious findings.

Mwalongo (2017) carried out a study teachers' perceptions about ICT for teaching, professional development, administration and personal use in Tanzania. He used a case study and his data solely depended on self-reports. In his findings, he reported that ICT was used to carry out administrative tasks such as preparing reports, letters, timetables, and schemes of work and for students' registration. However, he agrees with Unachukwu and Nwankwo (2012) that teachers did not use ICT to bring change in their practices but rather sustain their traditional practices. Mwalongo gathered information through self-reports and this method cannot be dependable for generalization. The current study incorporated other methods of data collection like observation to ascertain the availability and actual use of ICT facilities in school administration rather than solely depending on self-reported data.

Enayati et al. (2014) carried out a study on the use of mobile phones in providing educational content to students in Ebonyi state. Descriptive survey was utilized. Out of the total population of six thousand, seven hundred and forty villagers and administrators in ebonyi state, a sample of one hundred and eighty were drawn, through the use of purposive and quota sampling technique. The data collected were descriptively analyzed using mean and standard deviation, while the hypotheses were tested using t-test statistical tool. All the five null hypotheses developed for the study were rejected at 0.05 level of significance. The results indicated that transferring course materials via mobile phones and text messages are effective in learning; however, this method of transferring educational content does not offer any advantage over lectures. In a research on feasibility of implementing mobile-based learning (mobile learning) at university.

2.6    Summary of the Literature Reviewed

This chapter reviews relevant literatures on the perception of pre-service teachers on the use of mobile-phone in teaching sense organs in Biology in Senior Secondary School in Minna metropolis, Niger State. From the research of various researchers included in this work, it can be deduced that the perception of pre-service teachers on the use of mobile-phone in teaching sense organs in Biology in Senior Secondary School is more effective and advantageous. It is the perspective of this paper that mobile learning could enhance access in those situations where cost plays a significant role in learning. But most the researcher emphasized that Mobile learning provides effective ways to convey educational programs to large populations. In the literatures reviewed, 4 research works were reviewed which included Demirci (2019) conduct a study on teachers' attitudes towards the use of Geographic Information Systems (GIS) in Turkey. Enayati et al. (2014) conducted a study on the use of mobile phones in providing educational content to students. This research adopted the theory of constructivism which was 20th century cognitive psychologist Jean Piaget, a Swiss-born pioneer in educational theory. Piaget emphasized the importance of allowing the child/student to construct an educational environment that is relevant to the individual learner; this is opposed to the traditional classroom where a set group of lessons is presented by a teacher to a group of students who do not have a say in directing their learning.

And also Jerome Bruner's Learning Theory which introduced the concept of learning by discovery. Bruner is of the view that learning is effectively engaged in if the learner is giving the opportunity to discover facts by him/herself. Bruner argues that mere presentation of information will not enhance effective solution of a problem. The theory stresses cognitive effectiveness.

# CHAPTER THREE

## 3.0            RESEARCH METHODOLOGY

### 3.1    Research Design

The descriptive survey design was employed for the study. Oghene, (2015), descriptive survey design is research technique in which information is gathered from a sample of people through questionnaire and interview. And also, according to Ali, (2015), descriptive survey design is concern with the documentation and description of what exists or the present status of existence or absence of what is being investigated without any manipulations of what caused the event. Therefore, the survey design was considered suitable since the study seek information from the sample representing the entire population for the study.

### 3.2    Population of the Study

The total population of pre-service teachers in some selected public school within Minna metropolis. The total population of pre-service teachers for this study is 40. The number is made up of both male and female pre-service teachers, teaching Biology in senior secondary school.

### 3.3    Sample and Sampling Technique

In the survey, 4 selected secondary schools was been used for the study using 10 pre-service teachers in Minna metropolis for the study. Using the random sampling technique, the researcher randomly selected a sample size of 40 respondents from the 4 selected secondary schools. Each station contributed a sample size of 10 respondents. Therefore, the sample size for the study of 4 selected secondary schools is 40.

### 3.4    Research Instrument

The Research instrument used is structured Questionnaire, developed by the researcher which was designed for pre-service teachers in schools. It consists of items and Bio-data of respondents divided into sections A, B, C and D. Section 'A' deal with the respondent Bio-data. Section 'B' contains 10 items that deals with the perception of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School. Section 'C' contains 10 items that deals with the attitude of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary School. Section 'D' contains 10 items that deals with the problems encounter by pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools.

### 3.5    Validation of the Instrument

The instrument for data collection for the study was validated after thorough examination and necessary comments by the supervisor and it was validated by two experienced lecturers in

Educational Technology Department. Their observation and corrections were ``being effected before the instrument was administered to respondents of the study.

3.6     Trial Testing of the Instrument

A letter of introduction was attached to the instrument stating the aims and objective of the study. A copy of this letter was presented to individual pre-service teachers by the researcher and one colleague assisted in the distribution of the questionnaires and the questionnaires was collected after their completion by the pre-service teachers.

3.7     Reliability of the Instrument

The instrument was been pilot tested on 4 selected secondary schools using split half method.

Cronbach alpha statistic will be use for the analysis to ascertain the reliability index.

3.8     Method of Data Collection

The instrument was been collected from the respondents by the researcher. The researcher administered the questionnaire to the respondents and collection was been made. This will be possible with the help of the attached letter of introduction from the department of Technology Education in the faculty of School of Science and Technology in the Federal University of Technology Minna. This method enabled the researcher to obtain at least 100% return of the filled questionnaires; it also helped the researcher to offer assistance to the respondents when needed.

3.9    Method of Data Analysis

The data for the study was been collected from respondents and the collected answer analyzed

using the mean and the standard deviation. 2.5 will be used as a mean score. Which implies that

from 2.5 above represented available and 2.5 below represented not available in the analysis.

The likert scale will be used in rating the responses collected from the correspondents. The

Likert scale are: Strongly Agree (SA), Agree (A), Strongly Disagree (SD), and Diagree (D). And

their values are as follows: (SA) 4, (A) 3, (SD) 2, (D) 1 and from which a mid-point mean value was calculated. Formula

$\Sigma$ = Sum of

X = Nominal Value

N = Total Number of Respondents

Formula for Standard Deviation

$\Sigma = \Sigma FX$

$\Sigma$ = Sum of

F = frequency

X = Nominal value

N = Total number of Respondents

The numeric values assigned to a different scaling items used as follows:

SA/Strongly Agree = 4

A/Agree            = 3

D/Disagree        = 2

SD/Strongly Disagree = 1

The mean value therefore $= \dfrac{4+3+2+1}{4} \quad = \dfrac{10}{4} \approx 2.5$

<div align="center">

**CHAPTER FOUR**

</div>

**4.0          RESULT AND DISCUSSION OF DATA**

**4.1     Data Analysis and Response to Research Questions**

**4.1.1    Research Question 1**

What is the Perception of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis?

**Table 1:   Mean response of the Perception of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis.**

| S/N | ITEMS | N | Mean | Standard Deviation | Decision |
|-----|-------|---|------|--------------------|----------|
| 1. | I perceived mobile phone role more effective | 40 | 2.54 | 1.233 | Agreed |
| 2. | Learning via mobile phone is more motivating | 40 | 2.70 | 0.921 | Agreed |
| 3. | Use of mobile phone would make learning more efficient | 40 | 2.59 | 1.011 | Agreed |
| 4. | Learning via mobile phone improve teaching knowledge | 40 | 2.62 | 1.311 | Agreed |
| 5. | Use of mobile phone impact on         learning process development | 40 | 2.51 | 0.871 | Agreed |
| 6. | Learning via mobile phone is more interacting | 40 | 2.60 | 1.003 | Agreed |
| 7. | Use of mobile phone increase teaching efficacy | 40 | 2.87 | 1.401 | Agreed |
| 8. | Learning through mobile phone        support learning process | 40 | 2.77 | 1.004 | Agreed |
| 9. | I perceived that learning via mobile phone improve teaching experience | 40 | 2.64 | 1.301 | Agreed |
| 10. | Use of mobile phone enables knowledge building in different  context. | 40 | 2.72 | 1.244 | Agreed |
| | **Grand Mean** | **40** | **2.66** | | |

Decision Mean: 2.50

Table 1 shows the Mean and Standard Deviation of responses on the Perception of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis. The table reveals the computed mean score of 2.54 with standard deviation of 1.233 for item one, 2.70 with standard deviation of 0.921 for item two, 2.59 with standard deviation of 1.011 for item three, 2.62 with standard deviation of 1.311 for item four, 2.51 with standard deviation of 0.871 for item five, 2.60 with standard deviation of 1.003 for item six, 2.87 with standard deviation of 1.401 for item seven, 2.77 with standard deviation of 1.004 for item eight, 2.64 with standard deviation of 1.301 for item nine, 2.72 with standard deviation of 1.244 for item ten. The table revealed further that, the grand mean score of

responses to the 10 items was 2.66 which was greater than the decision mean scores of 2.50. This implies that preservice teachers perceived on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis.

### 4.1.2    Research Question 2

What is the Attitude of pre-service teachers on the use of mobile-phone in teaching sense-organ

in Biology in Senior Secondary Schools in Minna Metropolis?

**Table 2:    Mean response of the Attitude of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis**

| S/N | ITEMS | N | Mean | Standard Deviation | Decision |
|---|---|---|---|---|---|
| 1. | To impacted on pre-service teacher professional development | 40 | 2.50 | 0.773 | Agreed |
| 2. | It will hinder the pre-service teacher professional development. | 40 | 2.16 | 1.007 | Not Agreed |
| 3. | To established foundation for developing of self-efficacy | 40 | 2.67 | 1.200 | Agreed |
| 4. | It will hinder the foundation for developing of self-efficacy | 40 | 2.30 | 0.965 | Not Agreed |
| 5. | To increased pre-service teacher teaching efficacy | 40 | 2.57 | 1.413 | Agreed |
| 6. | It will decreased pre-service teacher teaching efficacy | 40 | 2.12 | 1.053 | Not Agreed |
| 7. | To support pre-service teacher learning capability | 40 | 2.41 | 1.051 | Not Agreed |
| 8. | It will hinder pre-service teacher learning capability | 40 | 2.71 | 0.812 | Agreed |
| 9. | To improve pre-service teacher teaching experience | 40 | 2.73 | 1.442 | Agreed |
| 10. | It will inhibit pre-service teacher teaching experience | 40 | 2.21 | 1.061 | Not Agreed |
| | **Grand Mean** | **40** | 2.63 | | |

Decision Mean: 2.50

Table 1 shows the Mean and Standard Deviation of responses on the Attitude of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis. It has been acknowledge that the above items mention on the table indicate that five (5) items which are computed mean score of 2.50 with standard deviation of 0.733 for item one, mean score of 2.67 with standard deviation of 1.200 for item three, mean score of 2.57 with standard deviation of 1.413 for item five, mean score of 2.71 with standard deviation of 0.812 for item eight, mean score of 2.73 with standard deviation of 1.442 for item nine, building up positive Attitude of the pre-service teachers on the use of mobile-phone help in teaching sense organ in Biology with grand mean of 2.63 which is greater than the decision mean score of 2.50 while five (5) items where which are mean score of 2.16 with standard deviation of

1.007 for item two, mean score of 2.30 with standard deviation of 0.965 for item four, mean score of 2.12 with standard deviation of 1.053 for item six, mean score of 2.71 with standard deviation of 1.051 for item seven, mean score of 2.21 with standard deviation of 1.061 for item ten, does not help in building up positive Attitude of the pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in senior secondary schools in Minna Metropolis. The table revealed further that, the grand mean score of responses of 2.63 which was greater than the decision mean scores of 2.50. This implies that positive attitude helps in building up pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools is positive in Minna Metropolis.

### 4.1.3 Research Question 3

What is the Problems encounter by pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis?

**Table 3: Mean response of the Problems encounter by pre-service teachers on the use of mobile phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis.**

| S/N | ITEMS | N | Mean | Standard Deviation | Decision |
|-----|-------|---|------|--------------------|----------|
| 1. | Inadequate teaching materials. | 40 | 2.90 | 0.921 | Agreed |
| 2. | Inadequate time for the practical teaching | 40 | 2.68 | 0.876 | Agreed |
| 3. | Inadequate power supply | 40 | 2.54 | 1.022 | Agreed |
| 4. | Lack of conducive environment for the teaching process | 40 | 2.70 | 1.302 | Agreed |
| 5. | Lack of network | 40 | 2.81 | 0.988 | Agreed |
| 6. | Lack of knowledge on how to use search engines. | 40 | 2.67 | 1.209 | Agreed |
| 7. | Unavailability of online diagrams for teaching process | 40 | 2.79 | 1.044 | Agreed |
| 8. | Inadequate provision of data for browsing | 40 | 2.59 | 1.009 | Agreed |
| 9. | Weak service network from network provider. | 40 | 2.62 | 0.722 | Agreed |
| 10. | Lack of ICT facilities which would have been useful for Educational purposes. | 40 | 2.51 | 0.881 | Agreed |
| | **Grand Mean** | **40** | **2.43** | | |

Decision Mean 2.50

Table 1 shows the Mean and Standard Deviation of responses on the problems encounter by preservice teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis. The table reveals the computed mean score of 2.90 with standard deviation of 0.921 for item one, 2.68 with standard deviation of 0.876 for item two, 2.54 with standard deviation of 1.022 for item three, 2.70 with standard deviation of 1.302 for item four,

2.81 with standard deviation of 0.988 for item five, 2.67 with standard deviation of 1.209 for item six, 2.79 with standard deviation of 1.044 for item seven, 2.59 with standard deviation of 1.009 for item eight, 2.62 with standard deviation of 0.722 for item nine, 2.51 with standard deviation of 0.881 for item ten. The table revealed further that, the grand mean score of responses to the 10 items was 2.68 which was greater than the decision mean scores of 2.50. This implies that preservice teachers encountered problems on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis.

## 4.2     Discussion of the Findings

Finding from the analysis revealed that pre-service teachers perceived on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools, as the responses shows a grand mean score of 2.66 shows that pre-service teachers perceived on the use of mobile-phone in teaching sense-organ in Biology in senior secondary schools in Minna metropolis, the grand means scores was above the established mean of 2.50.

The data analyzed also revealed that building up positive Attitude of the pre-service teachers on the use of mobile-phone help in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis, with the grand mean score of 2.63 which was above the already established decision mean of 2.50, indicating that positive attitude of pre-service teachers on the use of mobile phone help in teaching sense-organ in Biology in senior secondary schools.

The data analyzed also revealed that pre-service teachers encountered problems on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis, as the responses show a grand mean score of 2.68 shows that pre-service teachers encounter problems on the use of mobile-phone in teaching sense-organ in Biology in senior secondary schools, which was above the already established decision mean of 2.50, indicating that pre-service teachers encounter a lot of problems on the use of mobile-phone in teaching sense organ in Biology in senior secondary schools in Minna metropolis, which was in line with findings of Taylor (2015) study on pre-service teachers problem encounter in using mobile-phone for teaching which cause for increasing demands to access to internet, and also cause for increasing demand to mobile learning materials and resources.

# CHAPTER FIVE

## 5.0                  CONCLUSION AND RECOMMENDATIONS

### 5.1    Conclusion

The study revealed that pre-service teachers are aware of using mobile-phone for teaching and learning, and they are willing to teach using mobile-phone provided with the necessary equips and appropriate techniques. Therefore, public secondary schools have a mandate to equip their ICT with mobile-phone learning and teaching skills. Numerous studies have demonstrated the need to promote mobile-phone for learning sense-organ in senior secondary schools though some countries are still facing challenges in terms of teaching resources and personal.

### 5.2    Recommendations

The study recommended that pre-service teachers should be exposed to different teaching strategies to teach efficiently and effectively in public secondary schools. Among others recommendations are as follows;

1. The adoption and integration of mobile-phone in teaching sense-organ in senior secondary schools make teaching and learning more convenience for distance students.

2. Internet access should be made available for both pre-service teacher and students at public secondary schools.

3. The pre-service teachers should be exposed to different teaching strategies to teach efficiently and effectively using mobile-phone for teaching sense-organ in senior secondary schools.

4. Training, workshops should be held to enlighten pre-service teachers and students on the benefits of mobile-phone in teaching and learning sense-organ in senior secondary schools.

5. Government, Stakeholders and individual organizations should provide mobile-phone, stable power supply, mobile devices and ICT centers in public secondary schools.

### 5.3    Suggestion for further study

Research should be conducted and courses should be developed to train teachers in how to create their own teaching-learning media and how to use more advanced teaching-learning media especially in teaching Biology.

# REFERENCES

Abimbola, A. (2013). Effects of computer assisted instruction (CAI) on secondary school students' performance in biology. TOJET: *The Turkish Online Journal of Educational Technology*, 9(1), 62-69.

Aknmoyewa, E. (2017). Learning approach, control orientation and self-efficacy of beginning teacher education students. *Asia-Pacific Journal. Teach. Educ. Development.* 1(1):53-63.

Ali, D. (2015). Digital learning process in the age of the industrial revolution 4. 0 era technology disruptions. *Ministry of Research, Technology and Higher Education*, 1-13

Argyris & Schön, (2016). Social capital in the generation of human capital. *American Journal of Sociology*, 94, S95-S120.

Arumí, Y. (2019). Transformational practice: critical teacher research in *pre-service teacher education. Educational action research,* 23(4), 479-496. https://doi.org/10.1080/09650792.2015.1019902

Benson, P. (2017). Autonomy in language teaching and learning. *Language teaching*, 40(1), 21-40. doi:10.1017/S0261444806003958

Campbell & Neil (2017). Place effects for areas defined by administrative boundaries. *American Journal of Epidemiology,* 149(6), 577-585.

Corbeil & Corbeil, (2018). *Learning to think like an adult. Learning as transformation: Critical perspectives on a theory in progress*, 3-33. DOI: 10.1.1.463.1039

Demirci, N. (2019). "Inclusive and Special Education in Europe." Oxford Research Encyclopedia of Education. Accessed 13 June 2019. https://oxfordre.com/education/view/10.1093/acrefore/978 0190264093.001.0001/acrefore-

9780190264093-e1230

Dholakia & Dholakia, (2014). First-Year College Students' Attitudes toward Communication

    Technologies and Their Perceptions of Communication Competence in the 21st Century. *Communication Education*, 64(1), 107-131


Dickinson, M. (2016). Exploring the perceptions of pre-service teachers' experiences of
    autonomy in transformational teaching. *Journal of Social Sciences,* 33(3), 271-284. DOI:
    10.1080/09718923.2012.11893105


Driscoll, Fosnot & Prater, (2015& 2017). Exploring pre-service teachers' views regarding
    teaching for transformation: A proposed autonomous transformative framework for
    higher education institutions. *Mediterranean Journal of Social Sciences*, 4(13), 463. DOI:
    10.5901/mjss.2013.v4n13p463

Driscoll, J. (2015). Improving the quality of vocational education in the era of industrial
revolution

    4.0. Kemenristek Higher Education.


Egbo, F. (2017). Analysis Of Textbook Of Biology For Higher Secondary Students With

    Reference To 21st century Life Skills. *Journal of Research in Social Sciences, 4(2), 196*.


Enayati et al. (2014), Assessing educational equality and equity with large  scale assessment
    data: Brazil as a case study. Washington: Inter-American Development Bank.


Flavell, K. (2018). Developmental lag versus deficit models of reading disability: *A longitudinal,
individual growth curves analysis. Journal of Educational Psychology, 88, 3-17.*


Fosnot & Perry, (2016). "The Pythagoras Study: Investigating Effects of Teaching and Learning
    in Swiss and German Classrooms", in T. Janik and T. Seidel (eds.), *The Power of Video
Studies in Investigating Teaching and Learning in the Classroom, Waxmann Verlag,
Münster, pp. 137-160.*


Freire, J. (2016). Emotional intelligence and teaching situations: development of a new measure.
    Issues in Educational Research, 14(1), 29.

FutureLab, M. (2015). Decoding the meaning of factorial invariance and updating the practice of multi-group confirmatory factor analysis: A demonstration with TIMSS Data. Practical Assessment Research & Evaluation, 12 (3), 1-26.

Geddes, O. (2014). A multilevel model for community segregation. *Journal of Mathematical Sociology, 20(1), 23-40.*

Gess-Newsome, I. (2018). Strategies for blended approaches in teacher education. Effective Blended Learning Practices, 39–61. https://doi.org/10.4018/978-1-60566-296-1.ch003

Gilakjani (2013). Quality, appropriateness, incentive, and time: a model of instructional effectiveness. *International Journal of Educational Research, 21(2), 141-158.*

Green, Hechter, Tysinger, & Chassereau, (2014). *An analysis plan on educational equality and equity:* Recommendations for the OECD Education at a Glance. Paper prepared for the OECD NESLI INES Network for the collection and adjudication of system-level descriptive information on educational structures, policies and practices (NESLI). Fredericton: UNB-CRISP.

Harding-Esch, P. (2015). Generalizability of instructional and school effectiveness indicators across nations. *International Journal of Educational Research, 13, 789–799.*

Holec's, T. (2016). Kindergarten predictors of first and second-grade reading achievement. *The Elementary School Journal, 104(2), 93-109.*

Illich, D. (2017). School infrastructure and resources do matter: analysis of the incidence of school resources on the performance of Latin American students. *School Effectiveness and School Improvement*, 22 (1), 29-50.

Islam, I. (2015). Teaching via Mobile Phone: A Case Study on Malaysian Teachers' Technology Acceptance and Readiness. *Journal of Educators Online*, 10(1), 1-38.

Jarman, Ruth, McClune & Billy, (2016). The relative and absolute risks of disadvantaged family background and low levels of school resources on student literacy. *Economics of Education Review, 29(2), 214-224*.

Johnson, S. (2016). Communities, gender and education: Evidence from sub-Saharan Africa: Background paper for 2003 UNESCO Global Monitoring Report. *Centre for International Education, University of Sussex.*

Jonassen, G. (2019). The impact of science knowledge, reading skill, and reading strategy knowledge on more traditional "high-stakes" measures of high school students' science achievement. *American Educational Research Journal, 44(1), 161-196*

Kara, H. (2015). Cultural capital in educational research: A critical assessment. *Theory and Society,* 32, 567–606.

Keegan, J. (2017). Technology-Mediated Writing: Exploring Incoming Graduate Students' L2 Writing Strategies with Activity Theory. *Computers and Composition* 55 (2020) 102542.

Khalsa, & Sahib, (2017). A critique of thinking categories. Retrieved September 25, 2006, from http://www.ceap.wcu.edu/houghton/Learner/think/critthink.html

Klerk (2012). Viewing mobile learning from a pedagogical perspective. *Journal Research in Learning Technology*, 20 (1), 1-18. https://doi.org/10.3402/rlt.v20i0/14406

Knowles & Associates, (2014). Teacher questioning behaviour and student learning: What research says to teachers. (Paper presented at the 1993 Convention of the Western States Communication Association, Albuquerque, New Mexico). (ERIC Document Reproduction No.359572).

Kukulska-Hulme & Traxler, (2015). Thinking aloud about this process we call teaching. *Journal of the American Association of Teacher Educators in Agriculture, 29(1), 2-10*.

Kumar, Tewari, Shroff, Chittamuru, Kam & Canny, (2017). Google classroom for mobile learning in higher education: Modelling the initial perceptions of students. *Education and*

*Information Technologies*, 1793–1817. https://doi.org/https://doi.org/10.1007/s10639-018-09858-

Lam et al., (2018). Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and ICT Research, 2(2), 19-36.*

Liras, K. (2017). The application of google classroom as a tool for teaching and learning. *Journal of Telecommunication, Electronic and Computer Engineering*, 8 (10), 8-11.

Marchaim, S. (2011). Media communication: an introduction to theory and process. 2nd edition. New York: Palgrave Macmillan. 368.

Matsuda & Bommarito, (2015). *The state of inclusive education in South Africa and the implications for teacher education programmes*. Teaching for all. British Council South Africa Addis Ababa: *The African Child Policy Forum*

Motlik, A. (2018). Blended learning: a dangerous idea? *Internet and Higher Education, 18, 15–23*. https://doi.org/10.1016/j.iheduc.2012.12.001

Mwalongo, G. (2017). An introduction to teaching-learning media. A manual for student

Oghene, J. (2015). Regional evidence of climate change in Nigeria. *Journal of Geography and Regional Planning, 3, 142-150.*

Park, I. (2016). Learning in basic electricity: how do motivation, cognitive and class room

Peters, E. (2017). Research orientation: a practical study guide for students and researchers. Vanderbijlpark : L.M. Vermeulen

Plodkaew & Tanamai, (2014). Handleiding vir die gebruik van sielkundigeen skolastiese toetse as hulpmiddels by skoolverlating. Pretoria : RGN. (RGN-voorligtingreeks VR-2). 22.

Quinn, A. (2017). Education in the net generation. Educational Leadership, 55(3):7-11, Feb

Reiser & Dempsey, (2014). Exploring teacher perceptions of blended learning. *ProQuest Dissertations and Theses, 251.*

Reiss, E. (2017). A Framework for Preparing Teachers for Classrooms That Are Inclusive of All Students. *Teacher Education for the Changing Demographics of Schooling* 133-148.

Roberts, Q. (2011). Planning Supports for Students. With Intellectual Disability in General Education Classrooms. Inclusion, 8(1), 27–42.

Saunders, R. (2017). *Five types of qualitative methods. Denver, Colorado. https://measuringu.com/qualmethods/science education, 20 (3): 551-565.*

Sharples, Lonsdale, Meek, Rudman & Vavoula, (2017). Evaluation of teacher candidates'' attitudes concerning teaching profession (Dicle and Firat University sample). Dicle Üniversitesi Ziya Gokalp Eğitim Fakültesi Dergisi 14:13-24

Sharples, Y. (2018). Confirmatory factor analysis of the scale measuring teacher attitudes towards inclusive education (TAIS). *European Journal of Special Education Research*, 2(6), 196– 203.

Taylor, A. (2015). Exploring the link between pre-service teachers' ICT-related profiles and their TPACK teachers. Potchefstroom : PU for CHE : 50.

Teo, D. (2018). Planning Supports for Students. With Intellectual Disability in General Education Classrooms. *Inclusion,* 8(1), 27–42.

Teri (2016). Inligtingstegnologie vir alternatiewe vorme van onderwysvoorsiening, Potchefstroom : PU vir CHO. (Proefskrif - D.Phi1.) 258

Traxler, T. (2018). Contextualizing teacher autonomy in time and space: A model for comparing various forms of governing the teaching profession. *Journal of Curriculum Studies, 46*(1),

58-80. DOI: 10.1080/00220272.2013.812681


Valk et al., (2018). Prospective teachers' metaphors: Teacher, teaching, learning, instructional material, and evaluation concepts, *International Journal of Social Science Education*. 3(2):435-445.


Valk, Rashid & Elder, (2019). Planning for effective teaching in developing nations. In: L. Anderson (ed.), The encyclopedia of teaching and teacher education (Second Edition). New York: Pergamon Press


Visser & West, (2015). Classroom behavior problems: The relationship between preparedness, classroom experiences and self-efficacy in graduate and student teachers. *Australian Journal of Educational Development Psychology*. 3, 21-34


Wikipedia, S. (2015). Collective efficacy beliefs: Theoretical developments, empirical evidence, and future directions. *Education Resources*. 33(3), 3-13.

# APPENDIX

SECTION A

PERSONAL DATA OF RESPONDENTS

Name of School……………………………………

Gender:        Male (  )                    Female (  )

QUALIFICATION: NCE (    ),  BAED (    ),  M.TECH(  ),  DR (    ),  PROF (    )

SECTION B

Instruction: Tick ( ✓ ) against the correct answer that reflects your degree of agreement or disagreement with the statement. There is no right or wrong answer. Note that SA = strongly agree A = Agree SD = Strongly Disagree D = Disagree

Research Question 1

What is the Perception of pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis?

| SN | ITEMS | SA | A | SD | D |
|----|-------|----|----|----|----|
| 1. | I perceived mobile phone role more effective. | | | | |
| 2. | Learning via mobile phone is more motivating. | | | | |
| 3. | Use of mobile phone would make learning more efficient. | | | | |
| 4. | Learning via mobile phone improve teaching knowledge. | | | | |
| 5. | Use of mobile phone impact on learning process development. | | | | |
| 6. | Learning via mobile phone is more interacting. | | | | |
| 7. | Use of mobile phone increase teaching efficacy. | | | | |
| 8. | Learning through mobile phone support learning process. | | | | |
| 9. | I perceived that learning via mobile phone improve teaching experience. | | | | |

| 10. | Use of mobile phone enables knowledge building in different context. | | | | |
|-----|---------------------------------------------------------------------|---|---|---|---|

**Research Question 2**

What is the Attitude of pre-service teachers on the use of mobile-phone in teaching sense-organ in

Biology in Senior Secondary Schools in Minna Metropolis?

| SN | ITEMS | SA | A | SD | D |
|-----|-------|-----|---|-----|---|
| 1 | To impacted on pre-service teacher professional development. | | | | |
| 2 | It will hinder the pre-service teacher professional development. | | | | |
| 3 | To established foundation for developing of self-efficacy. | | | | |
| 4 | It will hinder the foundation for developing of self-efficacy. | | | | |
| 5 | To increased pre-service teacher teaching efficacy. | | | | |
| 6. | It will decreased pre-service teacher teaching efficacy. | | | | |
| 7. | To support pre-service teacher learning capability. | | | | |
| 8. | It will hinder pre-service teacher learning capability. | | | | |
| 9. | To improve pre-service teacher teaching experience. | | | | |
| 10. | It will inhibit pre-service teacher teaching experience. | | | | |

Research Question 3

What is the Problems encounter by pre-service teachers on the use of mobile-phone in teaching sense-organ in Biology in Senior Secondary Schools in Minna Metropolis?

| SN | ITEMS | SA | A | SD | D |
|----|-------|----|----|----|---|
| 1. | Inadequate teaching materials. | | | | |
| 2. | Inadequate time for the practical teaching. | | | | |
| 3. | Inadequate power supply. | | | | |
| 4. | Lack of conducive environment for the teaching process. | | | | |
| 5. | Lack of network. | | | | |
| 6. | Lack of knowledge on how to use search engines. | | | | |
| 7. | Unavailability of online diagrams for teaching process. | | | | |
| 8. | Inadequate provision of data for browsing. | | | | |
| 9. | Weak service network from network provider. | | | | |
| 10. | Lack of ICT facilities which would have been useful for Educational purposes. | | | | |