PREDICTORS OF INFORMATION AND COMMUNICATION TECHNOLOGY USAGE AMONG SCIENCE TEACHERS IN FEDERAL UNITY SCHOOLS IN NIGERIA

BY

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ABSTRACT

Information and Communication Technology (ICT) has great potential in transforming the traditional and teacher-centred mode of science teaching in schools into a modern and rich student-centred mode; hence, the encouragement of its usage in unity schools across Nigeria. Regardless of its encouragement and adoption in unity schools, the level of its usage among science teachers is still relatively low with negative consequences on the teaching and learning of science subjects. Previous studies on factors attributable to such low usage among science teachers have concentrated more on the relative influence of the predicting factors than their combined effects. This study, therefore, examined the extent to which demographic factors (age, gender, subjects' taught, educational qualification, teaching experience and ICT use-experience), computer self-efficacy (CSE), attitude towards ICT, ICT access and existence of school library media centre (SLMC) predicted ICT usage among science teachers in federal unity schools (FUSs) in Nigeria.

The study adopted the correlational research design. The multistage sampling procedure was adopted to select 464 science teachers and 25 school library media specialists from 25 selected FUSs in Nigeria. Six instruments were used: ICT Availability Scale (r=0.72), ICT Access Scale (r=0.83), Computer Self-Efficacy Scale (r=0.85), ICT Attitude Scale (r=0.65), ICT Usage Scale (r=0.89) and Role of SLMC Scale (0.75). These were complemented with an observation checklist. Ten research questions were answered and four hypotheses tested at 0.05 level of significance. Data were analysed using descriptive statistics, Pearson's product moment correlation and multiple regression.

Demographic variables, CSE, attitude towards ICT, ICT access and existence of SLMC significantly predicted ICT usage ($F_{(10, 342)} = 21.17$) and jointly accounted for 36.4% in the total variance of the dependent measure. Their relative contribution were: attitude towards ICT (β= .343, t=4.83), teaching experience (β=-.334, t=5.189), educational qualification, (β=-.275, t=5.26), computer self efficacy, (β=.165, t=2.34) ICT use- experience (β=.130,t=2.53). Observed relationships among the demographic variables and ICT usage were: age (r = -.301), gender (r = -.033), subjects taught (r = -.162), educational qualification (r = -.110), teaching experience (r = -.277) and ICT use- experience (r = .188). ICT usage was significantly positively related with CSE (r = .328), attitude towards ICT (r = .470), ICT access (r = .457) and existence of SLMC (r = .231).

Demographic variables, CSE, attitude towards ICT, ICT access, ICT use-experience and existence of SLMC slightly predicted ICT usage among science teachers in federal unity schools in Nigeria. To ensure high level of ICT usage by science teachers and improve the teaching and learning of science subjects in federal unity schools in Nigeria, adequate attention should be given to science teachers' demographic variables and other factors considered in the study. In addition, SLMC should be adequately equipped so as to function effectively in providing support for efficient ICT usage by science teachers in Nigeria.

Key words: ICT usage and access, Science teachers in Nigerian federal unity schools, School library media centre.

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"An Attitude of Gratitude Makes Ones Life a Beautitude" Anon

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DEDICATION

This thesis is solely dedicated to the Almighty God who gave me the grace for the completion of the research, my father, Comrade Francisco Olutunde Aramide of blessed memory who had always wished that I have a Doctorate degree, my wife who has always been a source of encouragement to me, my mother, a pillar of support and to all those who continue to do good despite man's injustice.

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CERTIFICATION

I hereby certify that this thesis was carried out under my supervision by Kolawole Akinjide Aramide at Abadina Media Resource Centre, Faculty of Education, University of Ibadan, Ibadan, Nigeria.

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Prof D.F. Elaturoti Date

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Science is a universal subject with no boundaries and the claim for its inclusion in the school curriculum was established based on its ability to revolutionise human life as well as the society. Evidence on relevance of science in schools suggests that science has been found to have influence on every field of human endeavour. Prakash (2005) while arguing for the inclusion of science in school curriculum described science as a subject that provides unique training in observation and reasoning for students and enables them to form an objective judgment. This is corroborated by Oak (2011) who emphasised that science is taught to enable students to explore their world and discover new things.

Science as a discipline allows students to explore their world and discover new things and teaches them the necessary skills that they can use in other areas of their lifes. It covers the broad field of knowledge that deals with observed facts and the relationships among facts (Diy, 2012). Science has enormous influence on humanities as it provides the basis for modern technology – the tools, materials, techniques, and sources of power that make our life and work easier.

Science as a subject and discipline has contributed immensely to the development in our society and has helped the modern society to be able to respond effectively to changing social, economic, and environmental trends to meet sustainability goals. Olatoye (2007) emphasized that science will continue to be a tool for explaining interactions between human activities and our environment while also proffering solutions to many problems that may arise as a result of human activities.

Hassard (2010) presented four arguments to support the teaching and learning of science in schools viz: economic argument, democratic/humanistic argument, skills argument, and cultural argument. The economic argument of teaching science in schools is based on the need to produce more scientists to meet the supply demands in science-related fields. The economic argument is considered as the dominant reason why science is taught especially in advanced and prosperous countries (Hassard, 2010).

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The democratic/humanistic argument for the introduction of science in schools is based on the need to prepare students to be informed citizens and knowledgeable consumers while the skills argument suggests that the study of science instills certain transferable skills that are important to students' understanding of science (Hassard, 2010). The skills argument claims that students should be involved in hands-on activities, be able to analyse data, and plan open-ended investigations. In order, to achieve the development of these skills in students, teachers are therefore expected to use inquiry-based approach to teaching and help students learn to practise inquiry (Science as Inquiry, 2011). Moreover, the cultural argument of teaching science in schools suggests the need to consider the history and philosophy of science, and try to bring to students' experiences how science discoveries are made.

Despite the relevance of science subjects, many students regard science as a difficult subject or discipline to venture into and this is mostly reflected in the poor academic achievement usually recorded in science subjects. Studies {Jenkins, 2008) on academic achievement of students in science subjects revealed that there is need for teachers to change their mode and style of teaching. The teaching of science at various levels in most developing countries, including Nigeria, still retains the old conventional approach (Olatoye, 2007, Ajayi and Ekundayo, 2009). Jenkins (2008) suggested that the introduction of ICT resources in the teaching of science may bring about the required change in the style and mode of teaching science in schools.

The relevance and importance of ICT in the teaching of science has been discussed and advanced at relevant fora. British Educational Communications and Technology Agency, BECTA (2010) and Association for Science Education (2013) recommended the use of ICT in the teaching of science subjects, as a result of observation that reveals that science teachers are not using ICT for teaching and learning of science.

Information and communication technology as described by Abdul-Salaam and Onakhume (2011) are computer based tools used by people to work with information and communication processing needs of an organisation which covers computer hardware, software, the network and other digital devices like video, audio, camera and so on which convert information (text, sound, motion etc) into digital form. According to them, information and communication technology as tools within the school environment include use for school administration and management, teaching

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and learning of ICT related skills for enhancing the presentation of classroom work, teaching/learning repetive tasks, teaching/learning intellectual, thinking and problem solving skills, stimulating creativity and imagination, for research by teachers and students and as communication tool by teachers and students.

The various ICT facilities used in the teaching learning process in schools according to Ofodu cited in Ajayi, Ekundayo and Haastrup, (2009) include; radio, television, computers, overhead projectors, optical fibres, fax machines, CD-Rom, Internet, electronic notice board, slides, digital multimedia, video/ VCD machine and so on. In the context of this study, ICT refers to both hardware and software resources that can be used in facilitating teaching and learning within the school environment such as computers, instructional video/audio tapes, multimedia projectors and resources, word processor, power point presentation software, computer aide instruction, simulation, models and graphical visualising tools, among others.

Ramayah (2006) emphasised that ICT provides access to a huge range of resources that are of high quality and relevant to scientific learning. In some instances, the multimedia resources available enable visualization and manipulation of complex models, three dimensional images and movement to enhance understanding of scientific ideas. Lua and Sim (2008) reiterated the capability of ICT in widening the range of materials that can be used in teaching and learning to include text, still and moving images and sound, and increases the variety of ways that the material can be used for whole class and individual learning. Therefore, science teachers have the opportunity of meeting the needs of students with different learning styles as well as being creative in their teaching through the use of ICT.

The National Council for Educational Technology, UK listed the benefits of ICT use in science teaching to include; making students learning more effective; increasing students' motivation; enhancing students' sense of achievement; providing students with access to richer sources of data and information and helping students to become autonomous learners among others (Hogarth, Benneth, Lubben, Campbell and Robinson, 2006). The potentials of ICT to improve teaching and enhance institutional administration had been established in the literature (Lavonen and Ampuja, 2008; Turlo, Karbowski and Shizewski, 2008). Thus, the use of ICT as a tool for enhancing

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teachers' instruction, and as a catalyst for improving access to quality education in formal and non-formal settings has become a necessity.

The introduction of ICT into the educational system in Malaysia has been hailed as a major catalyst of the long dreamed-about educational revolution (Ramayah, 2006), especially as ICT resources are designed to serve as a major vehicle for improving the efficiency and effectiveness of teaching in educational institutions. Shabaya (2009) in his study on the integration of ICT in teaching and learning in Kenya asserted that the which had been previously confined to training individuals had gradually developed into a new dimension affecting the teaching and instructional delivery process in a direct and positive way. This is making schools in Kenya to invest heavily in acquiring technologies that can be used in teaching, learning and research though researches still show that the potential users (that is teachers, students, researchers et cetera) may still not be using them as expected.

While the role of ICT in teaching is rapidly becoming one of the most important and widely discussed issues in contemporary education policy, it should be noted that the basis of discussion should be on its effective use in teaching to achieve the desired goals. The demand for quality teaching from stakeholders in education (learners, employers et cetera) has created a need to re-define teaching in schools in such a way that teaching is no longer restricted to scheduled classroom (same place and same time) where the teacher imparts knowledge to learners but has become flexible, asynchronous and controlled by the learner (any place and anytime). Thus, proper use of ICT would encourage flexibility in teaching by removing the rigidity in the traditional teaching and learning process, and also encourage critical thinking that cultivates deep learning where learners learn independently.

In addition, studies (Czerniewicz and Brown, 2007; Shabaya, 2009) have revealed that ICT can have a positive measurable impact on teachers' delivery of content and instructions while Olatoye (2007) described ICT as a powerful tool that strengthens teaching and provides facilities for teachers' repertoire, thereby enabling them to meet individual learner's needs. In corroborating this assertion, Abolade and Yusuf (2005) concluded that ICT allows for networking among teachers in Nigeria, where teachers are more connected with each other to exchange ideas, share resources, and improve teaching practices as well as provide opportunity for connecting schools to the world,

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as learning is expanded beyond the classroom. Thus, relevant real life context can be established. With ICT, teachers can access information and resources, and they can communicate with experts and peers and make useful contributions to knowledge through electronic publications.

The dramatic changes brought about by the application of ICT into the education sector go beyond mere increase in the number of computers appearing in schools to a more fundamental changes in the method of teaching, thus, the role of ICT in schools is shifting dramatically (UNESCO, 2000). Kozma (2005) noted that ICT is challenging traditional conception of teaching; and by reconfiguring how teachers gain access to knowledge, has the potential to transform teaching and learning processes. Information Communication Technology (ICT) provides an array of powerful tools that may induce the transformation of the present isolated, teacher-centred and text-bound classrooms into rich, student focused, interacting knowledge environments.

Although efforts are being put into the use of ICT in teaching in secondary schools in Nigeria, usage has not really caught up with the teachers (Adomi and Kpangban, 2010). For instance, in Nigeria, efforts at encouraging the use of computers and related resources in teaching and learning in schools started with the evolvement of the National Policy on Computer Education (NPCE) document in 1988. The document contained information on the application of computer at various levels of the country's education, issues related to basic objectives, hardware and software requirements, teacher training, specifically, for the secondary school level (Federal Ministry of Education, 2004).

The implementation of the policy was kick-started with the introduction of computer systems in the Federal government unity schools (FUSs) as well as the training of about one hundred and ninety seven (197) teachers from these schools on the use of computers for teaching. However, it was observed that there has been no significant improvement in the use of computers and related resources for teaching in the FUSs despite government efforts (Federal Ministry of Education, 2004). This is corroborated by Oshionebo and Ashang (2011) study on information and communication technologies' integration in secondary schools' curriculum in Nigeria which reported that despite the roles ICT can play in education, secondary schools in

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Nigeria have yet to extensively adopt them for teaching and learning; and that efforts geared towards integration of ICT into the secondary schools curriculum have not really taken off beyond the distribution and installation of school computers. Also, Abdul-Salaam and Obakhume (2011) findings reported that despite the investments on ICT infrastructure, equipment and professional development to improve education, effective integration of this technology into classroom practices poses a challenge to teachers, administrators and policy makers in Nigeria.

Furthermore, researches conducted in many schools in Nigeria had established that most of them are not effectively adopting and using ICT to support learning, teaching and management as intended (Manduku, Kosgey, and Sang, 2012). As with many developing countries (including Nigeria), this may be due to various factors associated with the use. Unavailability, low accessibility, poor motivation of the teachers, inadequate knowledge and command of the usage as well as teachers' negative attitude towards ICT have been found to lead to underutilisation of ICT in teaching (Thong, Hong, and Tam, 2002, Harrison, 2010; Nyambane and Nzuki, 2014).

Apart from these factors, the researcher is of the opinion that other factors that have to do with the teachers' characteristics and attitude may also determine the extent of use or non-use of ICT by teachers. According to Manduku, Kosgey, and Sang (2012). The success of integration and effective adoption of ICT is not dependent on the availability or absence of one individual factor, but is determined through a dynamic process involving a set of interrelated factors.

In this respect, the teachers' demographic variables, access to ICT resources, teachers' attitude toward ICT use, and teachers' self-efficacy level can play an important role in ICT use by science teachers (Ramayah, Jantan, and Bushra, 2003). Kennewell, Parkinson, and Tanner (2000) study concluded that further researches on ICT use should explore the relationship between access to ICT resources and ICT use. They strongly feel that "access' is a major factor that may influence the use of ICT by teachers. This refers not only to the number of computers but also the placement of the equipment where teachers can have access and use it to support teaching and learning.

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Kennewel, Parkinson, and Tanner (2000) emphasised that ICT can be placed in the classroom or any other place where it can easily be accessed in order to maximise the opportunities for curriculum activity. This is corroborated by Awoleye, Siyanbola, Egbetokun, Yesufu and Adewoyin (2008) findings from their study on pattern of computer and internet use among teachers in higher institution which identified computer room, home, library and cybercafés as places where teachers can have access to ICT facilities.

Information and Communication Technology (ICT) holds out the opportunity to revolutionise pedagogical methods, expand access to quality education, and improve curriculum implementation and the management of education systems in Nigeria (Adeogun, 2002; Oshionebo and Ashang 2011; Eberendu, 2014). Niederhauser and Stoddart (2001) described the various ways in which teachers use ICT in teaching. According to them, teachers who adhered to traditional transmission approaches to instruction tended to use skill-based ICT (e.g. drill and practice) while teachers who supported constructivist views of teaching and learning used skill-based as well as open-ended ICT (e.g. simulations, virtual laboratory, word processing et cetera).

However, while it may be expected that ICT availability would result in corresponding usage, evidence exists that reveals that investing in ICT does not always result in usage in teaching (Oshionebo and Ashang, 2011). As a matter of fact, it has been further observed that basic and post basic institutions in Nigeria are lagging behind as far as "in-class use" of ICT resources for teaching is concerned. Also, it is established that developed countries are decades away from their developing counterparts in regard to technology availability and accessibility. This is corroborated by Nyirongo (2009) that emphasised that developing countries have lagged not just economically and socially, but more recently, technologically as well. However, despite the prevailing problems that basic and post basic schools in these environments face to balance basic needs of running these schools and the technological needs, immense efforts are being taken to provide ICT to these schools as a step towards enabling them use and apply ICT in their teaching.

Moreover, several studies have indicated the benefits of ICT use in education and have found consistent positive and moderately high achievement gains at all

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educational levels from computer mediation in school subjects, particularly sciences and mathematics (Anderson, 2004; Hogarth, Benneth, Lubben, Campbell and Robinson, 2006; Lavonen, 2008; Europennet, 2013; Edward and Aladejana, 2014; Fakomogbon, Adebayo, Adegbija, Shittu, and Oyelekan, 2014). Other key benefits of ICT in teaching include: attraction of interests and engagement of students in teaching and learning activities; provision of access to resources (webpages, texts, databases, videos, and demonstration) that are of high quality and relevant to teaching and learning; enabling manipulation of complex models and images to enhance understanding of scientific ideas; promotion of greater collaboration among students for communication and sharing of knowledge; accurate feed backs to students that contributes towards positive motivation. Furthermore, ICT enable teachers' opportunities to use tools and applications in preparing lessons and teaching science (Lavonen, 2008; European Schoolnet, 2013).

In many developed countries, classroom use of ICT resources for teaching science has increased dramatically in recent years and ICT has proved to be a very effective tool in a variety of situation as far as the teaching of science is concerned. The most common use of ICT in teaching science involves the use of applications where computers are used to simulate or animate specific scientific phenomena which enable pupils to engage in hands-on-activities which are directed toward increasing their understanding and insight of the principles involved (Lavonen, 2008). This is corroborated by Kirschner and Davis, (2003) and Abdallah and Albadri (2010) as they emphasised considerable additional advantage to be gained by the integration of the various ICT and concepts available in teaching and laboratory experiments. In addition, ICT based teaching applications and tools provide an opportunity for a greater level of integration of different science disciplines.

The use of ICT in science teaching was broadly classified into six different types of activities which include: information gathering (which involves using Internet browsers and multimedia Compact Disk Read Only Memory), practical work.(which involves using interfaces and data-logging software), simulations (which involves virtual experiments and visual aids, simulating and helping to explain phenomena), data handling (for example using spreadsheets and graphing software to analyse data), use of mathematical models (for example exploring relationships, predicting

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and testing theories), and communication (for example publishing; record keeping; power point and web authoring), (Godwin, 2004; Edwards and Aladejana, 2014). The use of above applications in the teaching of science and mathematics can make the teaching of science subjects more effective.

Unfortunately in most classrooms, especially in developing countries, the traditional patterns of science education have remained largely unchanged as they exhibited the typical pedagogical pattern which reflects an authoritarian, didactic approach to classroom management. The natural curiosity, and eagerness, of pupils to understand their environment is often diminished by teaching method that discourages inquiry/discovery because of a combination of traditional factors and lack of expertise in the teaching of science. In Nigerian classrooms, traditional patterns of education have remained largely unchanged in most schools (Adams, 2005).

With all the resources invested in acquiring and developing ICT resources for teaching and instruction delivery in Nigerian schools, literature search and observations revealed that ICT resource still remain largely unused or seriously underutilised by teachers especially in schools in Nigeria where efforts are made to use ICT in teaching (Federal Ministry of Education, 2004, Oshionebo and Ashang (2011). This study, therefore, intends to investigate some factors that may predict use of ICT and extent of use of ICT in teaching by science teachers in Federal Unity Schools (FUSs) in Nigeria.

Thus, in order to appropriately use ICT in teaching and acquire the relevant benefits, it is important to examine some major factors that can affect the use of ICT for teaching such as the demographic variables of teachers, teacher's attitude toward ICT, access to ICTs, and teacher's computer self-efficacy. These factors, may determine to a large extent, the success or failure of ICT use in teaching in schools.

Demographic variables have been described as major factors that may influence or predict the use of ICT resources by individuals. Among the demographic factors that are often cited as having an influence on ICT use include: gender; income; level of education, skills and age (Inan and Lowther, 2009; UNDP, 2011). For the purpose of this study, demographic variables such as age, gender, teaching experience, subject(s) taught, computer use experience, and educational qualification were considered.

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Computer self-efficacy (CSE) has been described as one of the major factors that exert great influence on the decision of individuals to use computer and related resources. In order for teachers to use ICT successfully for teaching, they need to have the self-confidence in computer related task (Compeau and Higgins, 1995). Hew and Brush (2007) concluded that teachers with higher computer self-efficacy are likely to be more enthusiastic to use ICT in their classroom than those with lower self-efficacy. In the context of this study, teacher's computer self-efficacy would mean the belief by a particular teacher that he or she has the ability to use ICT in teaching. For the purpose of this study, the computer self-efficacy of teachers was trichotomised viz: high, moderate, and low.

Attitude as a factor that may influence individual's decision to use ICT reflects feelings of favourableness or unfavourableness toward using ICT. In the context of this study, teachers' attitude towards ICT' usage described the behaviour of teachers toward ICT use for teaching. Attitude guides behaviour and refers to the way individual responds to and is disposed towards an object (Ajzen and Fishbein, 2005; Hew and Brush, 2007; Nyabame and Nzuki, 2014). Such attitude may be positive or negative. Positive attitude from teachers would draw teachers to the use of ICT in teaching while negative attitude withdraws teachers away from ICT usage. In other words, attitudes, whether positive or negative affect how teachers react to use of technology in an instructional setting.

For teachers to effectively make use of ICT resources in the classroom, they must have easy access to various types of ICT resources (Alston, Miller, Chanda, and Elbert, 2003; Yildrim, 2007; Teo, 2008; Nyabame and Nzuki, 2014). According to Plomp, Anderson, Law and Quale (2009) access describes the extent to which a particular user is able to easily locate particular resources for use as well as the degree of accessibility of accessibility of such resources. It is a factor that can influence the use of ICT resources by the science teachers. The ease of location would determine whether a teacher would use ICT resources for teaching or not and it is expected that easy access to ICT resources would increase the tendency to use such resources and vice versa (Nyabame and Nzuki, 2014).

The role of the school library media centre was described as one which rubs on all the activities that take place within the school environment (Hay, 2006). It is described as

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a positive teaching and learning environment that supports teaching and learning activities where both teachers and students feel comfortable and can pursue their information, ICT use, and recreational interests. Todd (2004) described the school library media centre as a place where the ICT needs for teaching and learning can be met. While many teachers have provided examples of how the school library media centre supported their teaching in the digital age, some others reflected on longer term support provided by the school library media centre, including the provision of ICT facilities, provision of physical facility, as well as the support provided by library staff as key to effective teaching in schools (Lance, Rodney, and Hamilton-Pennel (2005). Commenting further on the role of school library media centre in facilitating ICT-enabled teaching, Todd (2004) reiterated school library media centre's support that may be given towards facilitating ICT use in teaching to include; ICT resourcing, and technical assistance on how to maximise the use of ICT in teaching by teachers. This is also supported by Kalejaye, Fabunmi and Adeoye, (2011) findings which reported the primary role of SLMC as that of supporting the application of technology in education, provision of expertise, and facilitation of the adoption of both technology in education and technology for education.

The adequacy and relevance of ICT facilities provided by the school library media centre may also determine the extent at which teachers would use the facilities for teaching However, while quantity and level of ICT continue to improve in many schools, provision of equipment alone is likely to be of limited value unless more is understood about the interactions and processes engendered by using the technologies in different settings, and how teaching strategies to enhance students' learning might be developed effectively through them (Kalejaye et. al., 2011).

There had been several studies on the use of ICT by teachers such as Aladejana (2007), Jarosievitz (2009), Hernesey, Harrison, and Wimkote (2010), Oye, Iada, and Rabin (2011), and Jarosievitz (2012). Most of these studies focused on teachers in tertiary and technical educational institutions with only few focusing on teachers in secondary schools outside the shores of Nigeria, and only few focusing on ICT use in science teaching generally. None of the few studies on the use of ICT for science teaching focused on specific science subjects such as physics, biology, chemistry, and mathematics. Also, several studies on the influence of computer self-efficacy and

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attitude on ICT use by teachers viz: Albirini (2006), Sadik (2009), Yildirin and Kaban (2010), Obakhume (2011), Awan (2011), and Simsek (2011) focused only on teachers in tertiary institutions as the researcher has not been able to lay hands on any study on investigating the extent to which computer self-efficacy and attitude towards ICT use among science teachers in secondary schools and colleges especially in Nigeria.

Furthermore the researcher is unaware of any study that has investigated demographic variables, computer self-efficacy, attitude, and ICT access as factors predicting ICT use among science teachers in Federal unity schools (FUSs) in Nigeria. Most importantly, there seems to be no study on the role of school library media centre in ensuring the use of ICT by science teachers in schools. The researcher is also unaware of any study that has combine demographic variables, computer self-efficacy, attitude toward ICT, and ICT access as factors predicting the use of ICT by science teachers in secondary schools in Nigeria. Therefore, the focus of this study is to investigate the extent to which demographic variables, computer self-efficacy, attitude towards computer, ICT access, and role of SLMC predict ICT use among science teachers in Federal Unity Schools in Nigeria.

The goal of this research is to embark on an analysis of the relationship between demographic variable, CSE, attitude, ICT access, ICT relevance, and role of school library media centre, and science teachers' use of ICT resources in Federal Unity Schools (FUSs). These findings may reveal the answers to the questions relating to how demographic variables, CSE, attitude, ICT access, and school library media centre role affect the use of ICT in teaching by the teachers. This study is based on the assumption that teaching with ICT is gaining acceptance among teachers in FUSs in Nigeria.

1.2 Statement of the Problem

Information and communication technology (ICT) has been viewed as an agent of change just as stakeholders in education have expressed the need for teachers to use and integrate ICT in the classroom. This has been against the backdrop that Federal Government of Nigeria and administrators of private schools are investing resources through the provision of computers and training of staff in a bid to increase ICT availability to teachers for the purpose of teaching and learning. This effort of the

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Federal Government was kick-started with the provision of ICT facilities in Federal Unity Schools as well as the training of staff in these schools. Also, the need to change the mode and style of teaching of science in schools, through the use of ICT have been emphasised by various studies.

These developments in the Nigerian education sector have placed a lot of pressure on educators to transform schools through technology. But while it may be expected that ICT availability would result in corresponding use, it was observed that most teachers in the FUSs and by extension in secondary schools in Nigeria do not make use of ICT during instruction delivery (Oshionebo and Ashang, 2011; Edwards and Aladejana, 2014; Fakomogbon et. al., 2014). This lack of use may be seen to be as a result of some other factors other than availability such as the computer self-efficacy level of teachers, attitude of teachers, relevance and adequacy of ICT facilities, teachers' opinion on the usefulness as well as on the ease of use of ICTs. The roles of SLMC in providing access learning resources including ICT resources as well as in provision of support to facilitate the use of learning resources have been established in literature (Ramayah, 2010; Kalejaye et. al., 2011). However, the extent to which the SLMCs in many schools have been able to live up to these roles is still in question as observations have revealed that many SLMCs may not be playing their roles effectively.

Moreover, reports from the Federal Ministry of Education revealed that the use of computers and related technologies is still very low and below expectation in Nigerian schools (Federal Ministry of Education, 2004) while observation also revealed that teachers in the Federal unity schools are not making use of ICT facilities in teaching especially in science subjects despite the availability of these resources. This study therefore examined the extent to which demographic variables, teacher's computer self-efficacy, attitude toward ICT, ICT access, as well as roles of school library media centres would predict ICT use for teaching by science teachers in FGUSs in Nigeria.

1.3 Objectives of the Study

The broad objective of this study is to investigate the extent to which demographic variables, computer self-efficacy, attitude of science teachers, and access predict their

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use of ICT in teaching at the Federal Unity Schools (FUSs) in Nigeria. The specific objectives of the study are to:

i. find out demographic factors that predict ICT use by science teachers in Federal Unity Schools s (FUSs) in Nigeria;
ii. find out the location of ICT access and degree of ICT accessibility among science teachers in FUSs in Nigeria;
iii. establish the computer self-efficacy level of science teachers and their attitude towards ICT;
iv. investigate the attitude of science teachers in FUSs toward ICT usage;
v. ascertain the purpose and frequency of ICT usage among science teachers in FUSs in Nigeria;
vi. ascertain the level of ICT resources availability and accessibility in school library media centres (SLMCs) in FUSs in Nigeria;
vii. investigate the role of school library media centre (SLMC) in facilitating ICT use by science teachers in FUSs in Nigeria;
viii. determine the relationships among demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMC, and ICT use by science teachers in FUSs in Nigeria; and
ix. investigate the relative contribution of demographic variables (age, gender, subjects taught, teaching experience, educational qualification, and ICT use experience), computer self-efficacy, attitude towards ICT, ICT access and role of SLMC to ICT usage among science teachers in FUSs.

1.4 Research Questions

i. The following research questions were answered in the study
ii. What demographic factors predict the use of ICT by science teachers in Federal Unity Schools (FUSs) in Nigeria?
iii. What is the location of ICT access and degree of ICT accessibility among science teachers in FUSs in Nigeria?
iv. What is the computer self-efficacy level of science teachers in FUSs in Nigeria?
v. What attitude do science teachers in FUSs in Nigeria exhibit toward ICT use?

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vi. What is the purpose and frequency of ICT usage among science teachers in FUSs in Nigeria?

vii. What is the level of ICT availability and accessibility in SLMCs in FUSs in Nigeria?

viii. What roles are being played by SLMC in facilitating ICT usage among science teachers in FUSs in Nigeria?

ix. What are the relationships among demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMC, and ICT use by science teachers in FUSs?

x. What is the relative contribution of demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience), computer self-efficacy, attitude towards ICT, ICT access, and role of SLMCs to ICT usage among science teachers in FUSs?

1.5 Research Hypotheses

The following hypotheses were tested at 0.05 level of significance:

H_{01}. There is no significant joint relationship among demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMC and ICT use among science teachers in FUSs.

H_{02}: There is no significant relative contribution of demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience to ICT usage.

H_{03}: There is no significant joint correlation among demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience and ICT usage.

H_{04}: There is no significant joint correlation among demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience), computer self-efficacy, attitude toward ICT, ICT access, role of SLMC and ICT usage.

1.6 Scope of the Study

This study investigated the relationship among demographic variables, CSE, attitude toward ICT, ICT access on ICT use by science teachers in FUSs in Nigeria. The scope covers the belief of science teachers that they can use computer and related resources

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for the teaching of science subjects and disposition of the science teachers toward the use of ICT resources for teaching. On the other hand, the study focuses not only on the degree of accessing the ICT resources but also on the placement of the equipment where teachers can have access and use it to support teaching.

The science subjects included in this study are the basic science subject which include physics, chemistry, biology and mathematics and all the teachers teaching these subjects at the senior secondary school level in FUSs are included in the study. The study intends to identify the extent to which demographic variables, computer self-efficacy, attitude towards ICT by teachers, ICT access and the role played by school library media centre in the provision of ICT facilities predict the use of ICT in teaching of science subjects. Also, the study intends to identify specific applications used in the teaching of science subjects. Though the study aimed at determining the relationship of demographic variables, computer self-efficacy (CSE), attitude toward ICT, ICT access, role of school library media centre, and ICT attitude with the use of ICT in teaching, it will consider the extent of ICT use by science teachers in FUSs.

1.7 Significance of the Study

This study finds relevance in the growing literature on factors predicting ICT adoption and use in education. The findings of this study would provide a basis for making recommendations on ICT facilities to be made available, and location of access for the teaching of science in secondary schools. The findings of this study would also contribute to informed decision making and the basis for recommending effective strategies for ICT use in the teaching-learning of science subjects in FUSs in Nigeria.

Moreover, findings would provide insight on the roles of the school library media centres in the provision of ICT facilities to support teaching in the Nigerian education sector. It is on the basis of this that the study examined some variables that may affect the use of ICT for teaching with the belief that a proper understanding of the influence these variables might have on ICT facilities use' would enable the proper management of such variables to enable maximum effective utilisation of ICT in teaching at the secondary school level in Nigeria.

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1.8 Operational Definition of Terms

Computer self-efficacy: this is defined as science teachers' belief in his/her ability or capacity to effectively use computers and computer applications for teaching. It explains the belief of science teachers that they can conveniently use ICT effectively in the teaching of science subjects. This was measured by making a list of statements to which the respondents agree or disagree with.

Degree of accessibility: refers to the frequency of accessing ICT facilities for use by science teachers.

Demographic variables: this describes the personal and background information of science teachers such as age, gender, work experience, computer use experience, subject(s) taught, and educational qualification

Federal Unity Schools: these are secondary schools established, owned and controlled by federal government of Nigeria. They include Federal government colleges (FGCs), Federal government Girls colleges (FGGCs), and Federal science technical colleges (FSTCs).

ICT access: ease of locating of ICT facilities for use by science teachers in FUSs

ICT attitude: refers to the kind of feelings that science teachers have toward the use of computer and related resources. Such feelings may be favourable or unfavourable. Favourable feelings from teachers toward computer refer to positive attitude while unfavourable feelings describe a negative attitude from the teachers toward computer as used in the study.

Location of Access: refers to the place of locating ICT facilities for use by science teachers in FUSs

School Library Media Centre: a place within the school environment that contain organised collection of teaching and learning resources including ICT for the use of both teachers and students

Science teachers: refer to teachers that teach Physics, Chemistry, Biology, and Mathematics in the Federal unity schools (FUSs).

Use of ICT: refers to the application of ICT for teaching by FUSs science teachers.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature relevant to the study. The literature was reviewed under the following headings:

2.2. Information and Communication Technology Use in Education

2.3. ICT use in Teaching and Learning of Sciences in Secondary Schools

2.4 Demographic variables and ICT use in Teaching in Secondary schools

2.5 Computer Self-efficacy and ICT use by Teachers in Schools

2.6 Attitude and ICT Use for Teaching in Schools

2.7. ICT Access and ICT use by Teachers in Schools

2.8 The role of School Library Media Centre in the Provision of ICT Resources for Teaching in Schools.

2.9 Policy Framework for ICT Use in Education in Nigeria

2.10 Theoretical Framework

2.11 Conceptual Model

2.12 Appraisal of Literature Review

2.2 Information and Communication Technology Use in Education

The introduction of information and communication technology (ICT) into the education sector has created a new social order just as its use is spreading rapidly into daily life, and directly affecting people's ideas and behaviour. Information and communication Technology has heralded the development and implementation of new and innovative strategies in education (Asain and Koha, 2006). Educators who advocated ICT use in the education process believed it will improve teaching and prepare teachers to effectively participate and deliver in the twenty first century workplace. Thus, recognising the impact of ICT on the education and everyday life, educational institutions try to restructure their education programs and classroom facilities, in order to minimize the teaching and learning technology gap between today and the future. Educational institutions require effective integration of ICT into existing context in order to provide learners with knowledge of specific subject areas, to promote meaningful learning and to enhance productivity.

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Education today relies heavily on technology and over the past decade schools have invested greatly in computers, networking and related technologies to enhance teaching and learning processes (Sylvia and Sylvia, 2002). In other words, technology has become a prevalent part of the educational culture and its impact on the changing face of curriculum can no longer be dismissed (Bennedeto, 2005). As a result of the diffusion of computer in schools, teachers' role has also changed, such that textbook is no more the only resource for the student's knowledge. Acknowledging the benefit of technology in enhancing education Privateer (2002) emphasised that expenditure to supply schools with computers and related technologies has increased throughout the world.

Furthermore, it is worth mentioning that the present level of ICT development permits the successful application in education just as the use of computer is very important in the realization of creative potential of student. It can even be more efficient in individualizing the classroom work with the help of adaptable curricula. Studies of ICT development in and for education in both developed and developing countries identified four broad approaches through which educational systems and individual institutions typically proceed in their adoption and use of ICT. These stages that may be conceived as a continuum or series of steps otherwise known as continuum model include: emerging, applying, infusing and transforming stages/steps (Kozma, 2000).

The emerging stage focused on the initial stage of ICT acquisition and exploration by schools/educational institutions. According to Rogers (1999) the emerging approach involves teachers' personal use of ICT such as the use of word processing to prepare worksheets, locating information on CD-ROMs or on the internet or by e-mail. The emerging stage lays emphasis on training in a range of tools and applications, and increasing teachers' awareness of the opportunities for applying ICT to their teaching in the future. The applying stage involves the use of ICT for tasks already carried out in institutional management and in the curriculum. Rogers (1999) emphasised that in the applying stage, teachers use ICTs for professional purposes, focusing on improving their subject teaching in order to enrich how they teach with a range of ICT applications. This stage often involves teachers integrating ICT to acquire specific subjects skills and knowledge, beginning to change their teaching methodology in the classroom and using ICT to support their training and professional development. The

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infusing stage, which is the third stage of ICT development for education involves integrating or embedding ICT across the curriculum, and also to seeing in the schools the employment of a range of computer-based technologies in laboratories, classrooms, and administrative offices. Teachers explore new ways in which ICT changes their personal productivity and professional practice. The curriculum begins to merge subject areas to reflect real-world applications.

According to Rogers (1999) the infusing approach supports active and creative teachers who are able to stimulate and manage the learning of students, integrating a range of preferred learning styles and uses of ICT in achieving their goals. Teachers also fully integrate ICT in all aspects of their professional lives to improve their own learning, as well as, the learning of their students. The last stage which is the transforming stage embedded schools that use ICT to rethink and renew institutional organization. The focus of the curriculum at the transforming stage is learner-centred that integrates subject areas in real-world applications. In the transforming approach to ICT development, teachers regard ICT as a natural part of everyday life of the schools that they begin to look at the process of teaching and learning in new ways (Rogers, 1999). Thus, the emphasis changes from teacher-centred to learner-centred. Teachers and students expect a continuously changing teaching methodology designed to meet individual learning objectives.

Moreover, Nicolle (2005) corroborated Kozma (2000) views by giving an interesting overview of five stages of the application of ICT in education. These five stages include: familiarisation, utilization, integration, re-orientation, and evolution. According to them, teachers at the first two stages were becoming familiar with ICT and trying it out. Teachers designating certain tasks to the technology and starting to rely on it characterized the third stage. The last two stages were described as marked by a change in focus from teachers' instruction to students' learning.

The rapid growth in Information Communication and Technology (ICT) resources have brought remarkable changes in the twenty-first century, as well as affected the demands of modern societies (Jamieson-Proctor, Burnett, Finger and Watson, 2006). Information communication technology has transformed the manner teachers teach as well as the way students learn (Bayindir and Inan, 2009). The use of Information and Communication Technology (ICT) in teaching and learning can enhance curriculum

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delivery, and concurrently improve the quality of education, provided that there is appropriate attention to pedagogy (Louw, Muller, and Tredoux 2008; Bytheway, Sadeck, Dumas, Chigona, Chigona, Mookets, Rega, and Fanni 2010). Therefore, there is a growing demand on educational institutions around the globe to use ICT to teach the skills and knowledge students need for the 21st century (UNESCO, 2002).

Jegede (2008) described ICT as an essential ingredient for creating 21st century teaching and learning environment. However, despite the apparent benefits derivable from the use ICT for educational purposes, studies have shown that the teaching and learning potential of ICT is deprived due to the fact that many teachers and students are still not fully literate (Lua and Sim, 2008). The ways ICT resources have been used in education can be clearly divided into two broad categories viz: ICT for education and ICT in education (Olakulehin, 2007). Information communication technology for education refers to the development of ICT specifically for teaching/learning purposes while ICT in education involves the adoption of general components of technologies in the teaching process (more specifically, often for the training of teachers in the use of ICT for teaching.

The role of teachers is pivotal in the use of ICT in education, as is the case with most educational innovation. (Demitriadis, Barbaras, Molohides, Paleigeorgious, Psiltos, Vlahavas, Tsoukalas, and Pombortsis 2003). Information communication technology is considered to have the power to improve teaching and learning in schools (Lundall, Howell, and Patrick, 2000; Hardman, 2005; Louw et al., 2008). The purported positive impact of technology on education is particularly noted in developing countries where most schools are tackling issues such as lack of resources and under-qualified teachers (Koo, 2008). This perception has resulted in a growing investment in government initiatives implementing ICT in schools in developing countries. Realizing the effect of ICT on the workplace and everyday life, today's educational institutions try to restructure their educational curricula and classroom facilities, in order to bridge the existing technology gap in teaching and learning. This restructuring process requires effective adoption of technologies into existing environment in order to provide learners with knowledge of specific subject areas, to promote meaningful learning and to enhance professional productivity (Tomei, 2005).

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Although, there have been several development projects, experiments and pilot studies on using ICT in schools, the studies about long-term and deep-going effects of ICTs in teaching and learning are still few (Kozma, 2003; Venetzky and Davies, 2001), research evidence showed that something changes in education when ICT are used (Khivlon and Patru, 2002; Kozma, 2000). ICT have also been regarded as a strategy to improve teaching and learning to implement and facilitate the new pedagogy of the information society (Voogtz and Pelgium, 2005). According to Shinohara (2003) Information and communication technology (ICT) can play a major role in ensuring quality education by improving access to education and promoting equity, improving the quality of teaching and learning; and improving management and efficiency of education. As such ICT facilities such as CD-ROM, Radio, and cable television, or a mix of technologies, can be combined with the internet to expand the reach of education. Haddad (2003) also affirmed that the development of ICT has provided improved tools for learning, through a global network and wireless technologies to enable developing countries with little telecommunications infrastructure to connect to the network.

The use of ICT in and for education is rapidly expanding in many countries and is now seen worldwide as both a necessity and an opportunity for improving and enhancing the education offered to citizens across the globe (UNESCO, 2006). The Hwa Chong Education Conference held in March 2010 at Singapore recognised that developments in ICT have opened up exciting new possibilities for teaching practices in order to better engage and excite learners. Also, the International Conference on Teaching and Learning with Technology (2010) stressed the pivotal role that ICT can play in transforming teaching and learning. Information and communication has the potential to enable teachers and students to construct rich, multi-sensory, interactive environments with an almost unlimited teaching and learning potential. Fu (2010) while commenting on the importance and relevance of ICT in teaching and learning reiterated that ICT cannot only be used to expand student's learning horizons but could be a powerful aid to learning and stressed that harnessing the power of ICT goes beyond simply investing in infrastructure but in achieving meaningful integration of ICT into educational practice.

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The idea that teaching and learning can successfully take place using ICT inspires both hope and dismay (Harrison, 2010). According to him, there is hope that more learners can be reached at a more convenience pace than has previously been the case with traditional method of teaching and learning, and dismay that the infrastructures necessary for deploying ICT resources and effective ICT platform are lacking in low-income countries.

According to Ogunlade (2008) the adoption of ICT in education would arouse a new interest among students, educators and educationist and possibly influence the attitude of teachers and students to learning. In other words, ICT has the ability to promote the interests, abilities and learning styles of students with the teachers as facilitator of learning. Salman, Ogunlade, Ogunlade and Adegbami (2013), in their study, reported that the value for the use of ICT in schools in Nigeria is still limited to private, unity schools and few public secondary schools. The most obvious influence of ICT in education has to do with improved efficiency in the administration and management of teaching and learning, including lesson preparation and presentation (Lai and Pratt, 2006). This assertion was supported by Balanksat, Blamire and Kefala (2006) that found ICT as having the capability to enable users to save time and to increase productivity in such activities as preparing and updating daily lessons and maintaining records. In addition, ICT can foster greater collaboration between teachers and students with increased sharing of resources and ideas. However, with respect to pedagogical practice teachers continue a more traditional approach to teaching simply viewing ICT as a tool to support their didactic approach (Rampersad, 2011).

Ali, Jane and Osman (2013) reiterated that the utilisation and integration of ICT tools can definitely assist teachers and students in acquiring competency in their subjects as well as enhance the quality of their teaching and learning experience. On the part of the learner, ICT has the ability to raise learner's self-esteem and confidence through interaction, verbalisation and involvement in collaborative learning. Lai and Pratt (2007), in their own study, concluded that the integration of ICT in educational practice had a number of positive social and motivational effects on learners including increased interest and engagement and that the social and motivational effects were more frequently observed than cognitive and learning effects. Also, part of the improvement brought into teaching and learning in schools include improvement in

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the presentation of work, increased sharing of resources, greater collaboration between students and increased motivation for learning as student-engagement was greater.

Furthermore, the importance of ICT in education cannot be underestimated. Ogunlade (2008) submitted that the adoption of ICT in education would arose a new interest among students, educators, and educationists and possibly influence the attitude of teachers and students learning. In other words, ICT has the ability to promote the interests, abilities and learning styles of students with the teachers as facilitator of learning. Deaney, Ruthven and Hennessy (2006) highlighted the possible contributions of ICT to teaching and learning include: broadening classroom resources and reference; enhancing working processes and products; mediating subject thinking and learning, fostering more independent student activity and improving student's motivation towards learning. This assertion was supported by Rampasad (2011) finding which reported that teachers affirmed the integration of ICT in classroom lessons through the use of Internet had exposed students to not only a wider range of resources but to resources of greater currency.

The process of ICT utilisation in schools involves the adoption and the use of ICT resources in the day-to-day activities of teaching and learning. According to Bowden (2004) ICTs integration is about teachers and how they teach using ICTs as well as about students and how they learn using ICT. It is not about replacing the existing practices; instead, it is about doing them better with ICT. The goal of supplying schools with ICT resources is to integrate them across curriculum (Godwin, 2004). However, some teachers are unable to differentiate between computer as a subject and computer as a tool, the former refers to isolated computer education courses, which teach students about computers and computer-related basic skills, whereas the latter refers to the integration or use of computer and related technologies throughout education for gathering information, communication presentation and enhancing problem solving skills.

The influence of ICT on education is felt more and more at schools, (Mikre, 2011). Information communication technology provides both students and teachers with more opportunities in adapting learning and teaching to individual needs forcing

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schools aptly to respond to this technical innovation. Tinio (2002), states the potentials of ICT in increasing access and improving relevance and quality of education in developing countries. Tinio further states the potentials of ICT as including, facilitating the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improving policy formulation and execution, and widening the range of opportunities for business and the poor.

Boakye and Banimi (2008), in their study of teachers' utilisation of ICT in Ghana, reported that teachers in Ghana make use of e-mail more than every other ICT facilities. The use of ICT is making major differences in the learning of students and teaching approaches. Schools in the Western World invested a lot for ICT infrastructures over the last 20 years, and students use computers more often and for a much larger range of applications (Volman, 2005). Several studies revealed that students taught using ICT facilities mostly show higher learning gains than those who were not taught with learning. Salman, Ogunlade, Ogunlade and Adegbami (2013) reported that the value for the use of ICT in schools in Nigeria is limited to private, unity schools and few public secondary schools.

Furthermore, the use of ICT in education also shifts the learning approaches. According to Volman (2005) there is a common belief that the use of ICT in education contributes to a more constructivist learning and an increase in activity and greater responsibility of students. This limits the role of the teacher to supporting, advising, and coaching students rather than merely transmitting knowledge. The gradual progress in using computers changes from learning about computers, to learning computers, and finally to learning with computers (Volman, 2005).

2.3 ICT use in the Teaching of Science in Secondary Schools

The methods and strategies of teaching and learning of science subjects in schools involve the use of some equipment and apparatus. According to Newhouse (2002) some teaching methods may only include the use of a blackboard and chalk while others may make use of a television or overhead projector, computers simulations etc. He further highlighted the ICT resources that could be used in science teaching to include, hardware such as the digital camera, data projector, laptop, and data loggers,

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and software such as interactive CDs (e.g Biotechnology Online School Resource, Interactive Applets and Simulations. Horgarth, Benneth, Lubben, Campbell and Robinson (2006) reaffirmed that simulation has great potential value in the teaching of science in classrooms as simulation can improve students' understanding compared to non-ICTs/traditional teaching and learning activities.

Students' interest in science has witnessed a sharp drop especially in Nigeria while the few students that offer science subjects find it difficult to achieve success in the subjects. Also, a comparison of ICT use across the curriculum reveals that secondary science has failed to embrace ICT, despite a vast investment of time, money and human resources (Department for Education and Employment [DfEE], 1996-2000). A major factor for this is the current model of science offered in schools that fails to effectively prepare students for their experience of science beyond school and to present science as a fascinating, interesting and rewarding subject at the fulcrum of human existence (LaVelle, McFarlane, and Brawn, 2012). Shabaya (2009) emphasised ICT as having the capability to revolutionised the teaching of science and make it more interesting to students.

Sulton (2006) considered it unthinkable that science teaching, learning, and research could proceed without access to ICT resources such on-line databases, electronic mail communications with other institutions, the use of sophisticated monitoring equipment for data collection, powerful spreadsheets and database packages for analysing and manipulating that data and publishing software for producing papers and reports. The use of ICT applications in science lessons remained very patchy, although there was good evidence that many teachers used it for personal and professional purposes, (Inan and Lowther, 2009).The poor use of ICT according to Deniz (2005) could be traced to a range of school circumstances and technical difficulties such as ICT relevance to science curriculum, lack of adequate computers to enable all pupils to work on computers all the time in a science lesson, distance between ICT and science curricula, systems problems leading to lesson time wastage, and the belief by teachers that ICT does not contribute much to pupils' learning of science.

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The role and value of ICT in education cannot be underestimated. These roles and values are varied and include; fostering students interests and motivation; promoting students commitment to learning; making lessons more exciting and interesting for both teachers and students; introducing the concept of new learning; and bringing students and teachers together for lectures, tutorials and one to one interactions across geographical locations (Onasanya, Shehu, Ogunlade and Adefuye, 2011). Other roles involve making students do science effectively and conducting experiments as viewed on screen; facilitating the process of learning through interactions with simulations; making students visit different landscapes, museums, libraries and any other places and promoting distance science learning.

Kumar, Subramainam, and Mukherjee (2005) presented a five-stage model of using ICT for practical work in science to include the use of; interactive CDs, on-line tutoring, virtual laboratories, home experiment, and laboratory sessions. The model, according to Basson (2010) reduces the dependency on real laboratories. Through interactive CDs that feature video clips on science experiments, students will learn how science experiments are conducted and the general rules of conducting an experiment along with the science observations that are featured (Zacharia, 2007). Video clips also have the tendency to motivate and increase the interest of the students to learn science (Woodley, 2009). In addition, multimedia can through its power to animate communicate dynamic information more accurately than a diagram, and can help students visualize phenomena that cannot be seen (Basson, 2010). Online tutoring can also help the teaching and learning process in teachers and students through acative discussions. de Jong (2006) reiterated that that online tutoring enables tutors and learners to bring the face-to-face classroom into virtual environment that ultimately generate new ideas and cultivate innovation.

The relevance of ICT resources in teaching of science practical in schools cannot be underemphasized. Kumar et. al. (2005) emphasised that ICT-based science practical offers the possibility of many attractive features including interactive experience that can widen the scope of constructivist learning. Basson (2010). Virtual experimentation provided through interactive computer-based simulations has proven to have a positive impact on teaching and learning of science in schools (Ronen and Elahu, 2000; Hsau and Thomas, 2002; Zacharia and Anderson, 2003; de Jong, 2006;

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Woodley, 2009). This is because there are specific scientific phenomena that students normally engage in hands-on activities which are directed towards increasing the effective delivery of instruction by teachers as well as the understanding and insight of the principles involved which are simulated. Virtual laboratories and computer simulations have been used to enables teachers to deliver effective instruction on how to handle apparatus and instruments, and to enable learners to gain experience in the use and control of apparatus and instruments without the necessity of having the equipment available

The potential of ICT to change teaching and learning styles is recognized by La Velle et al. 2012). Consistent evidence abound also from the earliest days of educational ICT that when pupils are given autonomy to derive and test their own ideas and understanding, their ways of learning change, and there is improvement in their understanding and achievement within a context, (Jewitt and Scott, 2002; Ittigson and Zasse, 2003; Jutik et.al., 2009). One of such context is the use of simulation. Nertha (2007) and Keengwe and Onchari (2008) reported that ICT simulation use in the school laboratory has advantages and disadvantages. Simulation and modeling programmes have been developed to help students to engage in investigations that were not only impossible to replicate in a school laboratory, but also above the mathematical abilities of the learners, (Nertha, 2007; Keenegwe and Onchari, 2008).

Information and communication technology tools that can be used in science classrooms can be considered as belonging to various categories. According to Murphy (2006) ICT can be categorized as a tool such as spreadsheets, databases and data-logging, as a reference source such as CD-ROMs and the Internet, as a means of communication such as e-mail and online discussion, digital camera, power point and interactive whiteboard and as means for exploration such as control technology, simulations and virtual reality. Kelleher in Bingimlas (2012) opined that most ICT used in science classrooms can be considered as belonging to one of the following categories viz: data-logging, data-handling, simulations, modeling, reporting and presentations, integrated learning systems and reference tools.

Bingimlas (2012) in his study of extent of science teachers' use of information and communication technology in enhancing learning and teaching environments reported that the frequency of use of ICT resources for science education activities in Riyahd

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city of Saudi Arabia was very low. According to him science teachers apparently use a number of communicative ICT resources such as the Internet, data projectors, and power point software and a number of ICT reference sources such as the Internet and CD-ROMs in some science lessons conducted in the classroom. Onasanya et al. (2011), in their study of teacher's awareness and extent of utilization of information communication technologies for effective science and health education in Nigeria, reported a low utilization of ICT resources by science teachers in Oyo State.

On the purpose of ICT use, Kiptalam and Rodrigues (2011) reported preparation of paper and teaching materials, collecting handouts and reference materials and preparing presentation as the most common purposes for which teachers use ICT facilities. Mwalongo (2011) findings also revealed the most common use of ICT in science teaching to include preparation of lesson notes, searching of teaching and learning materials, and preparation of examinations. Bingimlas (2012) also reported that teachers in Riyahd city make use of ICT resources for presenting lessons, searching the Internet for lesson ideas, preparation and producing worksheets. However, there may be need for teachers to go beyond these simple uses in order to transform students' learning.

Commenting on the frequency of use ICT by science teachers, Mwalongo (2011) established the most commonly used ICT resources for teaching as computers and television while digital cameras and scanners were found to be the least commonly used ICT facilities due to their inaccessibility when needed.

A substantial number of simulation and modeling programmes have been developed and evaluated. Lau and Sim (2008) emphasised that there is a basic difference between simulation and modeling progammes. They distinguished simulations as the exploration of existing models, and modelling as the expression of learners' ideas but constructing their own models. Sulton (2006) demonstrated that pupils were able to investigate much more complex models if they were provided in simulations than if they had to build their own. Cox (2002) reviewed research carried out over the past two decades on the educational use of ICT-based simulations and modeling, and concluded that the main contribution made to pupils' understanding of science is through the acquisition of investigative skills and improved understanding of some scientific concepts and processes.

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Goulding and Kurtacou (2008) corroborated Horgath et.al (2006) by emphasising that teachers' use of ICT simulations helped students to improve their understanding of science ideas more effectively compared to the use of non-ICT teaching activities. The use of ICT simulations would be more effective than using non-ICT teaching activities, for improving basic science ideas including science understanding and the scientific approach. The gains in students' learning when ICT simulations were used can further be enhanced when teachers actively scaffold or guide students through ICT simulations.

The role of ICT in the teaching and learning of science education has been widely justified. Osborne and Hennesy (2003) discussed a number of reasons for using technology in science teaching and learning. These reasons include, expediting and enhancing work production; increasing and enhancing work production; increasing the currency and scope of reference and experience; supporting exploration and experimentation; fostering self-regulation and collaborative learning and improved motivation and engagement. The need for constructivist approach to teaching and learning which encourages construction of knowledge and independent learning by students requires the use of ICT resources. However, Newton and Rogers (2001) commented that the widespread and routine use of technology in science teaching remains a goal still to be achieved.

Kirkman (2000) affirmed the relevance of ICT in teaching and learning of science subjects. They concluded that ICT serves as a means for experiencing natural systems and phenomena and facilitating science learning processes. Boqula (2004) opined that changing teaching approaches from teacher-based instruction to learner-based learning where teachers only facilitate learning requires the integration of ICT in teaching learning process. Teaching with ICT applications would promote higher order thinking and enables students to construct knowledge based on their experiences rather than based on the experience of the teachers. Sulton (2006) corroborated this by affirming that the use of computers and related technologies affects the motivation of students in the learning and enjoyment of science and mathematics, and that appropriate use of ICT can enrich, support, and mediate the learning of science and its concepts.

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Underlying the aim of integrating and improving the use of ICT in teaching-learning process is an assumption that teachers are competent and confident in the use of ICT in terms of teaching and learning. Teachers are a key component in the learning environment and therefore the impact of ICT on teachers and the strategies they employ to facilitate the environment are critical (Nicolle, 2005). There sometimes appears to be an assumption that using ICTs to support teaching and learning requires change for all teachers whereas some teachers have been creating appropriate learning environment for years without using ICT. According to Albirini, (2006) teachers tend to use ICT because they readily perceive that in doing so they will provide even better learning environments. Thus, for teachers to live, learn and work successfully in today's increasingly, complex information–rich and knowledge-based society, they must utilize ICT effectively.

The pedagogic use of the ICT necessitates the development, among teachers as well as students, of skills and attitude related to effective use of ICT. Privateers (2002) opined that aside of literacy, ICT also facilitates learning to program, learning in subject areas and learning at home on one's own, and these necessitate the use of new methods like modelling, simulation, use of databases, guided discovery, closed word exploration etc. The implication in terms of changes in the teaching strategy, instructional content, role of the teachers and context of the curricula are obvious as well as inevitable. A report from the Commonwealth and State Government across Australia indicated that over 95% of teachers interviewed assessed themselves as having more than a basic level of ICT operational skill even though majority of these teachers were not confident about applying ICT to facilitate student learning.

Pedagogy through the application of ICT has the advantage of heightening the motivation; helping recall previous learning; providing new instructional stimuli, activating the learner's response; providing systematic and steady feedback; facilitating appropriate practice; sequencing learning appropriately; and providing a viable source of information for enhanced learning (Tella et al 2007). Teachers who use this system of instructional strategy would be able to kindle in the hearts of the learners a derivable attitude towards ICT tools in their entire way of life. The impact of ICT on pedagogy, according to Newhouse (2002) has brought about more learner–centred, more cooperative and collaborative, more active learning and greater access

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to information and sources of information. The pedagogical usage of ICT in schools proceeds in four broad stages which include; supporting performance; enhancing traditional teaching; facilitating learning; and creating innovative learning environments (UNESCO, 2005).

At the supporting performance stage the teachers should be able to use productivity tools such as word-processor, visual presentation software, spreadsheet, database, e-mail etc; with emphasis laid on basic operation of electronic office software (Keengwe and Onchwari, 2008). Following on and from using productivity software to support and enhance performance, is the stage of enhancing traditional teaching. Teachers at this stage are just learning how to develop and use computer-assisted learning software (Anderson, 2004), in the traditional instruction process. Teachers select, develop and use various instructional packages to enhance traditional classroom teaching. The third stage of pedagogical use of ICT by teachers known as the facilitating learning stage" involves using various types of instructional software to facilitate student learning.

However, teachers need to learn how to choose the most appropriate tools for a particular task, and using these tools in combination to solve real life problems (Sulton, 2006). Teachers at the "facilitating learning stage" must possess the ability to recognize situations where various multimedia and specialised softwares can be utilised for teaching and learning. The last stage of pedagogical usage of ICT has to do with teachers specializing in the use of ICT to create innovative learning environment that would transform the learning situations. This is possible by incorporating emerging trends in pedagogy and learning principles in teaching and learning. Anderson (2004) emphasized the use of specialized software such as modelling and simulation, expert systems, semantic networking etc. to support pedagogical innovations.

Ilomaki (2008) while commenting on problems facing teachers in the implementation of ICT into educational practices affirmed that implementation of ICT into classroom has often focus on teacher's individual characteristics, such as teacher's pedagogical conceptions or experienced problems, how the school should support teacher's implementation processes, and external factors such as teachers' in-service training or

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necessary technical or pedagogical support as well as lack of appropriate educational material.

In the studies of Hakkarainen (2001), it was found that there was a relationship between teachers' pedagogical conceptions and the type of instructional use of ICT. Teachers who intensively used ICT emphasized the importance of using ICT for facilitating students' participation in progressive inquiry, collaborative learning, and the learner's active engagement in the knowledge formation process, but Lin (2001) emphasized that the relationship between teachers' conceptions and practice, is complex, not clear or simple.

Teachers with good ICT skills used ICT more, and more often in a student–centred way (Moseley, 1999), and they appeared to have adequate pedagogical means for pursuing new pedagogical practices (Hakkaranen, 2001). There are also findings regarding teachers who do not use ICT in teaching. Norton, McRobbie and Cooper (2000) found that teachers did not use ICT in teaching (mathematics) because of a teacher-centred view of teaching as a transmission/absorption image. Because the non-use was essentially based on such beliefs, teachers did not take any actions to increase their ICT–related expertise or access.

A number of researchers have shown that underutilization of ICT in schools still exists even when computers have become easily available and many teachers still do not use them to enhance the students learning (Bowman, 2004; Gifford, 2004; Baldrom and Keith, 2003; Cuban, 2001). The findings of these studies indicated that many hindrances prevent teachers from using ICT. Some of these obstacles are environmental, whereas others are personal. Personal barriers affecting teachers' acceptance of technology include teachers' beliefs, attitudes and self efficacy, among others (Coleman, 2004, Gifford, 2004; Godwin, 2004; Park, 2004, Baldwin and Sheppard, 2003). Unfortunately, little research has been done to identify the factors that influence acceptance of computer technology designed specifically for the teachers.

The development of teachers' self efficacy and positive beliefs about computers is considered to be a key factor in fastening computer integration and the enhancement

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of quality teaching and learning using computers and related technologies (Yuen and Ma, 2004). According to Koehang, (2001) teachers' beliefs, attitude and self-efficacy as well as knowledge and skills in using computers are major factors influencing their initial acceptance of computer technology and their future behaviour regarding computer image.

Therefore, emphasis should be on the teachers' professional and skills development and adoption should be considered before providing computers and related technologies in schools. It is also possible to conclude in the light of the findings of previous studies that without teachers' computer skills, self-efficacy and knowledge of technology integration, ICT adoption and utilization in schools will not take place

2.4 Demographic variables and ICT use by teachers

Interest in the use of ICT resources especially in secondary education is increasing significantly (Alampay, 2006). Therefore, as the teaching importance of ICT resources continue to rise among teachers in secondary schools, understanding of the factors that encourage ICT use among the teachers become critical (Jiang, Hsu, Klein and Lin, 2000). The revolution of the ICT is exerting profound effects on educational institutions. Alampay (2006) while commenting on differences in capabilities and opportunities to access and use of ICT resources by people affirmed that while access to ICT is a prerequisite to use, the capability approach says that individual differences, capabilities and choice play a role on whether an individual will make use of these ICT resources.

According to Sen (1999) people have different ways of transforming the same bundle of facilities into opportunities for achieving their plans in life, thus it is important to understand the complex nature of what determines the use of ICT by teachers, one of which is demographic factors.. Among the demographic factors that are often cited as having an influence on ICT use: gender; income; level of education, and age (UNDP, 2011). Olatokun (2009) highlighted demographic factors such as income level, level of education, age, and gender as the key individual differences that determine the freedoms, capabilities and functioning's that relate to ICT use.

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2.4.1 Teachers' age and ICT use

On the issue of age as a major factor influencing the use of ICT by teachers, Mayanja (2002) affirmed the influence of age on the use of ICT by reporting that young teachers make use of ICT resources more than the old people. According to the study, young teachers within the age range of 21-40 years were found to be more capable of using the ICT resources than every other age group. One explanation for this is the fact that the ICT is a more recent development and that the young population would have had the benefit of being exposed to it in their schools. This was corroborated by Alampay's (2006) study in the Philippines that emphasised that the use of ICT is more pronounced among the younger generation. Sanni, Awoleye, Egbetokun and Siyanbola (2010) corroborated Mayanja (2002) views on age differences in ICT use. According to them ICT usage is more pronounce among the younger teachers than among their older counterparts. Specifically, the study revealed that teachers aged between 22 and 28 would use the ICT more than those of any other age group. This may mean that younger teachers within the age range of 22 to 40 will make use of ICT resources than older teachers.

There is some concern that older teachers have fewer ICT use skills and that this may result in a deterioration of their position in the labour force (OECD 2004). A 'generation gap' with respect to exposure to ICT resources may explain a reduced opportunity to learn ICT use skills. Young teachers aged 25 and under were significantly more likely to grow up with a ICT facility in the home than those aged 25 and over (DfES 2003). As a result, there are fears of a growing mismatch between the skills of older teachers and those skills that are in demand, and concern that a lack of skills may cause a slowdown in the introduction and use of ICT in teaching activities filled by older teachers.

Overall, and consistent with previous research, age has been found to have exhibited a strong relationship with patterns of ICT use and familiarity. These patterns were generally similar across countries, showing a steady decline with age, particularly for diversity and intensity of ICT use, and use of ICT for task-oriented purposes such as teaching. Many of these task-oriented purposes are associated with ICT use at school such as writing or teaching, tutorial, presentation of new materials, testing, and experimentation, among others. The drop in these activities would be most substantial

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between the age categories of 46 to 55 and 56 to 65, suggesting that older teachers and retired persons may not be performing these tasks regularly (Simsek, 2011). Age is often assumed to be a factor with no significant relationship to ICT resources' use (Honeyman, 2007). Also, Inan and Lowther (2009) and Sukri (2005) affirmed a non-significant effect of teachers' age on ICT use by the teachers. However, Abu-Obaideh, Ab Rahim, Ramlah, and Asimiran (2012) and Kalogiannakis (2008) Lau and Sim, (2008) found that the teachers' age influences their use of ICT during the teaching process. The varying findings presented an unsettled discourse of the relationship between teachers' age and ICT use.

2.4.2 Gender and ICT use by Teachers

On the issue of gender and ICT use, Kirk and Zander (2004) reported gender as a very influencing factor on ICT use.. They (Kirk and Zander) reported that there is a gender digital divide, as result of high versus low literacy, high versus low income and rural-urban divide. According to Alampay (2006) men were more receptive to ICT use than women which may mean that male teachers would be more receptive to ICT use than female teachers. This according to Alampay (2006) may be due to the fact that women are more preoccupied with other issues that they do not have time to use the ICT facility. Doczi (2000) in his own study reported the fact that women were not as educated as men as a major factor while men tend to use the ICT more that women. Also, Birol, Bekigullari, Etci and Dagli (2008) observed that gender plays vital roles in motivating individual's ICT's use because females unlike their male counterparts are not so motivated to Internet use.

Research findings on gender gap have shown that females teachers differ in terms of ICT use (Mitra, 2001; Liu, 2000; Butler, 2000). Males are heavy users of ICT than females (Butler, 2000). According to Huang and Liu (2000), gender is related to ICT anxiety and males are more anxious and more confident about ICT usage. In the light of Huang and Liu's view, the issue of gender is so relevant when considering teachers' proficiency level in the use of ICT.

Furthermore, in establishing a relationship between gender and ICT use among teachers, studies by scholars such as Abu-Obadieh et.al. (2012), Teczi (2009), Jawarneh, El-Hersh and Khazaleh (2007), Sabariah Sharif, Khaziati and Osman

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(2005) revealed a non-significant influence of teachers' demographic characteristics in terms of gender on teachers' ICT use in contrast to studies by Samak (2006), Sadik, (2005), and Lu and Mille (2002) that found a significant influence of gender on ICT use by teachers.

2.4.3 Teachers' educational background and ICT use

As far as education was concerned, it was important, not only with respect to gaining the needed skills to use ICT, but also with respect to people's motivation to even use ICT. Olatokun (2009) emphasised that level of education had the strongest influence on the use of ICT as most of the people that use ICT are mainly educated people. Yi (2008) also asserts that those with higher education levels are more likely to use the ICT because they may have more skills and chances to go online. At the same time, the role of formal education in building teachers equipped with ICT skills is currently the subject of debate. While formal education such as training at colleges and universities may be an effective means to reach the future workforce, the rapid nature of technological change and developments in the world of ICT emphasize the need for lifelong learning over one-time educational instruction. Nonetheless, education can be an important means to develop at least basic ICT skills and the relatively recent introduction of ICT for teaching in schools may mean that as time goes by more people are likely to use ICT in school (OECD 2004).

Also, in terms of teachers' educational background and its effect or influence of ICT use by teachers Lua and Sim (2008) established a significant effect of the level of academic qualification of school teachers in Malaysia on the level of use of ICT by the teachers. Also, Mahmud and Ismail (2010) in their study on the impact of training on basic ICT literacy among secondary school teachers in Malaysia revealed that teachers qualification resulting from training contributed significantly to ICT use by the teachers.

Taylor (2003) reported that teachers with higher education levels are more likely to use ICT because they may have more skills and chance to go online. Meso, Musa and Mbarika (2005) reported academic discipline as another demographic factor that determines the adoption and use of ICT by teachers. They reported a significant difference between academic discipline of teachers, (that is, science, social sciences

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and humanities, and arts) and their use of ICT. Teachers in the social sciences and humanities were found to use ICT the most.

2.4.4 Teaching experience and ICT use by teachers

The relationship between years of experience of teachers and ICT use was also investigated by various scholars with the results showing variations in findings. For example, Mueller, Wood, Willoughby, Ross, and Specht (2008) investigated the discriminating variables between teachers who fully integrate computers and teachers with limited integration and found no significant relationship between teaching experience of teachers and their use of ICT in teaching. This is also corroborated by Abu-Obaideh et.al. (2012) study that revealed a non-significant relationship between teachers' years of experience and ICT use in teaching process. This result is however inconsistent with the results of the study conducted by Inan and Lowther (2009) which revealed that years of teaching experiences affect teachers' use of computer in a negative manner. Also, Kalogiannakis (2008), Ertmer (2005), and Bebell, Russel, and O'Dwyer (2004) revealed through their studies that teachers' years of work experiences influence the teachers' ICT use in teaching.

2.4.5 Computer use experience and ICT use by teachers

On teachers' computer experience, Buabeng-Andoh (2012) reiterated that teachers' computer experience relates positively to their computer attitudes which ultimately affect their utilization of ICT. Also, Rozell and Gardner in Buabeng-Andoh (2012) opined that the more experience teachers have with computers, the more likely that they will show positive attitudes towards computers and make use of ICT facilities. Positive computer attitudes are expected to foster computer integration in the classroom (van Braak, Tondeur, and Vackle, 2004). It therefore mean that computer experience is a key determining factor that may have either direct or indirect effect on the use of ICT for teaching and learning processes by teachers.

2.5 Computer Self-efficacy and ICT use by teachers

The self efficacy, theory, derived from social cognitive theory (Bandura, 1997), has received considerable empirical support for its exploration of individual behaviour across life domains. Self efficacy refers to an individual's belief in his or her ability to successfully perform a specific behaviour. Information system research has

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demonstrated the significant role of self efficacy in technology skill training (Johnson and Marakas, 2000) and technology acceptance (Venkatesh, 2000). More specifically, studies have shown that ICTs skill training increases self efficacy which in turn influences ICT acceptance (Alhajri, 2007, Godwin, 2004). This evidence suggests that incorporating self efficacy in researches should improve an understanding of the flow of behaviours from decisions to receive training to ICTs skill development and subsequent ICT acceptance.

Compeau and Higgins (1995) defined computer self-efficacy, construct as "an individual judgment of one's capability to use a computer and used this definition to investigate a decision to use computers and computer skills acquisition (Johnson and Marakas, 2000). Some studies reported the importance of computer self-efficacy on performance and ICTs acceptance (Venkatesh and Davis, 2000; Venkatesh 2000. Yet other studies reported, contradicting findings. For example, Bolt, Killough and Koln (2001) reported no significant link between computer self efficacy, ICTs acceptance and performance. Also, Ramayah and Aafaqi (2005) found that computer self efficacy was not related to usage behaviour. Marakas, Johnson and Clay (2007) suggested that such mixed results were attributed to the lack of appropriate theorizing of the self efficacy construct.

Consequently, Keengwe and Onchwari (2008) proposed that computer-self efficacy operates at two interrelated levels; the general computing behaviour level and the specific computer task or application level. General computer self efficacy refers to "an individual's judgment of efficacy across multiple computer domains' while application-specific self-efficacy refers to "an individual's perception of efficacy in performing specific computer- related tasks within the domain of general computing. The new conceptualization of the self efficacy construct supports the use of application–specific computer self efficacy to understand individual behaviour in specific applications or tasks (e.g. Word Processing, Excel and the Internet). Moreover, there is empirical evidence to support that application-specific computer self-efficacy has stronger explanatory and predictive power than the general construct (Marakas et. al, 2007, Johnson and Maracas, 2000). Consequent on the recent theorising on computer self efficacy this study intends to investigate the influence of self-efficacy on ICT acceptance and usage.

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For example, in discussing computer self-efficacy, Compeau and Higgins, (1995) distinguished between components skill, such as formatting disks and booting up the computer and behaviours individuals can accomplish with such skills, such as using software to analyse data. Thus, ICT self efficacy focuses on what a person believes he or she can accomplish with ICT resources now or in the near future, It does not relate to the actual skill level, but, are relevant in determining how long an individual persevere in a task and whether the task will be engage in at all.

Because people are generally more interested in performing activities in which they have high self efficacy (Sylva, 2007), it can be imagined that teachers with high self-efficacy will be more likely to take advantage of what is around them. That is, if they are familiar and feel comfortable with computers and other related technologies, they will use them, and if they feel that using ICT resources in instructional delivery will improve their quality of teaching, they will learn about them. Computer self-efficacy has a direct effect on the person's perception of the ease of computer use, which in turn, affects the frequency and time of computer use (Ren, 2000).

People who have little confidence in their ability to use ICTs, who are dissatisfied with their computer skills or who are uncomfortable using ICT resources may be said to have weak self-efficacy beliefs. Those with low self efficacy should be less likely to perform related behaviours in the future (Bandura, 1997), in this case, would be less likely to adopt and use ICT resources, than those with high degree of self-efficacy.

Individuals get their self-efficacy beliefs in several ways. The first and most significant way is by interpreting what they did. Self-efficacy is not a static concept; it is continually being actualized in an individual's mind, through what Bandura called "mastery experiences." According to Pajares (1997), outcomes interpreted as successful raise self-efficacy, those interpreted as failures low it. Also, self-efficacy could be developed through vicarious experiences. Individuals who develop self-efficacy through "vicarious experiences", observed how peers have dealt with certain experiences, and from there informing how they would handle a similar experience. However, this is a less significant way of establishing self efficacy (Pajares, 1997). A

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weaker way by which self-efficacy develops is through "verbal persuasion", when someone gives oral encouragement or communicates their confidence that someone else will be able to succeed. Interestingly Pajares (1997) established that it is usually easier to weaken self efficacy beliefs through negative appraisals than to strengthen such beliefs through positive encouragement. Individuals form their self-efficacy beliefs by incorporating and weighing these factors

Commenting on the relationship between computer self-efficacy and ICT use Chang and Tung (2008) and Papastergiou (2010) reported that a strong sense of computer self-efficacy among teachers affects both how often and the way ICT is used in everyday instructional practices. In other words, computer self-efficacy does have a strong influence on the extent and purpose of ICT use in teaching and learning.

2.6 Attitude towards ICT and Teachers' use of ICT

Teachers' attitude toward ICT use has been identified as one of the major factors that predict the use of ICT in teaching and learning process. Attitude determines whether a person is willing to try a new innovation (Rogers, 1995). So while most teachers appear to have a favorable attitude toward computers and recognize the need for them in the classroom, there is, at the same time, an anxiety about them. Attitude appears to be a related factor in teacher use of computers in classroom instruction. According to Al-Zaidiyeen, Mei, and Fook (2010) teachers' attitude are considered as a major predictor of the use of new technologies in the educational settings just as Batlor and Ritchie (2002) emphasized that the success of technology use in the educational settings largely depends on teachers' attitude toward technology use.

The term "attitude" has been defined in several ways by various authors. Allport (1935) defined attitude as a mental and neural" state of readiness organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related. Also, Taiwo (1998) described "attitude' as inclinations and feelings, prejudices, or bias, preconceived notions, ideas, fears, and conventions about any specific topic. Fishbein (1975), on the other hand, defined attitude as "a learned predisposition to respond to an object or class of objects in a consistently favourable or unfavourable way". The foregoing definitions revealed attitude as having to do with the feeling of an individual about a particular situations,

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objects, or issues which ultimately determine the way such individual would response to such situations, issues or objects.

Commenting on teachers' attitude toward ICT use, Hew and Brush, (2007) opined that teachers who easily accept and incorporate new ideas, changes, and reforms into their practices are more likely to make use of ICT in their teaching. Such teachers would have a positive attitude toward technology use in teaching and learning process. Positive attitude are assumed to be fundamental in the acceptance, implementation and success of new technologies (Spacey, Goudling and Murray, 2003). Attitudes have been suggested to influence behaviour though researches in this area varied in its conclusion. While Fishbein and Ajzen/s Theory of Reasoned Action (TRA) submitted that intention to perform a behavior is influenced jointly by an individual's attitude and subjective norm (in form of peer's influence), the Technology Acceptance Model (TAM) by Davis concluded that it is only attitude that influences behavioural intention with perceived usefulness and perceived ease of use having a mediating effect.

Albirini (2006) investigated the attitude of teachers in Syrian high schools toward technology use in education and concluded that syrian's high school teachers had positive attitude toward technology use in education. Al-Zaidiyen et.al. (2010) findings corroborated this conclusion as their study on teachers' attitude and levels of technology use in classrooms in Jordan schools revealed that teachers' positive attitude had a direct relationship with the use of ICT for educational purposes.

Furthermore, Kersaint, Horton, Stohl and Garofalo (2003) stated that positive attitudes of teachers have an effect on the increased use of technology as they feel more confident and comfortable with integrating technology in their teaching process. Findings from Bolandifar, Nordin and Babashami (2013) study corroborated this as it established that Malaysian ESL teachers showed generally positive attitudes towards integrating technology in classrooms. On the other hand, Erdemir, Bakirci and Eyduran (2009) opined that negative attitudes of teachers could lead to negative effects on the implementation of technology in classrooms.

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2.7 ICT Access and ICT use by science teachers

The definition of access to technology, as defined in the Congressional Office of Technology Assessment (OTA, 1995) report, has multiple connotations viz; computers in the classroom, ratio of teachers/students to computers, computers at home, current hardware and software, and location of computers. Obviously, for teachers to use computers in classroom instruction, they must have access to computers. While great strides are being made to place computers in classrooms in schools, there are still some great inequalities of access (Russek, 2001). The type of access is an issue because teachers find signing up for the use of a laboratory cumbersome and inconvenient. Teachable moments do not often allow the luxury of signing up for the computer laboratory.

The researchers at the Center for Applied Special Technology (2006) pointed out that acquisition of computers and other related resources is not enough to guarantee the use of ICT resources by teachers but adequate access should be guaranteed. This can be in form of making the ICT resources available in allocation where the teachers can easily have make use of it without any difficulties. This ease of access may end up increasing the frequency of use of the resources. Ertner (2005) describes schools acquisition of computers as just the beginning of ensuring use.

For teachers to effectively use ICT for teaching in classrooms, they must have easy access to the various types of ICT resources. Alston, Miller, and Williams (2003) found that in North Carolina schools, certain types of technology were widely available and accessible for teachers use, meaning the various types of ICT resources were located in the classroom or were easily accessible within the building. The available resources include videotape, television, desktop computer, CD-ROM, internet, email, laser printer, and video camera. The study further revealed that certain types of ICT resources such as LCD panel, computer projector, laptop computer, and digital camera were not within the classroom or even within the school to facilitate easy access by the teachers. Therefore location of access can be considered as a major factor that may influence the use of ICT resources by teachers.

Furthermore, Cohen, Negrini, Cuff, Laus, Volpe, Dun, and Sternhein (1999) revealed in their study that for teachers to be able to use the ICT resources for teaching, they

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must have access to not only a computer, but also other computer accessories and training in how to use these types of ICT resources. The teacher would also need to have classroom access to the ICT resources and ideas as to how to guide students in their search for information and use of activities related to Family and Consumer Sciences Education. With easier access to the internet, teachers are better able to implement it use into the classroom instruction (Jenkins, 2008).

Eisenberg and Johnson (1996) developed criteria for computer skills based on the Big Six Skills Approach, created by Eisenberg and Berkowitz (1996). The Big Six focuses on task definition, information seeking strategies, location and access, use of information, synthesis, and evaluation. Location and access are important factors when implementing technology into the classroom. The criteria focusing on location and access as created by Einsenberg and Berkowitz include, locating and use of appropriate computer resources and technologies available within the school library media center, including those on the library media center's local area network (e.g., online catalogs, periodical indexes, full-text sources, multimedia computer stations, CD-ROM stations, online terminals, scanners, digital cameras); locating and use of appropriate computer resources and technologies available throughout the school including those available through local area networks (e.g., full-text resources, CD-ROMs, productivity software, scanners, digital cameras); locating and use of appropriate computer resources and technologies available beyond the school through the internet (e.g., newsgroups, listservs, WWW sites via Netscape, Lynx or another browser, online public access library catalogs, commercial databases and online services, other community, academic, and government resources); and knowing the roles and computer expertise of the people working in the school library media center and elsewhere who might provide information or assistance.

Other criteria include, use of electronic reference materials (e.g., electronic encyclopedias, dictionaries, biographical reference sources, atlases, geographic databanks, thesauri, almanacs, fact books) available through intranets or local area networks, standalone workstations, commercial online vendors, or the internet; use of the Internet or commercial computer networks to contact experts and help and referral services; conducting self-initiated electronic surveys through e-mail, listservs, newsgroups and online data collection tools; use of organizational systems and tools

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specific to electronic information sources that assist in finding specific and general information (e.g., indexes, tables of contents, user's instructions and manuals, legends, boldface and italics, graphic clues and icons, and cross-references).

Access to ICT within the school is an important component when implementing its use into the classroom (Alston, Miller, and Williams, 2003). Therefore, without adequate access to various types of technology, including computers, internet, and technology experts (Alston, Miller, and Williams, 2003; Cohen, et al, 1999; U.S. Department of Education, 2005), teachers are unable to provide ICT-enriched lessons to their students. It is expected that if science teachers can follow the eight criteria set forth by Eisenberg and Johnson (1996), they will have an easier time accessing resources available to them within their school and community.

Kay (2006) identified insufficient access to ICT as an obstacle preventing successful implementation of technology. Grove (2008) emphasised that access levels can vary greatly across sites. He further reiterated that configurations can include from one or several computers in a classroom access to portable laptop cart for classroom use or access to a computer lab in the building. Researchers have reported that teachers with access to computers during class have higher frequencies of their students' use of technology while teachers with a single computer have few opportunities to develop, and learn how to facilitate lessons that involved student use of technology with content-area topics (Dexter and Reidel, 2003; Grove, Studler and Odell, 2004).

Also, Hernandez-Ramos cited in Burnip (2006) drew a distinction between ICT access and availability, suggesting that, even where ICT infrastructure is located within schools, this may not be freely available for use by some individuals and groups of teachers. The lack of accessibility to the ICT facilities may be due to factors such as inconvenience location of ICT facilities, and/or restriction of access times. This brought to the fore the importance of location of access in ICT utilisation among teachers.

2.8 The Role of School Library Media Centres in ICT Provision for Teaching in Secondary Schools

The school library media centre (SLMC) is a core component of a school that houses all the resources, including ICT resources, needed for effective teaching and learning

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and has the capability to inspire teachers and students alike (Barrett and Douglas, 2004). Clark (2006) stated that in recent years, the emergence of Information and Communication Technology (ICT) has considerably changed not only the educational theory and process, but also the SLMC services and facilities. The potential of ICT in the school is such that it can help sustain the quality of teaching and reinforce the relationship between learners and curriculum.

The ICT resources and applications within the SLMC provide school communities with a wide range of information resources and stimulate their perception of information (Garner, 2006). Evidence suggests that ICT resources have granted access to a broader range of knowledge beyond the school (CILIP, 2001). Developed countries, in particular, have integrated and deployed the ICT resources and applications into their education system, mainly through and with the support of the school library media centres (SLMCs). The SLMCs play the role of housing the ICT resources and making it available for the teachers and students alike just as it also provide the needed support, through the school library media specialists (SLMS), in terms of collaborating with the teachers on the appropriate ICT resources to be used in implementing a particular curriculum.

Elaturoti cited in Aramide and Elaturoti (2013) emphasized the 'Information specialist' role of the SLMS as key in the provision of ICT resources to support teaching and learning in schools. He further stated that the school library media specialist performs the role of information specialist through the provision of leadership and expertise in acquiring and evaluating information resources in all formats, including ICT resources. Access to information resources in all formats, including ICT resources is much needed in guaranteeing effective teaching and learning outcomes delivery in schools (Lowes, 2000). The SLMC through the SLMS brings an awareness of information issues into collaborative relationship with teachers, administrators, students, and others while also providing teachers and students with information on strategies and skills for using the ICT resources within and beyond the school library media centre.

The impressive change on the SLMC in recent years has varied its role. The antiquated school library was solely a store of books located in a small room within a school, supporting teachers and students with physical information. However, the

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school library, and indeed SLMC, is now a learning laboratory situated prominently within schools, providing non-traditional materials such as computers, internet and audio-visual means, in addition to traditional resources such as books, referencing and periodicals, (Morris, 2004; Roys, 2004). Clabo (2002) described in his own view described the typical SLMC as a "centralised information and ICT centre" designed to support the school's curriculum and provide resources that meet the educational and recreational needs of both the teachers and the students". Interestingly, the SLMC has played an important role in the school community, especially when ICT was integrated in its services (McDonald, 2006).

The integration of ICT into teaching and learning as well as the support given by the SLMC to ensure success in the integration of ICT into school curriculum has had a vast influence on the education sector. This recent technological innovation has created a significant evolution in role of the school library media centre in the school over the last few decades (Ingersoll and Culshaw, 2004). However, in spite of the widespread nature of ICT-based resources and applications, there are few studies conducted on the role of the school library media centre in the use of ICT resources for teaching and learning in schools.

In the developed countries' literature indicates that secondary SLMCs provide disparate traditional and non-traditional services and also advanced ICT services that provide sophisticated access to electronic formats that support the curriculum. Surprisingly, other studies have showed that many SLMCs in developed countries lack decent basic ICT resources (Liguete, 2007; Turner, 2006; Tilbian, 2005). In addition, Barstad, Audunson, Hjorsteter, and Oslie. (2007) found in their study that the majority of teachers and students use the ICT resources in the school library media centres infrequently just as he added that students claimed that teachers never encouraged them to visit the SLMC not to talk of accessing the ICT resources available therein.

Turning to the developing countries, the ICT resources in the school library media centres have been widely circulated due to their importance. The extensive nature of the new digital environment has dominated the developing countries' considerations in integrating the ICT applications into their SLMCs (Moahi, 2002). However, very few

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countries have taken real initiatives to supply their schools, or indeed embrace the fusion of ICT resources with traditional materials into the school library media centres to enable the school library media centre to respond adequately to the curriculum needs of the teachers and students. In addition, insignificant research has been conducted on the role of the school librsry media centre in the provision of ICT for teaching and learning in schools.

Magara and Nyumba (2004) emphasized that most developing countries struggle to enlarge their library services and concentrate on providing sufficient ICT resources and services for the school community (i.e teachers, students, et cetera). However, the status of the SLMC as well the integration of ICT in secondary school library media centres in some developing countries is still ambiguous and negligible in other countries due to its failures in different sectors. There are other factors that influence the development of ICT resources in the SLMC, which include budget, bureaucracy issues and mismanagement (Swee and Abdullah, 2005). Todd (2004) also reiterated the role of SLMCs in facilitating ICT use by teachers to include: provision of ICT facilities, ICT resourcing/infrastructural support, provision of technical support and human/training support.

Developing countries have striven to pursue the technological revolution and adoption of integration of ICT into the education system through the school library media centres (Al-Mekhlafy and Al-Basha, 2000). Albirini (2006) described the situation in developing countries regarding the deployment of ICT resources into the education system through the SLMCs as improving becuase governments in most developing countries have responded to the challenge by initiating national programmes to introduce computers into education with the SLMCs equipped with the needed resources to ensure the success of the programmes.

2.9 Policy Framework for ICT use in Education in Nigeria

The appropriate adoption, integration and utilisation of ICT in education require the entrenchment of appropriate environment. One major environmental factor that facilitates proper integration of ICT in education process is the appropriate policy framework. In Nigeria, the policy framework for the use of ICT in education was entrenched with the development of the Nigerian National Policy for Information

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Technology, tagged "Use IT" in 2001. In that year, the Nigerian Information and Communication Technology Agency (NICTA) produced the IT development policy which was approved by the Federal Executive Council. The policy tagged "USE IT" was a result of an awareness of the rapidly changing global environment and its increasing dependence on ICT. With its large population and an annual population growth of 2.2 per cent (World Bank, 2005), Nigeria has the human resources needed to become a key global player in ICT.

The strategy of the USE IT policy is to make IT (ICT) mandatory at all levels. By the time the USE IT policy was adopted, there was a need for ICTs curricula at all education levels, from primary to tertiary. At the secondary level, the use of ICT resources in instructional delivery and learning were part of the USE IT strategy for incorporating ICT into secondary education (Kayode, 2007). Recognising the need to reach educationally disadvantaged areas, the policy also aims to establish distance learning networks.

As related to education the general objectives of the National IT policy are to, integrate ICTs into the mainstream of education and training, establish and develop ICTs infrastructure and maximize its use nationwide; empower the youth with ICT skills and prepare them for global competitiveness and set up advisory standard for education, working practices and industry, among others.

Some of the several strategies adopted to meet the outline objectives of the "USE IT" policy include, making the use of IT mandatory at all educational institutions through adequate financial provision for tools and resources; developing relevant IT curricula (for primary, secondary and tertiary institutions) that are based on the appropriate national syllabus at the selected level and other global certification syllabi, to tie into key elements of the government's universal basic education policy; the proposed digital virtual library scheme and related educational initiatives, such as establishing a virtual system encouraging IT companies with appropriate incentives to invest in education and training through certification for tax rebates via existing government bodies that are experienced in such matters, such as the industrial training fund and the centre for Management Development, amongst others.

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The implementation of the IT policy started in 2001 with the establishment of the National Information Technology Development Agency NITDA, which is the implementing body. The policy empowers NITDA to enter into strategic alliance and joint ventures and to collaborate with the private sector to realize the specific of the country's vision of, "making Nigeria an IT capable country in Africa and a key player in the information society by the year 2005 through using ICT as an engine for sustainable development and global competitiveness." This is yet to be fulfilled (Agyeman, 2007). It should however be noted that as much as the National IT policy recognised the importance of ICT in education, the document has no serious application to education.

A critical appraisal of the National Policy on Information Technology revealed that the policy has no specific application to education. While there are sectoral applications for human resource development, health, agriculture, art, culture, tourism, and governance, education is subsumed under human resource development. There is need for sectoral allocation dedicated to just education. Also, the objectives and strategies relating to education as reflected in the sectoral application for human resource only focus on learning about ICTs, which is regarded as "Topicality.

Moreover, the schoolNet Nigeria, a non-profit organisation was also created to address the use of ICTs in Nigerian secondary schools with the support of several government ministries. It is a public sector initiative geared at mobilizing Nigeria's human and financial resources for the purpose of using ICTs in education. According to Terhemba (2006), the SchoolNet creates learning communities of educators and learners to use ICT resources to enhance education by implementing, supporting and co-ordinating ICT development projects in education; providing and supporting lower-cost, scalable technology and solutions and internet for schools; and providing support mechanisms for schools for technical infrastructure and connectivity. SchoolNet Nigeria has, in collaboration with the mobile phone operator MTN, established ICTs laboratories/cybercafés for four schools in four states in each of a four-phase project using Local Internet Service Providers (LISPs).

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2.10 Theoretical Framework

Several theories and models have been formulated and developed to investigate and understand the factors affecting the acceptance of technology in institutions and organizations. Notable among these theories and models are the Theory of Reasoned Action (TRA) by Ajzen and Fizbein (1975), Theory of Planned Behaviour (TPB), (Ajzen and Fishbein, 1980), the Diffusion of Innovation Theory (Rogers, 2003) and Technology acceptance Model (TAM) (Davis, 1989; Davis, Bagozzi and Washrow 1989).

2.10.1 Theory of Planned Behaviour (TPB)

The Theory of Planned Behaviour (TPB) extends from Theory of Reasoned Action (TRA) by incorporating an additional construct, namely perceived behavioral control, to account for situations in which an individual lacks substantial control over the targeted behaviour (Ajzen, 1991). According to TPB, an individual's behavior can be explained by his or her behavioural intention, which is jointly influenced by attitude, subjective norms, and perceived behavioural control. Perceived behavioural control also has a direct effect on behavioural intention. In the context of this study, TPB will suggest that a teacher's intention to use educational technology is jointly determined by his or her (1) positive or negative evaluative affect about using the technology; (2) perception of relevant others' opinions on whether or not he or she should use the technology; and (3) perception of the availability of skills, resources, and opportunities necessary for using the technology.

Attitude refers to an individual's positive or negative evaluative effect about performing a particular behaviuor. In this case, a teacher's intention to use educational technology is determined by his or her attitude towards using the technology. Subjective norms refer to an individual's perception of relevant others' opinions on whether or not he or she should perform a particular behaviour. Consequently, these opinions become the individual's normative beliefs with which he or she would comply.

Teachers who embrace comparable normative beliefs may vary considerably in the extent to which they want or are willing to comply with these beliefs. That is, teachers may exhibit differential motivations for complying with relevant others' opinions on

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the use of educational technology. Perceived behavioural control is a construct unique to TPB and refers to an individual's perceptions of the presence or absence of requisite resources or opportunities necessary for performing a behaviour (Ajzen and Madden, 1986). Broadly, a controlled belief is a perception of the availability of skills, resources, and opportunities necessary for performing the behaviour under discussion. In this case, a teacher's intention to use educational technology may be affected by such perceived control factors as training, self efficacy, skills and resources.

2.10.2 Technology Acceptance Model

The acceptance and effective utilisation of Information Systems (IS) by individuals and organisations are areas of research that have gained importance in recent years. The Technology Acceptance Model (TAM), introduced by Davis and associates (Davis, 1989; Davis et al., 1989), is one of the most widely used research constructs in the study of IS utilization. Studies using a variety of computer-related scenarios have provided the TAM with extensive empirical support (Davis, 1989; Mathieson, 1991; Szajna, 1996; Thomson, Compeau and Higgins, 2006; Abdallah and Albadri, 2010; Saichez and Hueros, 2010; Asiri, Mahmud, Abu-Bakar and Ayuba, 2012; Alharbi and Drew, 2014). The TAM uses two distinct but interrelated beliefs, perceived usefulness and perceived ease of use, as the basis for predicting end-user acceptance of computer technology. Of the two TAM variables of perceived usefulness and perceived ease of use, studies have found perceived usefulness to have the strongest influence (Satzinger and Olfman, 1995; Taylor and Todd, 1995; Burton-Jones and Hubona, 2006; Bagozzi, 2007; Chttur, 2009). Researchers have extended the TAM's general measures by explicitly including other IT acceptance variables, such as extrinsic and intrinsic motivators (Davis et al., 1992; Igbaria et al., 1995; Gong, Xu and Yu, 2004; Gao, 2005; Park, 2009; Shroff, Deneen and Ng, 2011), task-to-technology fit (Satzinger and Olfman, 1995), prior experience (Taylor and Todd, 1995), and computer self-efficacy (CSE) (Compeau and Higgins, 1995; Igbaria and Iivari, 1995), among others.

The Technology Acceptance Model (TAM) was developed to explain the computer-usage behaviour and has adopted the generic Fishbein and Ajzen's (1989) TRA model to the particular domain of user acceptance of computer technology. Adapted from TRA, Technology Acceptance Model (TAM) was developed specifically for

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explaining and predicting individual acceptance of computer technology (Davis, 1989; Davis et al., 1989). Broadly, TAM posits that the intensity of an individual's intention to use a technology can be explained jointly by his or her perception about the technology's usefulness, ease of use and attitude towards the technology use. In other words, the degree to which educational technology is easy to use, as perceived by a teacher, affects his or her perception of how useful the technology would be as well as his or her attitude towards using the technology. Also, TAM presents attitude as also being directly influenced by a teacher's perceived usefulness of the technology.

The goal of TAM was to provide an explanation of the determinants of computer acceptance that is generally capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified (Davis, 1989). Technology Acceptance Model as developed by Davis (1989) is the most well known and discussed. The model (TAM) is usually used for explaining the relationship between usage (both self-reported and anticipated future usage), perceived usefulness (PU) and perceived case of use (PEU)

In, Technology Acceptance Model (TAM), usage behaviour (B) is a direct function of behaviour intention (B1) which is, in turn, a function of: attitude toward usage (A), which reflects feelings of favourableness or unfavourableness towards using the technology, and perceived usefulness (U), which reflects the belief that using the technology will enhance performance. Attitude is determined jointly by perceived usefulness (PU) and perceived ease of use (PEU) (Ramayah and Aafaqi, 2004).

According to Tella, Tella, Toyobo, Adika, and Adeyinka (2007), TAM replaces many of TRA's attitude measures with the two technology acceptance measures - ease of use, and usefulness. TRA and TAM, both of which have strong behavioural elements, assume that an individual will be free to act without limitation when he/she forms an intention to act. In the real world, according to Nertha (2007), there will be many constraints limiting the freedom to act. Also, earlier research on the diffusion of innovations suggested a prominent role for perceived ease of use. King and He (2003) analysed the adoption of technology, finding that complexity or simplicity of use,

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among others, had the most significant relationship with adoption across a broad range of innovation types.

Several researchers have replicated Davis (1989) original study to provide empirical evidence on the relationships that exists between usefulness, ease of use and system use (Zhang, Duan and Wu, 2001; Waldman, 2003; Tella et.al, 2007). Much attention has focussed on testing the robustness and validity of the instrument used by Davis. Adams (1992) replicated the work of Davis (1989) to demonstrate the validity and reliability of his instrument and his measurement scales. Also, Szajina (1996) found that the instrument had predictive validity for intent to use, self-reported usage and attitude towards use. Tella et al (2007) established that the instrument is valid for testing the relationship between intention to use and perceived usefulness. The sum of these researches has confirmed the validity of the Davis instrument, and to support its use with different populations of users and different software choices.

In TAM, perceived usefulness and perceived ease of use has been established to determine an individual's intention to use a system, with intention to use serving as a mediator of actual system use. Perceived usefulness is also seen as being directly impacted by perceived ease of use. Researchers have simplified TAM by removing the attitude construct found in TRA from the current specification (Vankatesh 2000). Attempts to extend TAM are generally taken by one of three approaches: by introducing factors from related models, by introducing additional or alternative belief factors, and by examining antecedents and moderators of perceived usefulness and perceived ease of use (Wizom and Todd, 2005).

Technology Acceptance which has strong behavioural elements assumes that when someone forms an intention to act, that they will be free to act without limitation. In practice constraints such as limited ability, time, environmental or organisational limits, and unconscious habit will limit the freedom to act. Several recent studies that used TAM as a theoretical basis or framework suggested the exclusion of attitude from the model. For instance, Venkatesh and Davis (2000) removed attitude from their revised model because attitude did not appear to mediate fully the effect of perceived usefulness and perceived ease of use on behavioural intention as originally anticipated. The revised model (i.e., TAM without the attitude construct) has been

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applied and tested in several subsequent user technology acceptance/adoption investigations, including Venkatesh (1999, 2000), Venkatesh and Davis (2000), and Venkatesh and Morris (2000).

In this study, "attitude" construct is retained in the examination of TAM for two reasons. First, the retention of attitude facilitated the intended conceptual replication of the studies by Davis et al. (1989), Mathieson (1991), and Taylor and Todd (1995), all of which included attitude in their examinations of TAM. Second, given the relatively high autonomy and professional control (or even dominance) common to many educational institutions, attitudinal beliefs and assessments might assume an increasingly important role in individual teacher's technology acceptance decisions. Hence, inclusion of the factor, rather than exclusion of it, can allow an examination of this proposition. The original TAM was adopted for this study. In the context of this study, TAM was used in analysing the extent to which demographic variables, computer self-efficacy, attitude, ICT access, and role of SLMC in predicting ICT usage among science teachers in FUSs in Nigeria. The Technology Acceptance Model (TAM) framework is presented below in Fig 1.

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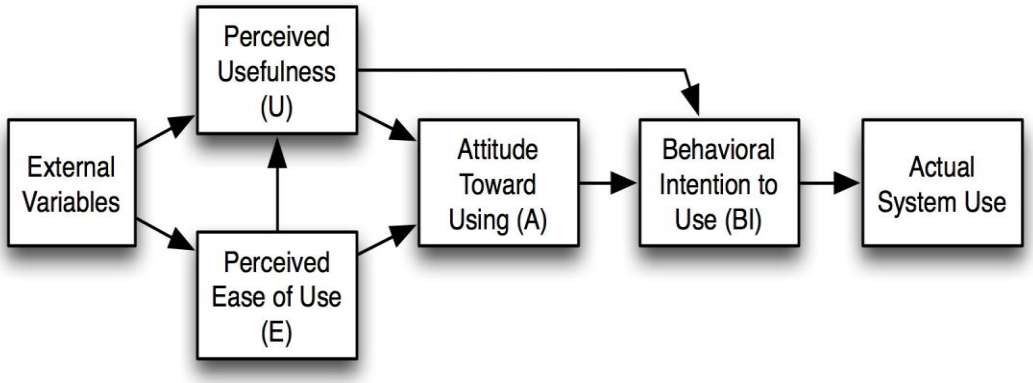

Fig 1: Technology Acceptance Model, (Davis, 1989)

2.11 Conceptual Model

The conceptual model for this study was developed by the researcher. The model was used to predict and explain factors relating to science teachers' use of ICT in teaching. Based on this theory, this study proposed that the relationship between demographic

variables, computer self-efficacy (CSE), attitude towards computer, ICT access and role of SLMCs may strongly predict the usage of ICT for teaching of science subjects by the teachers in Federal Unity Schools in Nigeria. (See Fig. 2). Note that the demographic variables, computer self-efficacy, ICT access and role of SLMC constitute the external variables in TAM while attitude toward ICT and ICT use in science teaching stand for the attitude towards using and actual system usage construct in the TAM.

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Conceptual Model for the Study

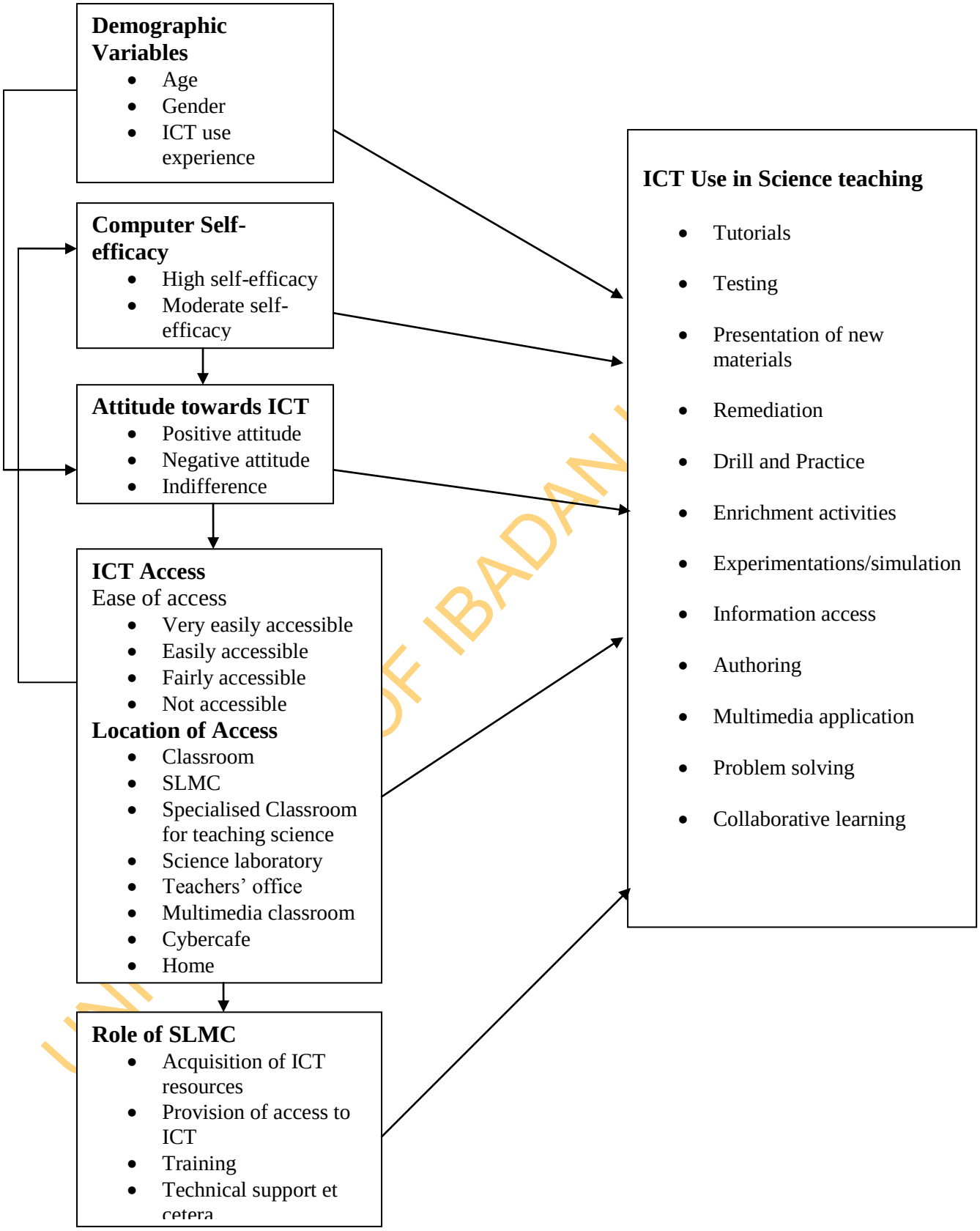

Fig 2: DCAASU model showing relationships among demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMC, and ICT use developed by the researcher.

2.12 Appraisal of Literature Review

The literature reviewed has highlighted the importance and relevance of ICT resources in teaching generally and specifically in the teaching of science subjects. On the other hand, the literature reviewed revealed the limited use of ICT resources in schools in most developing countries due to certain demographic and socio-economic factors. An extensive literature review was done on the theme of the study.

Several studies carried out at secondary school level in Nigeria examined the general use of ICT in schools with none focusing on investigating the extent to which a combination of demographic variables, computer self-efficacy, attitude toward ICT, ICT access, and role of SLMCs may predict the use of ICT among the science teacher. Also, the literature search failed to identify any study that relates demographic variables, computer self-efficacy, attitude toward ICT, ICT access and role of school library media centre as determinants of ICT resources usage among secondary school teachers (See Fig 2). This study, however intends to fill this observed gap in the literature.

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CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter focuses on the research methodology that was adopted by the researcher in carrying out the study. The chapter is aimed at explaining the research design; population of the study, sample size and sampling technique, method of data collection and data collection instruments as well as method of data analysis. This is presented to explain the way and manner of carrying out the study and it is discussed under the following sub-headings:

3.2 Research design

3.3 Study population

3.4 Sample and sampling procedure

3.5 Research Instrumentation

3.6 Validation and reliability of the instruments

3.7 Administration of questionnaires

3.8 Method of data analysis

3.2 Research Design

This study adopted the correlational design approach. The method was adopted because it is a method used in studying behaviour whereby the researcher attempts to determine the distribution of and relationship among a variety of variables. Also, the method is considered the appropriate method in obtaining reliable information about availability, accessibility, computer self-efficacy, attitude and utilisation of ICT resources in teaching of science subjects in Federal unity schools in Nigeria.

Moreover, the survey method would enable the researcher to have an understanding of the perceptions and opinions of randomly selected respondents from a larger group in order to ascertain the nature of the use of ICT by the science teachers in Nigeria generally, and in the sampled schools in particular.

3.3 Study Population

The population of the study comprises all the science teachers and school library media specialists (SLMSs) in all the Federal Unity Schools (FUSs) spread across the six geopolitical zones and thirty six states including Federal capital territory, Abuja, in

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Nigeria. There are one hundred and four (104) unity schools distributed across Nigeria (See Appendix III for the distribution).

Also, there are One thousand, seven hundred and sixty one (1761) science teachers and one hundred and four SLMSs spread across the Federal unity schools (FUSs) as at September 2012 (Field work). Out of the figure for the science teachers, six hundred and sixteen (616) representing about thirty eight percent (37.9%) teach mathematics, three hundred and seventy nine (379) representing about twenty two percent (21.6%) teach biology, three hundred and sixty one (361) representing about twenty one percent (20.6%) teach physics, while four hundred and five (405) representing about twenty three percent (22.9%) teach chemistry (See Appendix IV). These science teachers are very relevant to this study as they are the one that can offer valuable information as far as ICT facilities accessibility and use in teaching science subjects is concerned.

3.4 Sample Size and Sampling Technique

The multi-stage sampling technique was adopted in selecting the sample size for the study. At the first stage of selecting the sample, the systematic random sampling technique was used in selecting twenty-four percent (24.0%) of the total number of FUSs in Nigeria. Using this sampling technique, every fourth school on the list of the FUSs arranged in a serial order, was selected. The general formula for systematic random sampling technique is k = N/n, where N represents the total number of FUSs in Nigeria, n represents the sample size selected, and k represents the interval (See Appendix III). Thus, twenty-five FUSs were selected for the study as follows: North West (4), North Central (3), North East (5), South West (5), South East (2), South South (5), and FCT (1) (See Appendix V). The systematic random sampling was adopted because of its ability to reduce human bias in the selection of the FUSs included in the sample thereby providing the researcher with a sample that is highly representative of the population of FUSs in Nigeria. It also enables the researcher to make valid statistical conclusion from the data collected.

At the second stage of the sampling procedure, the total enumeration method was adopted in view of the fact that the total population of the science teachers and the school library media specialists in the selected FUSs is not much (see Appendix VI).

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Sambo (2005) stated that when a survey covers the whole population of interest and describes the situation in totality by giving complete information on the population it is called a total enumeration or census study. In this case the totality of the science teachers' population and school library media specialists in selected FUSs was considered for the study. Therefore, a total of 464 science teachers, comprising 103 biology, 101 chemistry, 154 mathematics, 106 physics teachers and 25 school library media specialists (SLMCs) were selected for the study (See Table 3.1).

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Table 3.1: Federal Unity Schools Selected and Population of Science Teachers

S/N	State Code	State	Name of FUS	No of Teachers				
				Bio	Chem	Maths	Phy	SLMC
1	02	Adamawa	FGC, Ganye	6	4	5	3	1
2	03	Akwa-Ibom	FGGC, Ikot-Obio-Ibong	4	3	5	6	1
3	04	Anambra	FSTC, Awka	7	6	8	5	1
4	06	Benue	FGGC, Gboko	3	4	12	6	1
5	07	Borno	FGGC, Monguno	2	2	5	3	-
6	09	Delta	FGC, Warri	5	6	4	8	1
7	10	Edo	FSTC, Uromi	2	3	6	4	1
8	12	Imo	FGGC, Owerri	6	6	5	5	1
9	14	Kaduna	FGGC, Zaria	5	6	7	4	1
10	16	Katsina	FGC, Daura	7	5	9	6	1
11	17	Kebbi	FGGC, Gwandu	4	4	7	3	1
12	19	Kwara	FGC, Ilorin	4	5	9	5	1
13	20	Lagos	Queens College, Lagos	5	6	8	6	1
14	21	Niger	FGGC, New Bussa	4	2	6	4	1
15	22	Ogun	FSTC, Ijebu Mushin	3	4	5	4	1
16	24	Osun	FGC, Ikirun	5	3	6	3	1
17	25	Oyo	FGGC, Oyo	3	5	7	4	1
18	27	Rivers	FGGC, Abuloma	5	2	5	4	1
19	29	Taraba	FGGC, Wukari	2	2	9	2	1
20	30	Yobe	FGGC, Potiskum	4	5	4	5	1
21	31	Abuja	FGBC, Apo-Garki, Abuja	3	5	6	5	1
22	32	Bayelsa	FGGC, Imiringi	3	3	4	3	1
23	34	Ekiti	FGC, Ido Ani	3	4	4	2	1
24	35	Gombe	FGGC, Bajoga	3	2	3	3	1
25	37	Zamfara	FGGC, Gusau	5	4	5	3	1
			Total	103	101	154	106	24

Source: Preliminary Survey, 2011

Key: FGC, Federal Government College; FGGC, Federal Government Girls College; FSTC, Federal Science Technical College, FGBC, Federal Government Boys College

Also, the school library media specialists in the selected FUSs (25) formed part of the respondents but only 24 responded to the questionnaire.

3.5 Instrumentation

The research instruments adopted for this study were questionnaire and observation technique. Two sets of questionnaire were adopted for this study. The first set of questionnaire adopted for this study was named **"Predictors of ICT Use by Science Teachers Questionnaire" (PIUSTQ)** comprises seven sections (A-F).

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The first section, (Section A) of the questionnaire is aimed at gathering data on the personal information of respondents such as Age, Sex, Designation, Highest educational level, subject specialization et cetera. Section B of the questionnaire is designed to measure the extent of availability and accessibility of ICT resources for teaching and learning by the respondents. The extent of availability will be measured using a 3 point scale of "Available"; "Available and functioning"; and Not functioning" while the level of accessibility to ICT facilities by science teachers was measured using a 4 point scale of "Very easily accessible"; "Easily accessible"; Occasionally accessible"; and "Not accessible". The location of ICT facilities was also measured. A list of the various locations from which ICT facilities can be accessed was produced out of which the respondents were requested to tick the ones appropriate to them.

Section C of the questionnaire is designed to gather information on pattern of use of ICT resources in teaching by science teachers in FUSs. The purpose of use of ICT resources contains 14 items, frequency of use has 17 items and was measured using a four point scale of "Highly Used", 'Used", "Fairly Used", and 'Not Used', It comprises statements to which the respondents indicate the option that best apply to them.

Section D is designed to gather information on the computer self-efficacy level of science teachers. It contains 17 items and was measured using a 4-point likert scale of "Strongly agree", "Agree", "Disagree", and "Strongly disagree". Section E of the questionnaire is designed to gather information on the attitude of the respondents toward the use of ICT facilities in teaching and it comprises of 20 items to which the respondents agree or disagree with. The 4 point likert scale was adopted for the section. Section F of the questionnaire was designed to collect information on the role of school library media centre in the provision and use of ICT for teaching by the science teachers in the FUSs. It contains statements to which the teachers agree or disagree with, and was measured on a 4 point scale of likert scale of "Strongly agree", "Agree", "Disagree", and "Strongly disagree".

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The second set of questionnaire tagged **"School Library and ICT Usage Questionnaire (SLIUQ)"** was designed to gather information on the role of school library media centres in ensuring provision, access and use of ICT facilities by science teachers in FUSs in Nigeria. It comprises three sections. Section A aimed at gathering data on the personal information of the school library media specialists (SLMSs) such as name of school, age, sex, highest educational qualification et cetera while Section B of the questionnaire is designed to establish the availability, functionality, and accessibility of ICT facilities at FUSs in Nigeria. Section C of the questionnaire was designed to gather information on the role of school library media centre in the provision of and use of ICT facilities by teachers.

3.6 Validation and Reliability of the Research Instrument

The drafts of the two sets of questionnaire were given to the researcher's supervisor and experts in the fields of educational technology and library and information studies including school media for their inputs on the adequacy and appropriateness of the items in the instruments. Based on their suggestions and criticisms, some items on the questionnaires were modified. The two sets of the questionnaires PIUSTQ and SLIUQ were trial-tested on fifty science teachers and two school library media specialists selected from two FUSs in Oyo (i.e FGC, Ogbomoso and Osun (i.e FGC Ipetumodu) states that were not part of the main study. The data collected were subjected reliability coefficient variable by variable. The result is presented in Table 3.2.

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Table 3.2: Reliability coefficients of study variables

Sections	Predictors of ICT Usage by Science Teachers Questionnaire (PIUSTQ)		School Library and ICT Usage (SLIUQ)	
	Number of Items	Reliability coefficient (r)	Number of Items	Reliability coefficient (r)
Demographic variables	6	0.61		
ICT Availability			18	0.72
ICT Access	18	0.83	18	0.82
Computer self-efficacy	17	0.85		
Attitude towards ICT	20	0.65		
Role of SLMC	18	0.75	14	0.76
ICT usage	17	0.89		

3.7 Administration of the Questionnaire

The administration of the questionnaire was done over a period of 20 weeks. The sets of questionnaire for this study were administered with the aid of research assistants that have been briefed about the questionnaire and process of administration. Two research assistants were selected from each of the geographical zones in which the FUSs selected for the study were located. The research assistants helped in the administration, collection, and postage of the copies of questionnaire from the respondents. Most of these research assistants used for data collection were school library media specialists working in the FUSs except in few cases.

By virtue of the researcher's position as the administrative secretary of the Nigerian School Library Association, he has access to the contacts (that phone numbers, e-mail and contact addresses) of all the school library media specialists and the principals in the FUSs in Nigeria. In most cases, the questionnaires were posted to the school library media specialists/research assistants using speed (EMS and UPS speed posts) while in some other cases the questionnaire were deployed to the e-mail addresses of the school library media specialists/research assistants. Also, the researcher visited some schools personally to administer the questionnaire.

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3.8 Method of Data Analysis

The descriptive methods of analysis such as frequency, percentage, mean, and standard deviation and inferential statistics such as Pearson Product Moment Correlation, and regression analysis in the Statistical Package for the Social Sciences (SPSS) software were used in analyzing the data collected for the study. The research questions were analysed using the descriptive statistics such as frequency, percentage, mean and standard deviation. In testing the hypotheses, the Pearson Product Moment Correlation was used to test the relationships between the variables while the multiple regression and stepwise multiple regression were used to test the contributions of the independent variables to the dependent variables and to determine the extent to which independent variables (demographic variables, computer self-efficacy, attitude towards ICT, ICT access and role of SLMC) predicted the dependent variable (ICT usage) respectively.

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CHAPTER FOUR
DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Introduction

This chapter presents findings of demographic variables, computer self-efficacy, attitude towards ICT, ICT access, and role of school library media centre as predictors of ICT use among science teachers in Federal government unity schools in Nigeria.

A total of 464 copies of science teachers' questionnaire were administered on the science teachers out of which only 353 were returned with useful responses giving a response rate of 76.1%. On the other hand, 24 copies of school library media specialists' questionnaire were returned with useful responses. These response rates were considered adequate for this study.

4.2 Presentation of Findings

The findings are presented based on the research questions answered and hypotheses tested for the study. However, the background information is presented before the detailed results.

4.2.1 Background Information

Table 4.1 presents information on the demographic distribution of science teachers in FUSs.

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Table 4.1: Demographic Information of Science Teachers

Demographic variables of science teachers		Frequency	Percentage
Age range (in years)	21 - 30 years	139	39.4
	31 – 40 years	124	35.1
	41 – 50 years	44	12.5
	51 – 60 years	46	13.0
	60 years and above	-	-
	Total	**353**	**100.0**
Gender	Male	199	56.4
	Female	154	43.6
	Total	**353**	**100.0**
Subjects taught	Physics	130	36.8
	Biology	108	30.6
	Chemistry	45	12.8
	Mathematics	70	19.8
	Total	**353**	**100.0**
Highest educational qualification	NCE	64	18.1
	NCE Plus Degree	103	29.2
	B.Ed	69	19.5
	B.Sc	60	17.0
	PGDE	46	13.0
	M.Ed	6	1.7
	M,Sc	5	1.4
	Total	**353**	**100.0**
Teaching experience (in years)	0 – 4 years	121	34.3
	5 – 9 years	100	28.3
	10 – 14 years	48	13.6
	15 – 19 years	11	3.1
	20 years and above	73	20.7
	Total	**353**	**100.0**

The background information of the teachers revealed that there are more science teachers within the age range of 20-40 years (263, 74.5%) than within the age range of 41-60 years (90, 25.5%). The distribution of the science teachers based on gender revealed that there are more male science teachers (199, 56.4%) than female science teachers among the respondents. The result on the highest educational qualification possessed by the science teachers revealed that majority of the science teachers holds a Bachelor degree (232, 65.7%) just as there are more science teachers with qualification in education (288, 81.5%) such as NCE, NCE with Degree, BE.d PGDE and M.Ed, which is a prerequisite for teaching in schools. Further results on the background information revealed that majority of the respondents (232, 65.7%) have taught for 5 years and above which implies that the science teachers have

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considerable experience in teaching. Furthermore, the background information of the teachers based on subject taught revealed the distribution of the science teachers as constituting, 130 physics teachers (36.8%), 108 biology teachers (30.6%), 45 chemistry teachers (12.7%), and 70 mathematics teachers (19.8%).

Table 4.2 presents information on the demographic distribution of school library media specialists in FUSs.

Table 4.2: Demographic Information of School Librarians/School Library Media Specialists

Demographic variables of school librarians		**Frequency**	**Percentage**
Age range (in years)	21 - 30 years	-	-
	31 – 40 years	2	8.3
	41 – 50 years	20	83.3
	51 – 60 years	2	8.3
	60 years and above	-	-
	Total	**24**	**100.0**
Gender	Male	18	75.0
	Female	6	25.0
	Total	**24**	**100.0**
Educational qualification	Diploma in Library Studies	2	8.3
	NCE	5	20.8
	Bachelor of Library Studies (BLS)	6	25.0
	Bachelor of Education (B.Ed)	2	8.3
	Master degree (MLIS/M.Sc./M.Ed)	9	37.5
	Others	-	-
Total		**353**	**100.0**

Analysis of the background information of school librarians revealed that there are more school librarians (22 or 91.7%) within the age range of 41-60 years. The distribution of the school librarians based on gender revealed that there are more male (18 or 75.0%) than female among the school librarians. Further analysis of the demographic information of respondents revealed that majority of the school librarians are graduates (17 or 70.8%). This implies that majority of the school librarians possessed the minimum qualification to work in FUSs and secondary schools in Nigeria. However, results of the analysis revealed that only few of the school librarians (8 or 33.3%) possess qualification in librarianship. This implies that only few of the school librarians in FUSs in Nigeria are professional qualified. Majority of the personnel in SLMCs in FUSs in Nigeria were found to possess NCE, B.Ed, M.Sc and M.Ed qualifications.

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Research question 1: What are the demographic factors that predict the usage of ICT by science teachers in Federal Unity Schools (FUSs) in Nigeria?

Table 4.3 presents information on the demographic factors that determine the usage of ICT by science teachers in FUSs in Nigeria.

Table 4.3: Demographic variables predicting ICT use by Science teachers in FUSs

Model	Unstandardised Coefficients'		Standard Coefficients	t	Sig
	B	Std Error	Beta		
ICT Use	-.285	.413		.690	.491
Age	.169	.102	.109	1.605	.097
Gender	.075	.148	.024	.510	.610
Subject(s) taught	.108	.078	.075	1.391	.165
Educational qualification	.-.303	.058	-.275	5.263	.000
Teaching experience	-.365	.070	-.344	5.186	.000
ICT use experience	.224	.088	.130	2.534	.012
ICT Access	.135	.069	.123	1.942	.053
Self-efficacy	.239	.102	.165	2.338	.020
Attitude	.507	.105	.343	4.830	.000
Role of SLMC	.046	.112	.026	.409	.682

Information on the demographic variables that predict ICT usage among the science teachers revealed educational qualification (β = -.275, t = 5.263, $p<0.05$), teaching experience (β = -.344, t = 5.186, $p<0.05$), and ICT use experience (β = .130, t = 2.534, $p<0.05$) as demographic variables that predicted the usage of ICT among the science teachers in FUSs. This implies that educational qualification, teaching experience, and ICT use experience are demographic variables that significantly predict ICT usage by science teachers in FUSs. Teaching experience and educational qualification were found to be the best predictors among the demographic variables that predict ICT usage by science teachers in FUSs though the predictions were negative. The negative predictions may mean that science teachers with lower educational qualification and less teaching experience make more usage of ICT than teachers with higher educational qualification and higher teaching experience. ICT use experience, on the other hand, had a positive prediction on ICT usage. This implies that science teachers with longer years of ICT use experience make more usage of ICT than those with shorter years of ICT use experience.

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Research question 2: What is the location of ICT access and degree of ICT accessibility among science teachers in FUSs in Nigeria?

Table 4.4 presents information on the degree of ICT accessibility among science teachers in FUSs in Nigeria.

Table 4.4: Response on Degree of ICT accessibility

Statement	Response				Mean	S.D
	VEA	EA	OA	NA		
Computers	158 44.8%	85 24.1%	10 2.8%	100 28.3%	2.85	1.26
Spreadsheet program (Excel etc)	151 42.8%	44 12.5%	37 10.5%	121 34.3%	2.64	1.33
Online databases	132 37.4%	85 24.1%	14 4.0%	122 34.6%	2.64	1.29
Interactive whiteboard/Smart board	72 20.4%	39 11.0%	45 12.7%	197 55.8%	2.64	1.33
Multimedia resources	141 39.9%	75 21.2%	6 1.7%	131 37.1%	2.64	1.33
Word Processor	154 43.6%	41 11.6%	9 2.5%	149 42.2%	2.57	1.40
Graphical visualizing tools (used to visualize abstract science concepts in real terms)	115 32.6%	25 7.1%	11 3.1%	202 57.2%	2.49	1.43
Concept mapping software (used to develop diagrams to illustrate concepts and relationships between science concepts)	111 31.4%	21 5.9%	37 10.5	184 52.1%	2.49	1.36
Multimedia projectors	119 33.7%	77 21.8%	12 3.4%	145 41.1%	2.48	1.32
Web-based Internet laboratories (used describe and perform science experiments on the Internet in a virtual laboratory)	86 24.4%	46 13.0%	17 4.8%	204 57.8%	2.48	1.38
Discussion list/Newsgroup	92 26.1%	39 11.0%	7 2.0%	215 60.%	2.45	1.41
Simulation (used to help students visualize complex or abstract phenomenom)	61 17.3%	22 6.2%	10 2.8%	220 62.3%	2.44	1.44
Presentation software(Power Point, KidPix)	105 29.8%	41 11.6%	17 4.8%	190 53.8%	2.40	1.38
E-mail (for Online communication with students)	114 32.3%	54 15.3%	43 12.2%	142 40.2%	2.40	1.30
Models/Modeling software (used to simplify science phenomenom and explain it)	82 23.2%	31 8.8%	11 3.1%	229 64.9%	2.37	1.34
Instructional video/audio tapes	100 28.3%	39 11.0%	70 19.8%	144 40.8%	2.27	1.26
Computer Aided Instructional Software (used to enable and help the student to learn at individual pace)	76 21.5%	64 18.1%	45 12.7%	168 47.6%	2.14	1.23
Overall Weighted Mean					**2.49**	

Key: (VEA) Very Easily Accessible (EA) Easily Accessible (OA) Occasionally Accessible, (NA) Not Accessible

Table 4.4 presents information on the degree of ICT accessibility among science teachers in FUSs in Nigeria. However, using the criterion mean of 2.50, only Computers (χ = 2.85), spreadsheet program (χ = 2.64), online databases (χ = 2.64), multi-media resources (χ = 2.64), and word processor (χ = 2.57) were found to top the

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list of ICT resources that are accessible among science teachers. On the other hand, the level of accessibility of science-based ICT such as graphical visualizing tool (χ = 2.49), web-based internet laboratories (χ = 2.48), simulation programmes (χ = 2.44), models/modeling software (χ = 2.44), and VCD individualized science instruction materials (χ = 2.05) was found to be low. Also, the overall weighted mean of 2.49 was found to be lower than the criterion mean of 2.50 set for high level accessibility of ICT usage. It may therefore be inferred that ICT resources and most importantly science based ICT applications are not readily accessible to the science teachers in FUSs

Table 4.5 presents information on the location of ICT access among science teachers in FUSs in Nigeria.

Table 4.5: Location of ICT access by science teachers

Location of access	Frequency	Percentage
Specialised classroom/laboratory	254	71.9
Library	91	25.8
Science laboratory	89	25.2
Cybercafé	68	19.3
Classroom	55	15.6
Teachers' office	54	15.3
Staff room	44	12.5
Meeting room	43	12.2
At home	43	12.2
ICT laboratory	33	9.3

Information on the location of ICT access by the science teachers as presented in Table 4.5 revealed that majority of the science teachers attested to specialized classroom/laboratory (254, 71.9%) as their location of ICT access. Other locations being used by the science teachers include; library (91, 25.8%), and science laboratory (89, 25.2%). The least used location of ICT access among the science teachers as revealed by the information gathered include staff room (44, 12.5%), meeting room (43, 12.2%), home (43, 12.2%), and ICT laboratory (33, 9.3%). This implies that the most used location of ICT access by the science teachers is the specialised classroom/laboratory within the school.

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Research question 3: What is the computer self-efficacy level of science teachers in FUSs in Nigeria?

Table 4.6 presents information on the computer self-efficacy level of science teachers in FUSs in Nigeria.

Table 4.6: Computer self-efficacy level of science teachers

Statement	Response				Mean	S.D
	SA	A	D	SD		
I can confidently use the computer facilities to find needed information	175 49.6%	95 26.9%	10 2.8%	73 20.7%	3.05	1.16
I can confidently use computer facilities to solve practical problems	156 44.2%	106 30.0%	16 4.5%	75 21.2%	2.97	1.60
I can confidently use computer to communicate with people	139 39.4%	126 35.7%	22 6.2%	66 18.7%	2.96	1.09
I can confidently use computer for research purposes	136 38.5%	131 37.1%	18 5.1%	68 19.3%	2.95	1.09
I feel confident learning to use a variety of programmes (software)	135 38.2%	131 37.1%	15 4.2%	72 20.4%	2.93	1.11
I can use computer to access information needed to perform tasks related to teaching in an efficient manner	125 35.4%	140 39.7%	4 1.1%	84 23.8%	2.87	1.42
I find computer flexible to interact with	121 34.3%	141 39.9%	12 3.4%	79 22.4%	2.86	1.12
I feel confident using the computer to organize information	134 38.0%	102 28.9%	47 13.3%	70 19.8%	2.85	1.13
I feel confident working on a personal computer	133 37.7%	106 30.0%	34 9.6%	80 22.7%	2.83	1.16
I could complete a job or task using computer without ant assistance or help	126 35.7%	109 30.9%	49 13.9%	69 19.5%	2.83	1.12
I am experienced at using computer	131 37.1%	97 27.5%	45 12.7%	80 22.7%	2.79	1.16
I feel confident getting software up and running	126 35.7%	104 29.5%	45 12.7%	78 22.1%	2.79	1.15
I can confidently use computer to teach the students	123 34.8%	101 28.6%	52 14.7%	77 21.8%	2.76	1.15
I feel confidents to integrate computer facilities in teaching	117 33.1%	103 29.2%	41 11.6%	92 26.1%	2.69	1.18
I feel confident organizing and managing files	116 32.9%	90 25.5%	63 17.8%	84 23.8%	2.67	1.17
I am experience at using ICT in teaching	114 32.3%	97 27.5%	43 12.2%	99 28.0%	2.64	1.20
Overall Weighted Mean					**2.84**	

Key: SA: Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree

Table 4.6 revealed that the overall weighted mean of computer self-efficacy of science teachers in FUSs in Nigeria is 2.84 which was found to be higher than the criterion mean of 2.50 set for high level of computer self-efficacy. Hence the inference can be drawn that the computer self-efficacy level of science teachers in FUSs is high. This high computer self-efficacy level is revealed in the positive

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responses recorded for each of the statements on the scale for estimating the computer self-efficacy level of the science teachers and the higher mean recorded for each of the statements on computer self-efficacy.

Research Question 4: What attitudes do science teachers in FUSs in Nigeria exhibit toward ICT?

Table 4.7 presents information on the attitudes of science teachers in FUSs in Nigeria toward ICT.

Table 4.7: Attitude of science teachers toward ICT

Statement	Response				Mean	S.D
	SA	A	D	SD		
I would like to learn more about computer	165 46.7%	116 32.9%	10 2.8%	62 17.6%	3.09	1.10
I feel comfortable when there is discussion on ICT use for teaching	133 37.7%	126 35.7%	14 4.0%	80 22.7%	2.88	1.15
I am convinced that use of ICT in teaching of science will give better results	164 46.5%	72 20.4%	17 4.8%	100 28.3%	2.85	1.28
I feel comfortable in my ability to use ICT	131 37.1%	98 27.8%	41 11.6%	83 23.5%	2.78	1.18
I use ICT for other activities than for teaching	121 34.3%	96 27.2%	54 15.3%	82 23.2%	2.73	1.16
I won't have anything to do with ICT	135 38.2%	76 21.5%	31 8.8%	111 31.4%	2.67	1.27
I consider ICT very useful in exploring science concepts and ideas	146 41.4%	61 17.3%	24 6.8%	122 34.6%	2.65	1.32
I want to get better at using ICT to help me in the teaching of my subjects	134 38.0%	70 19.8	27 7.6%	122 34.6%	2.61	1.30
I have reservation about using ICT for teaching	120 34.0%	60 17.0%	69 19.5%	104 29.5%	2.56	1.23
I do not like using ICT for teaching important topics in my subject	121 34.3%	60 17.6%	62 17.6%	110 31.2%	2.54	1.25
I have phobia for ICT equipment	132 37.4%	43 12.2%	53 15.0%	125 35.4%	2.52	1.31
I am indifferent about using ICT for teaching	94 26.6%	83 23.5%	79 22.4%	97 27.5%	2.49	1.16
I know ICT resources are important but I don't feel I need to use them to teach my subject	120 34.0%	55 15.6%	57 16.1%	121 34.3%	2.49	1.27
I feel using ICT is too new and strange to make it worthwhile for teaching and learning of science subject	104 29.5%	62 17.6%	61 17.6%	126 35.7%	2.41	1.25
I have never been excited about using ICT to teach	93 26.3%	81 22.9%	53 15.0%	126 35.7%	2.40	1.22
I am not what I could call a computer person	103 29.2%	59 16.7%	60 17.0%	131 37.1%	2.38	1.25
I find having to use ICT frightening	104 29.5%	53 15.0%	60 17.0%	136 38.5%	2.35	1.26
I would rather teach by traditional method(i.e chalk, and talk)	108 30.6%	55 15.6%	50 14.2%	140 39.7%	2.37	1.28
Overall Weighted Mean					**2.59**	

Key: SA: Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree

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Considering the attitude of science teachers in FUSs towards ICT facilities, Table 4.7 revealed that the overall weighted mean of science teachers' attitude towards ICT is found to be 2.59 which is greater than the criterion mean of 2.50 set for positive attitude of science teachers. Hence, the inference can be drawn that the science teachers in FUSs have positive attitude towards ICT facilities. The positive attitude is also reflected in their agreement with most of the positive statements on attitude toward ICT and their disagreement with most of the negative statements on attitude toward ICT.

For example majority of the science teachers agreed with the statement like 'I would like to learn more about computer' (281, 79.6%), "I feel comfortable when there is discussion on ICT use for teaching" (259, 72.4%) and, "I am convinced that use of ICT in teaching of science will give better results" (236, 66.9%). It can be inferred from the responses to the statement that the science teachers are positively disposed to ICT facilities. The disagreement with negative statement on attitude toward ICT facilities among science teachers such as "I have phobia for ICT", "I find having to use ICT frightening", and "I feel ICT is too new and strange to make it worthwhile for teaching and learning of science subjects" with response rates of 175 (50.4%), 157 (44.5%), and 166 (53.3%) respectively further affirms the positive disposition of the science teachers towards ICT facilities.

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Research question 5: What is the purpose of ICT usage among science teachers in FUSs in Nigeria?

Table 4.8 presents information on the purpose of ICT usage among science teachers in FUSs in Nigeria.

Table 4.8: Purpose of usage of ICT facilities by science teachers

Purpose of use	Frequency	Percentage
Collaborative learning (enabling group work and learning among students)	94	26.6
Enrichment activities (using computer to create variety of graphics, pictures and projects that can aid teaching and learning of science concepts)	91	25.8
Multimedia application	89	25.2
Tutorials	85	24.1
Information access via CD-ROM	80	22.7
Testing	81	22.9
Problem solving (using computer programmes and/or games to guide students into finding solutions into science problems)	80	22.7
Drill and Practice	82	23.2
Recreational and educational games	79	22.4
Presentation of new materials	74	21.0
Remediation and acceleration	65	18.4
Experimentation/Simulations (used to help students visualize complex or abstract phenomenon)	63	17.8

The pattern of usage was measured by the purpose of use and level/extent of use of ICT resources. Information from Table 4.8 on the purpose of ICT usage facilities by the respondents revealed collaborative learning (94, 26.6%), enrichment activities (91, 25.8%) and multimedia application (89, 25.2%) and tutorials (85, 24.1%) as topping the list of purposes for which science teachers use ICT facilities. The purposes for which the science teachers make least use of ICT resources include presentation of new materials (74, 21.0%), remediation and simulation (65, 18.4%), and experimentation and simulation (63, 17.8%). Also, Table 4.6 showed that less than one-third of the respondents affirmed the use of ICT resources for one purpose of the other. The implication to be drawn from this is that there is low or poor usage of ICT resources among the science teachers studied. It can also be inferred from information supplied in the table that science teachers use ICT facilities more for classroom-based

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activities such as collaborative learning, enrichment activities, and tutorials than laboratory based activities such as experimentation and simulation activities which is a major element of science teaching.

Table 4.9 presents information on the extent of ICT usage among science teachers in FUSs in Nigeria.

Table 4.9: Extent of use of ICT facilities by science teachers

Statement					Mean	S.D
	HU	U	FU	NU		
I use online database to access science based content online	163 46.2%	71 20.1%	18 5.1%	101 28.6%	2.84	1.30
I Use data collection probes is to collect data online	47 13.3%	69 19.5%	24 6.8%	213 60.3%	2.78	1.28
I use ICT for information access (CD-ROMs, Internet, databases in finding and accessing information and educational resources)	182 51.6%	37 10.5%	20 5.7%	114 32.3%	2.24	1.37
I use ICT such as word processing in preparation of lesson notes	179 50.7%	47 13.3%	25 7.1%	102 28.9%	2.20	1.33
I use ICT for tutorials, word processing, instructional video/audio tapes	87 24.6%	60 17.0%	30 8.5%	176 49.9%	2.16	1.28
I use ICT for problem solving (simulations, virtual laboratory, discussion lists/newsgroup, graphical visualization)	101 28.6%	40 11.3%	16 4.5%	196 55.5%	2.13	1.34
I use ICT for presentation of new materials (use of presentation software)	187 53.0%	38 10.8%	32 9.1%	96 27.2%	2.12	1.31
I use of recreational and educational games to help students learn better	90 25.5%	45 12.7%	31 8.8%	187 53.0%	2.11	1.29
I use ICT for remediation/acceleration of instruction	93 26.3%	42 11.9%	27 7.6%	191 54.1%	2.10	1.31
I use online discussion board in facilitating discussion between the myself and students	100 28.3%	37 10.5%	16 4.5%	200 56.7%	2.10	1.33
I use videos, simulations, model, and databases to enrich teaching and learning activities	99 28.0%	28 7.9%	33 9.3%	193 54.7%	2.09	1.32
I use ICT such as drill and practice to guide students learning	84 23.8%	43 12.2%	38 10.8%	188 53.3%	2.07	1.27
I use online communication tool such as e-mail to facilitate communication between the myself and students	208 58.9%	41 11.6%	10 2.8%	94 26.6%	2.06	1.33
I use ICT for testing students' knowledge (e.g Computer based testing, drill and practice, etc)	81 22.9%	55 15.6%	12 3.4%	205 58.1%	2.03	1.29
I use ICT resources such as internet and wikis to facilitate collaborative learning among students	94 26.6%	26 7.4%	31 8.8%	202 57.2%	2.03	1.31
I use ICT such as simulation models, and virtual laboratory for virtual experimentation	87 24.6%	34 9.6%	14 4.0%	218 61.8%	1.97	1.31
Overall Weighted Mean					**2.18**	

Key: HU = Highly Used, U = used, FU = Fairly Used, NU = Not Used

Information on the extent/level of ICT use by science teachers in FUSs as presented in Table 4.9 revealed that majority of the respondents affirmed the high use of e-mail

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and communication tool for communication between teachers and students (208 or 58.9%), presentation software for presentation of new materials (187, 53.0%), CD ROMs and Internet for information access (182, 51.6%), and word processing for preparation of lesson notes. Also, the non-use of database to access science based content online (252, 71.4%), virtual laboratory facilities (218, 61.8%), data collection probes for data collection (213 or 60.3%), computer-based testing facility (205, 58.1%), online discussion board (200, 56.7%), use of online problem solving application such as simulations (196, 55.5%), video and simulations for enrichment activities (193, 54.7%), recreational and educational games (187, 53.0%) was affirmed by the respondents.

Also, the overall weighted mean of science teachers' level of ICT usage was found to be 2.17 which is lower than the criterion mean of 2.50 set for high level of ICT usage by science teachers. Hence, the inference can be drawn that there is a low and irregular use of ICT facilities for teaching activities among science teachers in FUSs in Nigeria.

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Research question 6: What is the level of ICT availability and accessibility in SLMCs in FUSs in Nigeria?

Table 4.10 presents information on the level of availability and accessibility of ICT facilities in SLMCs in Nigeria.

Table 4.10: Available ICT facilities in SLMCs in FUSs in Nigeria

Statement	Response				Mean	S.D
	AV	AV & F	AV & NF	NR		
Computers	16 66.7%	2 8.3%	6 25.0%	0 0.0%	2.42	0.881
Multimedia projectors	12 50.0%	2 8.3%	10 41.7%	0 0.0%	2.08	0.974
Word Processor	12 50.0%	0 0.0%	12 50.0%	0 0.0%	2.00	0.022
E-mail (for online communication with students)	12 50.0%	0 0.0%	12 50.0%	0 0.0%	2.00	0.022
Online databases	12 50.0%	0 0.0%	0 0.0%	12 50.0%	2.00	0.022
Interactive whiteboard/Smart board	9 37.5%	5 20.8%	10 41.7%	0 0.0%	1.96	0.908
Presentation software(Power Point, KidPix)	0 0.0%	0 0.0%	11 45.8%	13 54.2%	1.96	0.955
Multimedia resources	9 37.5%	5 20.8%	10 41.7%	0 0.0%	1.96	0.908
Discussion list/Newsgroup	3 12.5%	0 0.0%	0 0.0%	21 87.5%	1.88	0.947
Web-based Internet laboratories	3 12.5%	0 0.0%	0 0.0%	21 087.5%	1.88	0.947
Spreadsheet program (Excel etc)	9 37.5%	3 12.5%	12 50.0%	0 0.0%	1.88	0.947
Simulation programmes and Games	7 29.2%	4 16.7%	13 54.2%	0 0.0%	1.75	0.897
Instructional video/audio tapes	5 20.8%	6 25.0%	13 54.2%	0 0.0%	1.67	0.816
Graphical visualizing tools	5 20.8%	1 4.2%	0 0.0%	18 75.0%	1.58	0.830
Concept mapping software	0 0.0%	2 8.3%	0 0.0%	22 91.6%	1.50	0.834
Computer Aided Instructional Software	4 16.7%	2 8.3%	18 75.0%	0 0.0%	1.42	0.776
Models/Modeling software	5 20.8%	0 0.0%	19 79.2%	0 0.0%	1.42	0.830
Overall Weighted Mean					**1.84**	

Key: AV = Availability; AV&F = Available and Functioning; AV & NF = Available and Not Functioning; NR = No Response)

Table 4.10 presents information on ICT resources availability within the SLMCs. In the context of this study, availability is measured by availability and functionality. Therefore, information from the table showed that the most commonly available ICT

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resources in SLMCs are computers (18, 75.0%; χ = 2.42), multimedia projectors (14, 58.3%; χ = 2.08), word processor (12, 50.0%; χ = 2.00), e-mail facility (12, 50.0%; χ = 2.00), and online databases (12, 50.0%; χ = 2.00) while the least commonly available ICT resources include; simulation programmes (11, 45.9%, χ = 1.75), instructional video tapes (11, 45.9%, χ = 1.67), graphical visualising tools (6, 25.0%; χ = 1.58), concept mapping software (2, 8.3%; χ = 1.50), computer aided instructional software ((6, 25.0%; χ = 1.42) and models/modelling software (5, 20.8%; χ = 1.42). Furthermore, the overall weighted mean of ICT availability in SLMC in FUSs in Nigeria was found to be 1.84 which is lower than the criterion mean of 2.0 set for high level of ICT availability. It can therefore be inferred that there is dearth of science-based ICT resources and applications in SLMCs in FUSs in Nigeria. Models/modeling software, computer aided instruction software, graphic visualizing tools, web-based internet laboratories, and concept mapping software were found to be the least commonly available ICT facilities to support science teaching in SLMCs in FUSs.. Hence, the inference can be drawn that there is dearth of ICT availability in SLMCs in FUSs in Nigeria.

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Table 4.11 presents information on the degree of ICT accessibility in FUSs in Nigeria.

Table 4.11: ICT Accessibility in SLMCs in FUSs in Nigeria

Statement	Response				Mean	S.D
	VEA	EA	OA	NA		
Computers	10 41.7%	3 12.5%	0 0.0%	11 45.8%	2.38	1.44
E-mail (for Online communication with students)	7 29.2%	2 8.3%	0 0.0%	15 62.5%	2.04	1.40
Presentation software(Power Point, KidPix)	7 29.2%	0 0.0%	2 8.3%	15 62.5%	1.96	1.37
Word Processor	15 62.5%	2 8.3%	0 0.0%	7 29.2%	1.96	1.37
Interactive whiteboard/Smart board	7 29.2%	0 0.0%	2 8.3%	15 62.5%	1.96	1.37
Simulation programmes and Games	7 29.2%	0 0.0%	2 8.3%	15 62.5%	1.96	1.37
Spreadsheet program (Excel etc)	7 29.2%	0 0.0%	0 0.0%	17 70.8%	1.88	1.39
Online databases	7 29.2%	0 0.0%	0 0.0%	17 70.8%	1.88	1.39
Graphical visualizing tools	7 29.2%	0 0.0%	0 0.0%	17 70.8%	1.88	1.39
Multimedia resources	7 29.2%	0 0.0%	0 0.0%	17 70.8%	1.88	1.39
Discussion list/Newsgroup	5 20.8%	2 8.3%	0 0.0%	17 70.8%	1.88	1.39
Web-based Internet laboratories	7 29.2%	0 0.0%	0 0.0%	17 70.8%	1.88	1.39
Computer Aided Instructional Software	6 25.0%	0 0.0%	3 12.5%	15 62.5%	1.88	1.30
Multimedia projectors	5 20.8%	0 0.0%	6 25.0%	13 54.2%	1.88	1.19
Concept mapping software	5 20.8%	2 8.3%	0 0.0%	17 70.8%	1.79	1.29
Models/Modeling software	5 20.8%	0 0.0%	0 0.0&	19 79.2%	1.62	1.25
Instructional video/audio tapes	0 0.0%	3 12.5%	6 25.0%	15 62.5%	1.50	0.72
Weighted Mean Average					**1.89**	

Key: VEA = Very Easily Accessible (EA) Easily Accessible (OA) Occasionally Accessible, (NA) Not Accessible

On the level of ICT accessibility in SLMCs in FUSs, information from Table 4.11 revealed that only word processing facility and computers are easily accessible in SLMCs in FUSs as attested to by 17 or 70.8% and 13 or 54.2% respondents respectively. Other ICT facilities were found to be accessible on occasional basis. This, therefore, implies that there is a low level of access to ICT facilities through SLMCs in FUSs in Nigeria. Also, the overall weighted mean of ICT accessibility in

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SLMCs which was found to be 1.89 which is lower than the criterion mean of 2.50 set for high level of ICT accessibility through SLMCs. Hence, the inference can be drawn that there is a low level of ICT accessibility in SLMCs in FUSs in Nigeria.

Research question 7: What roles are being played by school library media centre (SLMC) in facilitating ICT usage among science teachers in FUSs in Nigeria?

Table 4.12 presents science teachers' response on the roles being played by school library media centres in facilitating ICT usage.

Table 4.12: Science teachers' response on role of school library media centre in ICT usage

Statement	Response			
	SA	**A**	**D**	**SD**
Provision of access to and use of computers	199 56.4%	123 34.8%	3 0.8%	28 7.8%
Access to and use of printing facilities	28 7.9%	3 0.8%	178 50.4%	144 40.8%
Access to suite of software programs	35 9.9%	6 1.7%	191 54.1%	121 34.3%
Help in facilitating usage of websites for research	29 8.2%	11 3.1%	184 52.1%	129 36.5%
Access to and use of internet	158 44.8%	166 47.0%	15 4.2%	14 4.0%
Help in using presentation software	14 4.0%	7 2.0%	131 37.1%	201 56.9%
Provision of support staff to assist in the use of ICT for teaching	66 18.7%	4 1.1%	171 48.4%	112 31.7%
Training and capacity building for teachers	15 4.2%	58 16.4%	113 32.0%	162 47.3%
Provision of technical support	65 18.4%	0 0.0%	163 46.5%	125 35.4%
Maintenance of ICT facilities	62 17.6%	13 3.7%	165 46.7%	113 32.0%
Subscription to software to support science teaching	164 46.5%	119 33.7%	3 0.8%	67 19.0%
Web access to in-house developed library databases/Online catalogue	157 44.5%	125 35.4%	3 0.8%	68 19.3%
Subscription to web-based electronic resources, electronic books, databases et cetera	161 45.6%	118 33.4%	5 1.4%	69 19.5%

Key: SA: Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree

Information gathered on the role of SLMC as attested to by the science teachers revealed access to and use of the internet (324, 91.8%), provision of access to use of computers (322, 91.2%), access to and use of printing facilities as (322,91.2%),

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subscription on the web-based electronic resource (229, 79.0%) and web-access to in-house developed library database (282, 79.9%) as the only roles being played by the SLMC in facilitating ICT usage by science teachers. These roles can be categorised under the provision of ICT facilities and resourcing/infrastructural roles of SLMCs. The Table further revealed that the SLMCs are lacking in other important roles aimed at providing technical and human/training support for the science teachers. It may be inferred from this result that the SLMCs are lacking in playing fully the role that would aid the use of ICT facilities by science teachers' in FUSs.

Table 4.13 presents school library media specialists' response on the roles being played by school library centre in facilitating ICT usage among science teachers in FUSs in Nigeria.

Table 4.13: School Library Media Specialists' response on the role of SLMCs in ICT use

Statement				
	SA	**A**	**D**	**SD**
Acquisition of ICT facilities	6 25.0%	0 0.0%	13 54.2%	5 20.8%
Maintenance of ICT facilities	6 25.0%	0 0.0%	15 62.5%	3 12.5%
Provision of technical support	4 16.7%	0 0.0%	16 66.7%	2 8.3%
Provision of support staff to assist in the use of ICT for teaching	4 16.7%	0 0.0%	16 66.7%	4 16.7%
Development and maintenance of in-house computer-based teaching resources	2 8.3%	2 8.3%	14 58.3%	6 25.0%
Training and capacity building for teachers	4 16.7%	0 0.0%	18 75.0%	2 8.3%
Web access to in-house developed library databases/Online catalogue	14 58.3%	8 33.3%	0 0.0%	2 8.3%
Subscription to web-based electronic resources, electronic books, databases et cetera	16 66.7%	6 25.0%	0 0.0%	2 0.0%
Provision of instructional support	20 83.3%	2 8.3%	0 0.0%	2 8.3%
Provision of ICT information sources such as CD-ROM, Internet, and databases	1 4.1%	0 0.0%	2 8.3%	21 87.5%
Provision of access to and use of computers	1 4.1%	2 8.3%	20 80.0%	1 4.1%
Disseminating useful information on ICT facilities relevant subject teaching	22 91.7%	0 0.0%	0 0.0%	2 8.3%
Coordinating the use of ICT facilities	22 91.7%	0 0.0%	0 0.0%	2 8.3%

Key: SA: Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree

Table 4.13 shows the response of the school library media specialists on the role of SLMCs in ICT use by science teachers, it can be inferred from result of analysis that web access to in-house developed library database (22, 91.6%), subscription to web-based electronic resource (22, 91.6%), provision of access to and use of computers

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(22 or 91.6%), provision of instructional support (22, 91.6%) and provision of ICT information sources such as CD-ROM, internet, and database (22, 91.6%) are major roles being played by the SLMC in facilitating ICT use based on the responses of the school library media specialists. This is in support of the conclusion in Table 4.12.

Research question 8: What are relationships exist among demographic variables (age, gender, subject taught, teaching experience, educational qualification, and years of using ICT), computer self-efficacy, attitude toward ICT, ICT Access, role of school library media centre and ICT usage by Science teachers in FUSs?

Table 4.14 presents information on the relationships among the independent variables (demographic variables, computer self-efficacy, attitude towards ICT, ICT access, role of school library media centre and dependent variables (ICT usage).

Table 4.14: Summary of Test of Significant Relationships among Variables of Interest

Correlation Matrix

S/N	Variable	Mean	SD	ICT Use	Age range	Gender	Subject taught	Highest educ. qual	Teaching experience	Years of using ICT	CSE	Attitu-de toward ICT	ICT access	Role of SLMC
1	ICT Use	1.32	1.59	1.000										
2	Age range	1.99	1.02	-.301	1.000									
3	Gender	1.44	0.49	-.033	.041	1.000								
4	Subject (s) taught	2.14	1.11	-162	.490	.078	1.000							
5	Highest educational qualification	2.88	1.44	-110	.015	.154	-.077	1.000						
6	Teaching experience	2.48	1.49	-.277	.649	-.039	.467	.164	1.000					
7	Years of using ICT	1.69	0.92	.188	-.099	-.062	.008	.432	.108	1.000				
8	Computer self-efficacy	2.89	1.09	.328	-.178	-.099	-.074	.316	.213	.364	1.000			
9	Attitude toward ICT	2.50	1.07	.470	-.368	-.041	-.279	.279	-.052	.360	.659	1.000		
10	ICT Access	1.68	1.45	.457	-.384	.012	-.370	.079	-.239	.280	.501	.652	1.000	
11	Role of SLMC	3.20	0.90	.231	-.151	-.205	-.007	.304	.206	.298	.663	.289	.586	1.000

N.B: **Sig p<0.01

Table 4.14 presents information on the relationships between the independent variables (demographic variables, computer self-efficacy, attitude towards computer, ICT access, role of school library media centre) and ICT use. It can be deduced from Table 4.14 that age of respondents (r = -0.301, p<0.05), gender (r = -0.033, p<0.05), subjects taught (r = -.162, p<0.05), educational qualification (r = -.110, p<0.05), and teaching experience (r=-0.277, p<0.05) are negatively related with ICT use. The negative relationship between age and ICT use implies that ICT use among the science teachers decreases with age increase which means that younger science teachers make use of ICT than older science teachers. This may be due to the fact that younger science teachers, being referred to as digital natives, are more versatile in the

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use of ICT facilities than older teachers. This corroborates Alampay (2006) and Sanni, Awoleye, Egbetokun and Siyanbola (2010) which reported that ICT usage is more pronounce among the younger teachers than among their older counterparts.

Also, the negative relationships between gender of respondents and ICT use may mean that female respondents make use of ICT more than the male respondents. In other words, female science teachers were found to use ICT more than their male counterparts. This finding is in contrast with Alampay (2006) which reported men as being more receptive to ICT use than women and Birol et. al. (2008) findings which revealed that female teachers unlike their male counterparts are not motivated to ICT usage. Furthermore, the negative relationship established between subjects taught and ICT use implies that the science teachers that teach less difficult subjects make use of ICT facilities more than those who teach difficult subjects.

Moreover, educational qualification was found to be negatively related to ICT use. This shows that science teachers with lower educational qualification such as Diploma in Library Studies, NCE, and Bachelor's degree make more use of ICT than teachers with higher educational qualification such as PGDE, M.Ed, M.Sc et cetera and vice versa. This finding is at variance with Yi (2008) view which emphasized that those with higher education levels are likely to use the ICT more because they may have more skills and chances to go online.

The negative relationship between teaching experience of science teachers and their ICT use implies inverse relationship. This corroborates Inan and Lowther (2009) finding which revealed that years of teaching experiences affect teachers' use of computer in a negative manner. The implication to be drawn from the results is that science teachers with lower teaching experience make use of ICT more than science teachers with higher teaching experience and vice versa. Teachers with lower teaching experience are most likely to belong to the younger generation of teachers who are digital natives and versatile in ICT use.

On the other hand, the results further revealed ICT use experience ($r = .188$, $p<0.05$), ICT access ($r = .457$, $p<0.05$), Computer self-efficacy ($r = .329$, $p<0.05$), and role of SLMC ($r = .231$, $p<0.05$) as positively related with ICT use by science teachers. The positive relationship established between ICT access and ICT use shows that ease of

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accessing ICT would facilitate high level of ICT use by science teachers. In other words, the more the science teachers are able to easily and frequently access ICT facilities the more they are able to make use of ICT facilities and vice versa.

On the positive relationships between ICT use experience and ICT use, it can be inferred that science teachers with higher experience in ICT use make more use of ICT than science teachers with lower experience in ICT use. This may be due to the fact that teachers with high experience in ICT use tend to have high positive disposition towards ICT use which would ultimately result in regular use of ICT facilities.

The positive relationship established between computer self-efficacy and ICT use implies that science teachers with high computer self-efficacy would use ICT more than those with low computer self-efficacy. This is in support of Chang and Tung (2008) and Papastergiou (2010) views that there is a strong positive relationship between computer self-efficacy of teachers and their ICT use.

Furthermore, the positive relationship established between attitude towards computer and ICT use implies that science teachers with positive attitude towards ICT tend to making use of ICT facilities more than science teachers with negative attitude. It can also be inferred that the degree of positive or negative attitude towards ICT among science teachers would determine their extent of ICT use. For instance, science teachers with strong positive attitude would make use of ICT more than those with weak or negative attitude towards ICT. This is in corroboration of Hew and Brush (2007) views which emphasized that teachers who are positively disposed to ICT innovations are more likely to make use of ICT in their teaching.

Analysis of the relationship between ICT access and ICT use revealed that ICT access is positively related with ICT use. This implies that increases ease of access would bring about increased use of ICT among science teachers in FUSs in Nigeria. This finding corroborates Jenkins (2008) view that emphasized easier access to ICT as a prerequisite for better and increased use of ICT in classroom instruction.

The result on the relationship between the role of SLMC and ICT use revealed that role of SLMC is positively related with ICT use by science teachers (r = .231,

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p<0.05). It establishes an increase in ICT use with an increase in the role being played by SLMC in FUSs in Nigeria. The role of SLMC in FUSs includes provision of ICT access, provision of technical support, training, and maintenance facilities among others.

Further analysis on the relationship between demographic variables and attitude towards ICT among science teachers revealed that age (r = -.368), gender (r = -.041), subjects taught (r = -.279), and teaching experience (r = -.052) have negative relationships with ICT attitude towards ICT while educational qualification (r = .279), and ICT use experience (r = .360) were found to be positively related with attitude towards ICT. The negative relationship established between gender and attitude towards ICT implies that female science have positive attitude towards ICT than their male counterparts. Note that male teachers were assigned higher value than female teachers. This is at variance with Bakr (2011) that reported that male teachers in Egypt are positively disposed to ICT than their female counterparts. Also, gender was found to have contributed 0.2% to the total variance in attitude towards ICT among science teachers in FUSs.

The negative relationship established between age of respondents and attitude toward ICT implies that age of respondents is inversely related to ICT use. The implication of this is that younger science teachers are found to be more positively disposed to ICT than older teachers. Age was found to have contributed 13.5% to the total variance in science teachers' attitude toward ICT. Also, the negative relationship established between subjects taught and attitude towards ICT shows that science teachers teaching less difficult subjects are more positively disposed to ICT than those teaching difficult subjects. Note that values were assigned to subjects based on the level of difficulty in teaching and learning. Subjects that are difficult to teach were assigned higher values than subjects with less difficulty in teaching and learning. Also, subjects taught was found to be responsible for 7.8% of the total variance in science teachers attitude towards ICT.

The results on relationship between teaching experience and attitude toward ICT revealed that teaching experience is negatively related with attitude towards ICT of science teachers (r = -.052) which implies that there is a negative relationship between teaching experience and attitude toward ICT. Therefore, teachers with less teaching

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experience tend to be more favourably disposed to ICT than teachers with higher teaching experience. This may be due to the fact that teachers with lower teaching experience would belong to younger generation of teachers that are more versatile in ICT use. Teaching experience was found to determine only 0.3% of the total variance in science teachers' attitude towards ICT. This contribution is considered very low and non-significant.

Results on the relationship between ICT use experience and attitude towards ICT revealed that ICT use experience is positively related with attitude toward ICT among science teachers (r = .360) which signify a positive relationship between the two variables. This implies that science teachers with higher experience in ICT use exhibit higher positive disposition to ICT than those with lower ICT use experience. Bakr (20110 reported in his study that Egyptians teachers with higher experience in ICT use are more favourably disposed to ICT. Also, ICT use experience was found to be responsible for 12.9% of the total variance of science teachers' attitude toward ICT.

The positive relationship between educational qualification and attitude towards ICT (r = .279) implies that science teachers with higher educational qualification are more positively disposed toward ICT than teachers with lower educational qualification. Educational qualification was also found to be responsible for 7.8% of the total variance in attitude toward ICT among science teachers in FUSs. Relating this finding with the negative relationship established between educational qualification and ICT usage suggests that and higher qualification and positive attitude alone cannot determine the actual usage of ICT. Therefore, other factors such as ICT skills and usage competency may work together with educational qualification and attitude towards ICT to ensure actual usage. Teachers with positive attitude but no sills and competency to use may be unable to make use of ICT. Future research may focus on this.

Overall, demographic variables such as teaching experience, ICT use experience, gender, educational qualification, subject taught, and age are found to be jointly responsible for a total of 42.5% of the total variance in science teachers attitude toward ICT. This may mean that there are other demographic variables that determine science teachers' attitude toward ICT.

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Results of the analysis on the relationships among computer self-efficacy, ICT access, and attitude toward ICT as presented in Table 4.10 revealed a strong positive relationship between ICT access and attitude ($r = .628$, $p<0.05$). This established a strong positive relationship between ICT access and attitude toward ICT. Access to ICT was also found to be responsible for 39.4% of the total variance in attitude towards ICT. This implies that teachers with positive attitude would be more positively disposed to accessing ICT.

Moreover, ICT access was found to be positively related with computer self-efficacy ($r = .504$, $p<0.05$) which may mean that science teachers with high level of ICT access may end up developing positive attitude towards ICT. On the other hand, science teachers with high degree of ICT access may end up developing a high computer self-efficacy. Result from the study further revealed that ICT access is responsible for 25.4% of the total variance of computer self-efficacy of science teachers.

On the relationship between computer self-efficacy and attitude towards ICT, the result of the analysis revealed that attitude towards ICT is positive related with computer self-efficacy ($r = .657$, $p<0.05$) while computer self-efficacy is found to contribute 43.1% to the total variance in science teachers' attitude towards ICT. This indicates that positive attitude would be determined by high computer self-efficacy. The attitude of a science teacher towards ICT would be favourable if such teacher is very confident in his/her ability to use computer to perform tasks. Investigation on the relationship between role of SLMC and ICT access revealed a positive relationship between ICT access and SLMC ($r = .586$, $p<0.05$). This indicates that provision of access to ICT facilities is one of the major functions of SLMC. Role of SLMCs was found to have contributed 34.3% to the total variance in ICT access. This contribution which is below average indicates that SLMC in FUSs are not doing enough in the provision of access to ICT facilities in FUSs.

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Research 9: What is the relative contribution of demographic variables (age, gender, subject(s) taught, educational qualification, teaching experience, ICT use experience, computer self-efficacy, attitude towards ICT, ICT access, and role of SLMCs to ICT usage among science teachers?

Table 4.15 presents information on the relative contributions of independent variables (demographic variables, computer self-efficacy, attitude towards ICT, ICT access, role of school library media centre to dependent variables (ICT usage).

Table 4.15: Summary of Relative Contributions of Independent Variables on Dependent Variables

Model	R	R Square	Adjusted Square	Std Error of the Estimate
1	.470	.221	.219	1.406
2	.534	.285	.281	1.349
3	.573	.328	.323	1.309
4	.591	.350	.342	1.290
5	.604	.365	.356	1.277
6	.610	.372	.361	1.272

a. Predictors: (Constant), attitude towards ICT

b. Predictors: (Constant), attitude, Teaching experience

c. Predictors: (Constant), Attitude, Teaching experience, Highest educational qualification

d. Predictors: (Constant), Attitude, Teaching experience, Highest educational qualification, Computer self-efficacy

e. Predictors: (Constant), Attitude, Teaching experience, Highest educational qualification, Computer self-efficacy, ICT use experience

f. Predictors: (Constant), Attitude, Teaching experience, Highest educational qualification, Computer self-efficacy, ICT use experience, Age

g Dependent: ICT use

Table 4.15 above revealed attitude towards ICT, teaching experience, educational qualification, computer self-efficacy, ICT use experience, and age as major contributors to ICT usage among science teachers in FUSs in Nigeria. The Table further revealed attitude towards ICT as the leading contributor with a contribution of 21.9% to the total variance in ICT usage (Step 1). This is followed by teaching experience that contributed 6.2% to the total variance in ICT usage (teaching experience and together with attitude towards ICT contributed 28.1% to the total variance in ICT use (Step 2). The third major contributor to ICT usage among science teachers is educational qualification that contributed 4.2% to the total variance in ICT

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usage and together with attitude towards ICT and teaching experience accounted for 32.3% of the total variance in ICT usage (Step 3).

Moreover, computer self-efficacy alone as a factor that may predict ICT usage added 1.8% to the total variance in ICT usage while together with attitude towards ICT, teaching experience, educational qualification contributed 34.2% to ICT use (Step 4). ICT use experience was also found to have contributed 1.4% to the variance in ICT use as a variable while together with attitude towards ICT, teaching experience, educational qualification, and computer self-efficacy contributed 35.6% to the total variance in ICT use (Step 5).

The last least contributor to ICT usage among science teachers was found to be age which contributed only 0.5%. However, the total contribution of attitude towards ICT, teaching experience, educational qualification, computer self-efficacy, ICT use experience, and age was 36.1% (Step 6). The inference to be drawn from this is that attitude towards ICT is a major contributor to ICT usage among science teachers in FUSs in Nigeria. It may also be inferred that the contribution of other independent variables such as gender, subject(s) taught, ICT access, and role of SLMC to ICT use among science teachers was not major.

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4.3 Test of Hypotheses

Four (4) null hypotheses were tested at 0.05 level of significance

H_{01}: There is no significant joint relationship among demographic variables, computer self-efficacy, attitude towards ICT, ICT access, role of SLMC, and ICT usage by science teachers

Table 4.16 presents information on the test of significant joint relationship among demographic variables, computer self-efficacy, attitude towards ICT, ICT access, role of school library media centre and ICT usage.

Table 4.16: Summary of regression analysis showing significant status of joint relationship of demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMC, and ICT use

Model	Sum of Squares	df	Mean Square	F	Sig
Due to Regression	340.674	10	34.067	21.178	.000
Due to Residual	550.154	342	1.609		
Total	890.827	352			

R = 0.618; R^2 = 0.382; Adjusted R^2 = 0.364; SEE = 1.268

a. Predictors: (Constant), Roleofslmc, Subject(s) taught, Sex, Years of using ICT, Teaching experience, ICTaccess, Educational qualification, Age, Computer self-efficacy, Attitude towards ICT.
b. Dependent variable: Use

From Table 4.16 it can be inferred that there is a joint significant relationship between the independent variables (age, gender, educational qualification, subject taught, computer use experience, teaching experience, computer self-efficacy, attitude towards ICT, ICT access, and role of SLMC) were found to have joint significant relationship with the dependent variable (ICT use) ($F_{(10,\ 352),}$ 21.178; $p<0.05$). Therefore, the null hypothesis is rejected..

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H_{03}: There is no significant relative contribution of demographic variables, computer self-efficacy, attitude towards ICT, ICT access, and role of SLMC to ICT usage by science teachers

Table 4.17 presents information on the relative contributions of demographic variables, computer self-efficacy, attitude towards ICT, ICT access, role of school library media centre and dependent variables (ICT usage).

Table 4.17: Multiple regression analysis showing relative contributions of independent variables to dependent variable

Model	Unstandardised Coefficients'		Standard Coefficients	t	Sig
	B	Std Error	Beta		
ICT Use	-.285	.413		.690	.491
Age	.169	.102	.109	1.605	.097
Gender	.075	.148	.024	.510	.610
Subject(s) taught	.108	.078	.075	1.391	.165
Educational qualification	.-.303	.058	-.275	5.263	.000
Teaching experience	-.365	.070	-.344	5.186	.000
ICT use experience	.224	.088	.130	2.534	.012
ICT Access	.135	.069	.123	1.942	.053
Computer self-efficacy	.239	.102	.165	2.338	.020
Attitude towards ICT	.507	.105	.343	4.830	.000
Role of SLMC	.046	.112	.026	..409	.682

Information on the relative significant contributions of independent variables (demographic variables, computer self-efficacy, attitude toward ICT, ICT access, and role of SLMC) to the dependent variable (ICT use by science teachers) and it revealed educational qualification, ($B = -.275$, $t = 5.263$, $p<0.05$), teaching experience ($B = -.334$, $t = 5.186$, $p<0.05$), attitude toward ICT ($B = .343$, $t = 4.830$, $p<0.05$), ICT use experience ($B = .130$, $t = 2.534$, $p<0.05$), computer self-efficacy, and ($B = .165$, $t = 2.338$, $p<0.05$) as factors that significantly contribute to the use of ICT by the science teachers. On the other hand, age of respondents ($B = 0.109$, $t = 1.665$, $p>0.05$), gender ($B=0.024$, $t = 0.510$, $p>0.05$), subject taught ($B=0.075$, $t = 1.391$, $p>0.05$), ICT Access ($B=.123$, $t = 1.942$, $p>0.05$) and role of SLMC ($B = 0.026$, $t = 0.409$, $p>0.05$) were found to be factors that do not have no significant contributions to ICT use by

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science teachers.. This implies that educational qualification, teaching experience, ICT use experience, computer self-efficacy, and attitude towards ICT are the only factors that significantly predicted ICT usage among the science teachers

H_{03}: There is no significant joint correlations among demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience) and ICT usage among science teachers in FUSs in Nigeria

Table 4.18 presents information on the test of joint correlations among demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience) and ICT usage.

Table 4.18: Regression Analysis of Demographic Variables and ICT Use by Science Teachers

Model	Sum of Squares	df	Mean Square	F	Sig
Due to Regression	152.182	6	25.364	11.881	.000
Due to Residual	738.645	346	2.135		
Total	890.827	352			

R = .413; R2 = .171; Adjusted R^2 = .156; SEE = 1.461

Information from Table 4.18 showed that demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience when taken together significantly predict ICT use among science teachers in FUSs in Nigeria. Also, demographic variables had multiple correlations with ICT use of the science teachers (R = 0.171, P<0.05).

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H_{04}: There is no significant joint correlation among demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience), computer self-efficacy, attitude toward ICT, ICT access, role of SLMC and ICT usage

Table 4.19 presents information on the test of joint correlations among demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience), computer self-efficacy, attitude toward ICT, ICT access, role of SLMC and ICT usage.

Table 4.19: Summary of regression analysis showing significant status of joint correlation of demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMC, and ICT use

Model	Sum of Squares	df	Mean Square	R	R^2	Adj R^2	F	Sig
Due to Regression	340.674	10	34.067	0.618	0.382	0.364	21.178	.000
Due to Residual	550.154	342	1.609					
Total	890.827	352						

SEE = 1.268

a. Predictors: (Constant), Roleofslmc, Subject(s) taught, Sex, Years of using ICT, Teaching experience, ICTaccess, Educational qualification, Age, Computer self-efficacy, Attitude towards ICT.

Information from Table 4.19 showed that demographic variables (age, gender, subjects taught, educational qualification, teaching experience and ICT use experience), computer self-efficacy, attitude toward ICT, ICT access, and role of SLMC when taken together significantly predict ICT use among science teachers in FUSs in Nigeria. Also, demographic variables, computer self-efficacy, attitude toward ICT, ICT access, and role of SLMC had strong positive multiple correlations with ICT usage ($R = 0.618$, $P<0.05$). The independent variables (demographic variables, computer self-efficacy, attitude toward ICT, ICT access, and role of SLMC) were found to have jointly accounted for 36.4% of the total variance in ICT use (Adjusted $R^2 = 0.364$). The joint contribution of the independent variables to dependent variable is shown to be significant

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4.4 Discussion of findings

4.4.1 Demographic variables of science teachers in FUSs

The background information of the science teachers revealed that there are more teachers within the youthful age range of 20-40 years (263, 74.5%). This is in support of Jenkins (2008) that there are more young teachers (within the age range or 20-40 years) among the teachers in secondary schools in State of Kentucky. Considering this age distribution in the context of ICT use, it may be inferred that majority of the science teachers are digital natives. Prensky (2001) describe a digital native as a person who was born during or after the general introduction of digital technologies and through interacting with digital technology from an early age, has a greater understanding of its concepts. Prensky (2001) further emphasized that digital native is used to describe people born during or after 1980s as well as people who grew up with technology.

Findings on gender distribution of the science teachers in FUSs revealed that there are more male science teachers than female in FUSs in Nigeria. This corroborates Osman, Halim, and Meerah (2006) finding which also revealed that there were more male than female science teachers in secondary schools in Malaysia. Further, findings on demographic information of science teachers possesses the requisite teaching qualification which is in support of Jenkins (2008) which established that majority of science teachers in State of Kentucky have teaching qualification. Also, finding on subject taught by the science teachers in FUSs revealed that there are more physics and chemistry teachers in FUSs in Nigeria. This is in contrast to Osman et. al. (2006) findings which established that there are more biology teachers in secondary schools in Malaysia.

4.4.2 Computer self-efficacy of science teachers in FUSs in Nigeria

The study found that the computer self efficacy level of science teachers in FUSs is high. This implies that the science has the ability to use computer and computer-based resources in teaching. The high computer self-efficacy of the science teachers was affirmed through their agreement with the statements designed to measure their ability and capability in computer use. This result affirmed that the science teachers are able to use computer facilities for basic tasks in teaching and related purposes. This finding is in contrast with Aremu and Fasan (2011) findings which established an average

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computer self-efficacy for teachers in Nigerian secondary schools and Simsek (2011) findings which reported low computer self-efficacy among teachers because the teachers find it difficult to follow developments in computer technology. Higher computer self-efficacy usually produces more preferences toward ICT-based teaching environments where they can use with ease, explore real life problems, display multiple sources of information, enrich teaching, conduct open-ended inquiry teaching activities, and elaborate the nature of knowledge (Liang and Tsai, 2008).

The computer self efficacy of teachers was graded into high self-efficacy, moderate self-efficacy, and low self-efficacy. High self-efficacy implies that the science teachers have the ability to use computer for teaching and general purposes and is occurs when the overall weighted estimated mean is greater than the criterion mean. Moderate self-efficacy implies that the science teachers have the ability to use computer for general purposes only and occurs when the overall weighted mean is equal to criterion mean while low self-efficacy occurs when the overall weighted mean is less than the criterion mean and that science teachers have low ability to use computer for both general and teaching purposes.

Computer self-efficacy is also a behavioural construct that explains an individual's capability to use computer and related resources (Aremu and Fasan, 2011). More specifically, studies have shown that computer self-efficacy influences attitude toward technology which in turn determines acceptance and usage of technology (Alhajri, 2007, Godwin, 2004).

4.4.3 Attitude towards ICT use by science teachers in FUSs

The findings of the study revealed that the science teachers have positive attitude towards ICT facilities and resources. This is revealed through their positive responses to statement on positive attitude towards ICT and disagreement with negative statements on attitude toward ICT. The science teachers affirmed their ability to use ICT, comfortability when there is discussion on ICT use for teaching, lack of phobia for ICT equipment, as well as lack of fear to use ICT facilities for teaching. This is in agreement with Cavas, Cavas, Karaoglan, and Kisla (2010) findings which reported positive attitude towards ICT among Turkish science teachers, Albirini (2006) and Al-Zaidiyeen et.al (2010) results that reported positive attitude towards ICT use among science teachers in secondary schools and Omollo et. al (2013) findings which

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revealed that teachers in secondary schools had positive attitude toward ICT use in implementing biology curriculum in secondary schools. The positive attitude is further corroborated by Bakr (2011) that reported that teachers' attitude toward computer at governmental schools is relatively high. In, Technology Acceptance Model (TAM), attitude towards technologies reflects feelings of favourableness or unfavourableness towards using the technology and a function of ICT use which has been established as a predictor of ICT acceptance and usage (Davis, 1989).

The positive attitude exhibited by the science teachers towards ICT may be attributed to the usefulness and potential benefits derivable from ICT use in teaching of science subjects. Other benefits that may attract science teachers' positive disposition towards ICT include; access to rich teaching and learning materials as well as resources that make learning practical, interactive and interesting. The negative attitude exhibited by science teachers, on the other hand, may be due to factors such lack of relevant ICT usage skills and competency level as well as difficulty in accessing ICT resources by science teachers.

4.4.4 ICT access by science teachers in FUSs

Gillwald and Stork (2008) noted that introducing ICT into schools is largely dependent upon the availability and accessibility of ICT resources while Jenkins (2008) emphasized that effective use of ICT resources by teachers is dependent on the ease of access to various types of ICT resources. This study investigated the degree of accessibility of ICT facilities and location of ICT access among science teachers in FUSs. and the findings from the study revealed only few ICT facilities such as computers, spreadsheet program; online database, multimedia resources, interactive whiteboard and word processor are easily accessible to the science teachers. On the other hand, ICT facilities such as simulations, models, web-based laboratories, and graphical visualizing tools were found not to be frequently accessed by the science teachers.

This implies that there is high level of accessibility to general ICT facilities among science teachers in FUSs but a low level of accessibility to science-based ICT facilities such as web-based laboratories, simulation programs and games, model/modeling software, graphical visualizing tools, and science presentation software. This implies that science-based ICT applications are not easily accessible to

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science teachers in FUSs in Nigeria. This result corroborates Ada (2013) findings which reported that teachers do not have access to science-based ICT facilities for teaching, hence, they are deprived of enjoying the benefits derivable from the use of ICT facilities. Benefits derivable from ICT use in teaching according to Fu (2013) include promotion students-centred teaching and learning, promotion of critical thinking skills, improvement in the quality of teaching and learning and promotion of creative learning environment.

On the location of ICT access among the science teachers the findings from the study revealed "specialized classroom/laboratories as the most used location of ICT access by science teachers in FUSs. This may be due to the fact that the specialised classroom/laboratories are adequately equipped with ICT facilities and easy to access by the science teachers. The fact that most of the teachers in FUSs are resident within the school premises may also be responsible for the preference for the specialized classroom/laboratories by the science teachers. Observations on location where science teachers access ICT facilities revealed that ICT facilities are located in specialized buildings, for example CISCO building, ICT building, or Computer building, in the FUSs selected for the study. This corroborates Edward (2005) view that reiterated the importance of making ICT resources available in locations within the school where teachers can easily have access if the teachers are to make use of ICT without difficulties. A major external variable that can affect the use of ICT is access to ICT facilities. This study investigated the relationship between location of access and degree of accessibility and established a significant relationship between location of access and degree of accessibility. This in turn may mean that ease of accessing location would determine ease of accessibility which in turn may lead to increase in use.

4.4.5 Level of ICT availability and accessibility in SLMCs in FUSs in Nigeria

From the findings, it was observed that there is a low level of ICT availability and accessibility in SLMCs in FUSs in Nigeria. This finding corroborates Kalejaye et. al. (2011) results which revealed unavailability of relevant ICT facilities in secondary school libraries in Ekiti State, Nigeria. In his opinion, Hay (2006) reiterated the need for school library media centre to be a functional centre of access to ICTs and digital information resources and services. There is no doubt that the SLMCs in FUSs has

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not lived up to the expectation of making available and providing access to ICT resources in supporting the use of ICT facilities by science teachers in FUSs in Nigeria. The low level of ICT availability and accessibility in FUSs in Nigeria may be the major reason why the SLMCs in FUSs are unable to effectively play the roles in supporting effective and efficient use of ICT resources by the science teachers. School library media centres are established for provision of technical, material, human, infrastructural, and material resources to support the use of ICT in teaching and learning in schools (Hay, 2006).

On the other hand, findings from this study is in disagreement with Todd (2004) findings which identified ICT resourcing, infrastructural support, technical support, expert provision and training/human support as SLMCs role that can aid maximum utilization of ICT in teaching by teachers and Kalejaye, Fabunmi and Adeoye (2011) views that described the primary role of SLMC as that of supporting the application of technology in education, provision of expertise, and facilitation of the adoption of both technology in education and technology for education. The SLMC should serve as a centre for the adoption, diffusion and dissemination of instructional innovations as well as for carrying out a thorough technology audit which would help the school library media specialists to determine the needs of the school and how best to satisfy the needs. Therefore any SLMC that cannot perform these roles has fallen short of expectations.

4.4.6 Role of SLMC in supporting ICT use by science teachers in FUSs

The findings from the study on the role of SLMCs in supporting ICT use for teaching and learning revealed that SLMCs in FUSs are lacking in the areas of provision of materials, infrastructure, technical, and human support. The provision of access to and use of computer facilities, printing facilities, internet, and software to support science teaching by some SLMCs are in the area of material and infrastructural support for ICT use. Analysis of the interview with the some Principal also affirmed inadequate provision of ICT for teaching and learning in SLMCs in FUSs in Nigeria. This finding negates what Kalejaye et. al. (2011) found in their study. According to Kalejaye et. al. (2011) the primary role of SLMC is that of supporting the application of technology in education through provision of expertise, facilitation of the adoption of technology in education, planning and carrying out research activities in the area of educational

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technology, adoption, diffusion, and dissemination of instructional innovations, and carrying out technology audit which will help the school library media specialist to determine the needs of the school and how best to satisfy the needs.

The inability of the SLMCs in carrying out these roles effectively implies that the science teachers would not be able to depend on the SLMCs in meeting their ICT needs which would ultimately affects their use of ICT in teaching. Todd (2004) considered the school libraries as teaching and learning laboratories in terms of access to resources, technologies, and expertise provision.

4.4.7 ICT use by science teacher in FUSs

The findings of the study revealed a low level of ICT use among the science teacher in FUSs in Nigeria. This is evident from the fact that less than one-third ($^1/_3$) of the science teachers affirmed the use of ICT facilities for one purpose or the other. The study further revealed a low level of use of ICT facilities for experimentation/simulation activities which is core to science teaching. Majority of the science teachers in FUSs make use of ICT facilities basically for classroom-based activities (i.e tutorial, enhancement activities, multimedia application use in classroom, and collaborative learning) at the expense of laboratory-based activities (i.e experimentation /simulation). This is in contrast to Hogarth et.al. (2006) and Goulding and Kurtacou (2008) findings that affirmed high use of simulations and models among Jordanian and Australian teachers. According to them (Hogarth et al. 2006; Goulding and Kurtacou, 2008) simulations and models have great potential value in the teaching of science as it can improve students' understanding of science more effectively compared to use of non-ICT teaching activities. However, the lack of use of science-based applications such as simulations and models may be traced to the unavailability and lack of access to these resources by the teachers as well as lack of knowledge and skills in the use of these facilities by teachers.

Moreover, findings from the study on the extent of use of ICT facilities among the science teachers in FUSs revealed that they make regular use of ICT basically for tutorial, presentation of new materials, information access via CD ROM, internet, and database, and online communication via e-mail at the expense of laboratory-based activities which happens to be the backbone of science teaching in schools. This result

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corroborates Kiptalam and Rodrigues (2011) and Mwalongo (2011) which reported the regular use of ICT for preparation of lesson notes, searching of teaching and learning materials, preparation of examinations and preparation of presentation by teachers. This implies that the regular use of ICT facilities for laboratory based activities is very low among the science teachers in FUSs in Nigeria is very low. However, there is the need for science teachers to go beyond these simple uses in order to transform the teaching and learning of science in schools.

Observations also revealed that laboratory-based ICT applications are not readily available and accessible for use by science teachers in FUSs. The ICT resources available and accessible for use by science teachers in FUSs are those for classroom-based activities only. Overall, the low use of ICT facilities among the science teachers in FUSs in Nigeria is established through the findings from this study. The low level use of ICT facilities for laboratory based activities among science teachers in FUSs in Nigeria corroborates Al-Zaidiyeen et.al. (2010) findings that reported low level of ICT use for education purpose among teachers.

4.4.8 Relationship between demographic variables and ICT use

Findings from the study revealed teaching experience, educational qualification, ICT use experience and age as demographic variables that predict ICT use by the science teachers in FUSs. This is in support of Teczi (2010), UNDP (2011) and Almerich et.al. (2011) findings that established level of education, teaching experience, and computer use experience as major determinants of ICT use. Teaching experience was found to be the strongest predictor of ICT use among the demographic variables ahead of ICT use experience, teaching experience and age.

Moreover, teaching experience and age was found to be negatively related with ICT use implying that ICT use decreases with age and teaching experience and that younger teachers incorporate ICT into their teaching more than their older counterparts. This finding corroborates Rahimi and Yadollahi (2011) result which revealed that ICT is inversely related with age and years of teaching experience. However, it is expected that ICT use should increase with teaching experience, hence, there may be need to probe into the reasons why teachers' willingness to use ICT facilities decreases with experience regardless of the context and culture. This is

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necessary to guide against the situation whereby young teachers who enter the profession lose their enthusiasm towards ICT as they become more experienced.

Findings from this study further established a negative relationship between educational qualification and ICT usage which is at variance with Rahimi and Yadollahi (2011) findings which revealed that ICT use is positively correlated with academic qualification of teachers. The negative relationship between ICT use and educational qualification revealed by this study implies that ICT use decreases with teachers' higher qualification. Thus, teachers with lower qualification tend to make use of ICT more than their counterparts with higher qualification. Furthermore, the negative relationship between educational qualification and ICT usage among science teachers may also suggest that teachers with higher educational qualification are pre-occupied with other activities such as administrative and supervisory roles that may divert them from ICT usage. It is also possible that teachers with higher educational qualification may be delegating activities that involve ICT usage to their counterparts with lower educational qualification. This finding is a clear departure from the general belief that an individual is expected to know more about several things as he/she progresses in learning.

Moreover, findings from this study revealed an inverse relationship between gender and ICT use which implies that female science teachers in FUSs in Nigeria make more use of ICT than their male counterparts. This is at variance with Alampay (2006) which reported men as being more receptive to ICT use than women and Rahimi and Yadollahi (2011) findings that established non-significant relationship between gender and ICT use by teachers.

4.4.9 Relationship between computer self-efficacy, attitude towards computer, ICT access, role of SLMCs and ICT use by science teachers

On the relationship between computer self-efficacy and ICT use by science teachers in FUSs, the study established a positive significant relationship between computer self-efficacy and ICT use among the science teachers. This finding is in contrast with findings of Bolt, Killough, and Koln (2001) and Ramayah and Aafaqi (2005) that

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reported computer self-efficacy as not directly and significantly related and linked to ICT use.

Findings from the study on the relationship between attitude of science teachers in FUSs towards ICT and ICT use established that science teachers attitude towards ICT is positively and significantly related with ICT use. This is in support of Al-Zaidiyeen et.al. (2001), Batlor and Ritchie (2002) and Hew and Brush (2007) findings that revealed a significant relationship between attitude and ICT use.
ICT access was found to be positively related to ICT use among science teachers in support of Jenkins (2008) study that reported a positive relationship between ICT access and ICT use. This implies that increased ICT access would lead to increased ICT use. Batlor and Ritchie (2002) emphasized that accessibility is fundamental in the acceptance, implementation, and success of new technologies.

The findings on the relationship between the role of SLMC and ICT use among the science teachers revealed a positive but non-significant relationship. This implies that role of SLMC is very fundamental to ICT use by science teachers but that the impacts of such roles are not being felt as far as ICT use by science teachers in FUSs in Nigeria is concerned. The SLMC is supposed to be a centre of resource utilization for teaching and learning, including ICT facilities but the study revealed a lack of significant role in facilitating the use of ICT by science teachers. This finding is in contrast to Londsdale (2003) that reported provision of access to and facilitating use of ICT resources as a major role of SLMC in facilitating ICT use for teaching and learning in schools.

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CHAPTER FIVE

5.0 SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the findings, conclusion, and recommendations.

5.2 Summary of findings

Based on the research questions answered and hypotheses tested in this study, the findings revealed that:

1. Teaching experience, educational qualification, and ICT use experience are demographic variables that do predict the use of ICT by science teachers in FUSs in Nigeria. Teaching experience was found to be the leading predictor of ICT use among the demographic variables that predicted ICT usage among science teachers in FUSs in Nigeria.
2. Science teachers in FUSs have a high computer self-efficacy level
3. Science teachers in FUSs in Nigeria have positive attitude towards ICT use.
4. Attitude towards ICT, teaching experience, educational qualification, computer self-efficacy, and ICT use experience predict ICT usage among science teachers in FUSs.
5. Attitude towards ICT is the leading predictor of ICT usage among science teachers in FUSs in Nigeria. Therefore, attitude of science teachers towards ICT is an indispensable requirement of ICT use among science teachers in FUSs
6. ICT access did not make any significant contributions towards predicting ICT usage among science teachers.
7. There is a low level of access to science-based ICT facilities and application, such as simulations and modeling, and graphical visualizing tools, among the science teachers in FUSs in Nigeria
8. Different types of location of access of ICT facilities exist in FUSs in Nigeria such as specialised classroom/laboratories, school library media centre, and teachers' office but the most used location of access is the specialized classroom/laboratories.

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9. Science teachers in FUSs make use of ICT facilities mainly for classroom-based teaching activities at the expense of laboratory and experimentation based activities.
10. There is generally a high level of use of ICT facilities by science teachers in FUSs in Nigeria.
11. There is a dearth of ICT facilities availability occasional access to ICT facilities through school library media centres in FUSs in Nigeria.
12. School library media centres (SLMCs) in FUSs are not adequately stocked with ICT facilities to guarantee ICT access in support of teaching of science subjects, hence teachers cannot access ICT from SLMC.
13. School library media centres are lacking in playing their roles in supporting ICT use by science teachers due to the dearth of ICT facilities in the SLMCs.
14. The combination of attitude towards ICT, teaching experience, educational qualification, computer self-efficacy, ICT use experience and age jointly accounted for 37.2% of the total variance in ICT use by science teachers in FUSs in Nigeria.
15. Demographic variables, computer self-efficacy, attitude toward ICT, ICT access, role of SLMCs have a joint significant relationship with ICT usage by science teachers in FUSs.

5.3 Implications of findings from the Study

Attitude of science teachers towards ICT has been established to be the leading predictor of ICT use. This implies that government and other stakeholders in education should work on the attitude of teachers to ensure positive disposition towards ICT which would ultimately lead to use.

Provision of ICT access has been established to have a positive relationship with ICT use. But ICT access in FUSs was found to have no significant contribution towards ICT use by science teachers. This non-significant contribution of ICT access may be due to the low level of access to science-based ICT facilities by the science teachers in FUSs in Nigeria. This implies that ICT access can be considered as an important factor on which other factors determining ICT use revolve round.

On the other hand, the non-significant-contribution of SLMCs towards ICT use by science teachers may be due to the low level of availability and accessibility of ICT

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facilities through SLMCs as well as lack of professionally qualified staff in SLMCs in FUSs in Nigeria. The aforementioned are some of the major factors responsible for the inability of the SLMCs to play the required roles of provision of technical, infrastructural, and personnel support for effective use of ICT by the science teachers in FUSs in Nigeria. ICT access in SLMCs in FUSs would enhance the use of ICT facilities by teachers. The provision of ICT access should be within the school to guarantee ease of locating ICT and eventual regular use by the teachers

High computer self-efficacy is necessary to guarantee positive attitude toward ICT use among the teachers and vice versa. Computer self-efficacy and attitude toward ICT alone is not enough to guarantee acceptance and use of ICT facilities as against what was proposed by Technology Acceptance Model (TAM) that attitude has a direct link to usage. The implication to be drawn from this study is that the link between attitude and ICT use has to be moderated by ICT access.

5.4 Conclusion

Based on the findings of the study, it can be concluded that attitude towards ICT, teaching experience, educational qualification, computer self-efficacy, ICT use experience and age were found to be the major predictors of ICT use. Therefore, attitude towards ICT, teaching experience, educational qualification, computer self-efficacy, ICT use experience, and age are the most important variables that predict ICT use by teachers in FUSs in Nigeria. Positive attitude towards ICT is a necessary ingredient for the use of ICT by science teachers in FUSs.

The fact that ICT access and SLMCs role made no significant contributions to ICT use by science teachers in FUSs is a cause for concern. It is expected that the SLMCs being the hub of learning resources for educational institutions would guarantee access to learning resources through adequate provision and support.

Moreover, it can be inferred from the findings of the study that inadequate provision of relevant and useful ICT facilities within the easy reach of teachers may hinder the use of such facilities by the teachers. In other word, the location of ICT access point within the schools premises such as specialised classroom/laboratory and SLMC would facilitate use of ICT by teachers.

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It can also be concluded that science teachers do not make use of ICT facilities for laboratory-based/experimentation activities. This is based on the fact that the few science teachers that make use of ICT facilities do so mainly for classroom based activities. However, ICT facilities are mostly needed in the area of investigating science concepts and ideas in the laboratories to enhance clarification of concepts and ideas.

Furthermore, it may be necessary to also conclude that SLMCs in Nigerian are not adequately stocked with ICT facilities to support the teaching of science subjects, thereby not being able to play their roles of providing access to and use of ICT facilities for teaching and learning within the schools.

Another conclusion of the study is that high computer self-efficacy of teachers would strongly determine positive attitude toward ICT use among teacher and vice versa. There is, therefore, the need for government and other stakeholders in education to work toward training and retraining of teachers for computer skills acquisitions and enhancement that would eventually lead to high computer self-efficacy of teachers.

It could also be concluded from the study that high computer self-efficacy and positive attitude toward ICT alone could not guarantee ICT use by science teachers as the two variables are responsible for only 32.8% of the total contribution of all the independent variables. This implies that the joint contribution of computer self-efficacy and attitude toward ICT is very low.

5.5 Recommendations

The following recommendations were made based on the findings of the study:

1. Provision should be made for access to ICT facilities within the school environment to guarantee ease of locating and accessing by the teachers.
2. The school management and government should ensure the provision of latest relevant technologies that would enhance effective teaching and learning in FUSs. This would enable the teachers to use the technologies in meeting the different learning styles of the students.

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3. The school library media centre needed to be stocked with relevant and adequate ICT facilities for the use of the teachers. The availability of these facilities would attract the teachers and students to the SLMC.
4. The school library media centre should endeavour to provide the necessary human, material, technical, and infrastructure support needed for effective access and use of ICT facilities by teachers.
5. Government should also make provision for science-based ICT applications such as simulations, modeling, and graphic visualizing tools that do make teaching meaningful and real. Science-based ICT applications ensure the replacement of the abstract nature of teaching that characterized traditional teaching with meaningful and real teaching.
6. Science teachers should endeavour to use ICT facilities for laboratory-based and experimentation activities.
7. School library media specialists should be considered as teaching staff in FUSs that can enjoy career progression just like other teachers.

5.6 Contribution of this Study to Knowledge

Access to ICT has been established as having a positive relationship with ICT use by science teachers. Therefore, access to relevant ICT resources is a necessary ingredient towards effective teaching among teachers and improved academic achievement among learners. Thus, there is need for the provision of access to relevant science-based ICT resources in FUSs and by extension secondary schools in Nigeria to ensure effective teaching of science which would ultimately bring about improved academic achievement among the students. With ICT resources, science teachers will have access to more resources to improve their teaching and ultimately make students to be more interested in science subjects and bring about improved academic achievement in science subjects among the students.

But the study has also revealed that science teachers in FUSs are disadvantaged in having access to science-based ICT facilities such as simulations, modeling, web-based laboratories and graphical visualizing tools. This low level of access has also resulted into low use of science-based ICT facilities among the science teachers. Therefore, ICT access did not make any significant contribution towards predicting the use of ICT among science teachers in FUSs in Nigeria. Moreover, adequate

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provision of science-based ICT facilities and applications such as simulations/modeling, graphic visualization tools, and multimedia resources would attract science teachers to the use of the facilities. Simulations/modeling and graphic visualising would enable effective teaching of science concepts and ideas that may be harzadous if taught using the conventional methods of teaching.

Also, SLMCs in Nigeria should be designed as the hub of access to ICT resources in FUSs and secondary schools in Nigeria. Their inability to play this role effectively due to unavailability of ICT resources in the SLMCs has negatively limited the teaching of science to conventional mode which cannot bring about good academic achievement in science among the students.

The lack of professionally qualified personnel in SLMCs in FUSs is a matter of concern as this has limited the ability of the SLMCs to adequately play their role as the hub of learning resources including ICT resources. This lack of qualified staff has been traced to the lack of career progression for school library media specialists in FUSs, therefore, there is need for school library media specialists to be accommodated within the guidelines that allows career progression for other teachers in FUSs in Nigeria.

5.7 Limitations of the Study

This study covers only 25 FUSs representing 24.0% of the total number of 104 FUSs in Nigeria. This limitation was based on the need to ensure effectiveness and quality of the research. The study also focused on Federal Government Owned secondary schools at the expense of State and Private owned secondary school which is due to the fact that the prevailing conditions in state and private secondary schools are different from what is obtainable in Federal Government secondary schools. The subjects of the study are limited to science teachers only whereas it is equally important to consider other categories of teachers.

5.8 Suggestions for Further Researches

Due to the fact that no single study can investigate all the variables that could predict ICT use and based on findings from the study that revealed that there may be other factors responsible for predicting the use of ICT facilities by teachers apart from the ones investigated in this study, the following suggestions are made for further studies:

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1. Influence of Availability, Accessibility, Preference, and Use on Teaching Effectiveness and Academic Achievement in FUSs
2. The study could be replicated in the state and private secondary schools in the country.
3. Also, the study could be extended to state and private primary schools in Nigeria.

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Appendix I

Abadina Media Resource Centre
University of Ibadan
Predictors of ICT Use by Science Teachers Questionnaire

Dear respondents,

This questionnaire has been designed to elicit your response on demographic variables, ICT access, computer self-efficacy, attitude and Use of ICT resources among science teachers in Federal Government Unity Schools (FGUSs) in Nigeria. This is purely for the purpose of collecting data for a doctoral research and any information provided will be treated in strict confidentiality and used only for academic purposes.

Thanks

K.A. Aramide

Section A: Demographic Information

1. **Name of School:** _____
2. **Date established:** _____
3. **Age range:** a. 20 – 30 years [ ] b. 31 – 40 years [ ] c. 41 – 50 years [ ] d. 51–60 years [ ] e. 60 years and above [ ]
4. **Gender of respondent:** a. Male[ ] b. Female [ ]
5. **Classes taught:** **a**. SS1 [ ] b. SS2 [ ] c. SS3 [ ]
6. **Numbers of Arms of Class Assigned**:_____
7. **Average number of students in your class/classes**_____
8. **Subject(s) taught:** a. Physics [ ] b. Biology [ ] c. Chemistry [ ] d. Mathematics [ ]
9. **Is there science laboratory for teaching your subject?** a. Yes [ ] b. No [ ]
10. **Highest educational qualification**: a. NCE [ ] b. NCE + Bachelors' degree [ ] c. Bachelor of Education degree [ ] d. Bachelor of Science degree [ ] e. PGDE [ ] f. Master's degree (in education) [ ] g. Master's degree (in subject areas) [ ] h. PhD [ ] i. Any other, please state _____
11. **Teaching experience:** a. 0 – 4 years [ ] b. 5 -9 years [ ] c. 10 – 14 years [ ] d. 15 – 19 years [ ] e. 20 years and above [ ]
12. **How long have you been using ICT facilities for teaching of your subjects?**
    a. I do not use [ ] b. Less than 1 year [ ] c. 1-3 years [ ] d. 4-7 years [ ] e. 8-11 years [ ] f. 11 years and above [ ]

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Section B: Availability and functionality of ICT Resources

13. Which of these ICT facilities are available for your use in your school? (Please tick as many option as applicable)

	ICT facilities	Available	Available and functioning	Available and not functioning
AV1	Computer Aided Instructional Software			
AV2	Individualised instruction tutorials (e.g Science for Students etc)			
AV3	Instructional video/audio tapes			
AV4	Multimedia projector			
AV5	Presentation software (Power Point, KidPix)			
AV6	Computers			
AV7	Word Processor			
AV8	E-mail (for Online communication with students)			
AV9	Interactive whiteboard/Smart board			
AV10	Spreadsheet program (Excel etc)			
AV11	Online databases			
AV12	Models/Modeling software			
AV13	Simulation programmes and Games			
AV14	Graphical visualizing tools			
AV15	Concept mapping software			
AV16	Multimedia resources			
AV17	Discussion lists/Newsgroup			
AV18	Web-based Internet laboratories			

14. Which of these ICT facilities are accessible for your use in your school? (Please tick as many option as applicable)

	ICT facilities	Very easily accessible	Easily Accessible	Occasionally accessible	Not accessible
ACC1	Computer Aided Instructional Software				
ACC2	Individualised instruction tutorials (e.g Science for Students etc)				
ACC3	Instructional video/audio tapes				
ACC4	Multimedia projector				
ACC5	Presentation software (Power Point, KidPix)				
ACC6	Computers				
ACC7	Word Processor				
ACC8	E-mail (for Online communication with students)				
ACC9	Interactive whiteboard/Smart board				
ACC10	Spreadsheet program (Excel etc)				
ACC11	Online databases				
ACC12	Models/Modeling software				
ACC13	Simulation programmes and Games				
ACC14	Graphical visualizing tools				
ACC15	Concept mapping software				
ACC16	Multimedia resources				
ACC17	Discussion lists/Newsgroup				
ACC18	Web-based Internet laboratories				

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15. Where are the ICT facilities located?

a. In Classrooms [ ] b. In the Library [ ] c. Specialised classroom for teaching science [ ] d. In the science laboratory [ ] e. Specialised laboratory for teaching of science [ ] f. In my Office [ ] g. In Staff room [ ] h. In Meeting room [ ] i. Multimedia classroom [ ] k. Cybercafe [ ] l. At home [ ] m. Other, please specify

Section C: Use of ICT Resources

16. Please indicate your opinion on the purposes for which you use ICT facilities for in your school/classroom

I use ICT facilities for:

a. Tutorials [ ] b. Testing [ ] c. Presentation of new materials [ ]
d. Remediation/acceleration [ ] e. Drill and practice [ ]
f. Recreational and educational games [ ] g. Enrichment activities [ ]
h. Experimentations/simulations [ ] i. Information access via CD-ROM [ ] j. Authoring [ ]
k. Multimedia application [ ] l. Problem solving [ ] m. Collaborative learning [ ]

17. Please indicate the response option that best describes your opinion on the extent of use of ICT resources for teaching and learning activities

	Statement	Highly used	Used	Fairly used	Not used
U1	I Use ICT for **Tutorials** (word processing, instructional video/audio tapes, teaching courseware etc				
U2	I use ICT for **Remediation/acceleration of instruction** (use of teaching courseware, instructional video/audio tapes, etc				
U3	I Use ICT for Testing (computer based testing, drill and practice, etc)				
U4	I use ICT for presentation of new materials (use of presentation software e.g power point, multimedia projector etc)				
U5	I use ICT for drill and practice				
U6	I Use recreational and educational games to enhance learning among studentts				
U7	I use ICT such as word processor in preparation of lesson notes				
U8	**I use** video and simulations, models, databases etc to enrich my teaching activities				
U9	I use simulations, virtual laboratory, discussion lists/newsgroup, graphical visualization tool etc. for problem solving activities				
U10	I Use ICT such as CD-ROMs, Internet, databases in finding and accessing information and educational materials on my subject and other relevant subjects) for information access				
U11	I Use ICT for experimentation/simulation (simulation, models, virtual laboratory etc				
U12	I use ICT such as Internet, Wikis to facilitate collaborative learning among students				
U13	I use online communication tool such as e-mail to facilitate communication between the teacher and students				
U14	I use Web cam to monitor distant location				
U15	I use online discussion board in facilitating discussion between myself and students				
U16	I use online databases to access science based content online				
U17	I use of data collection probes is to collect data online				

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Section D: Computer Self-efficacy level of Science Teachers

19 Computer self efficacy: Indicate your extent of agreement or disagreement with the following statements as regards the use of ICT facilities

	Statement	Strongly agree	Agree	Disagree	Strongly disagree
CSE1	I can confidently use computer to teach the students				
CSE2	I can confidently use the computer facilities to find needed information				
CSE3	I can confidently use computer facilities to solve practical problems				
CSE4	I can confidently use computer to communicate with people				
CSE5	I can confidently use computer for research purposes				
CSE6	I could complete a job or task using computer without any assistance or help				
CSE7	I find computer flexible to interact with				
CSE8	I am experienced at using computer				
CSE9	I feel confident to integrate computer facilities in teaching				
CSE10	I am experience at using ICT in teaching				
CSE11	I can use computer to access information needed to perform tasks related to teaching in an efficient manner				
CSE12	I know what to do using computers in instructional environments				
CSE13	I feel confident working on a personal computer				
CSE14	I feel confident getting software up and running				
CSE15	I feel confident learning to use a variety of programmes (software)				
CSE16	I feel confident using the computer to organize information				
CSE17	I feel confident organizing and managing files				

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Section E: Attitude toward ICT Resources Use

20 **Please indicate the option that best describes your opinion on your attitude to ICT**

	Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
ATT1	I am indifferent about using ICT for teaching				
ATT2	I feel comfortable in my ability to use ICT				
ATT3	I feel comfortable when there is discussion on ICT use for teaching				
ATT4	I have reservation about using ICT for teaching				
ATT5	I use ICT more at school than at home				
ATT6	I use ICT for other activities than for teaching				
ATT7	I am convinced that use of ICT in teaching of science will give better results				
ATT8	I do not like using ICT for teaching important topics in my subject				
ATT8	I find using ICT in teaching my subject better than using the traditional chalk and talk method				
ATT10	I consider ICT very useful in exploring science concepts and ideas				
ATT11	I know ICT resources are important but I don't feel I need to use them to teach my subject				
ATT12	I feel using ICT is too new and strange to make it worthwhile for teaching and learning of science subjects				
ATT13	I want to get better at using ICT to help me in the teaching of my subjects				
ATT14	I have never been excited about using ICT to teach				
ATT15	I find having to use ICT frightening				
ATT16	I am not what I could call a computer person				
ATT17	I would rather teach by traditional method (i.e chalk and talk) than with Computer				
ATT18	I have phobia for ICT equipment				
ATT19	I won't have anything to do with ICT				
ATT20	I would like to learn more about computer				

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Section F: Role of the School Library Media Centre to Support the Use of ICT facilities for Teaching

21 What do you consider as the major role(s) of school library media resource centre in the use of ICT for teaching of science in your school?

	Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
RSLMC1	Training and capacity building for teachers				
RSLMC2	Acquisition of ICT facilities				
RSLMC3	Maintenance of ICT facilities				
RSLMC4	Subscription to online databases				
RSLMC5	Subscription to software to support science teaching				
RSLMC6	Provision of technical support				
RSLMC7	Provision of support staff to assist in the use of ICT for teaching				
RSLMC8	Development and maintenance of in-house computer-based teaching resources				
RSLMC9	Web access to in-house developed library databases/Online catalogue				
RSLMC10	Subscription to web-based electronic resources, electronic books, databases et cetera				
RSLMC11	Maintaining an organized access to free science-based information gateways				
RSLMC12	Provision of access to and use of computers				
RSLMC13	Help in facilitating websites for research				
RSLMC14	Access to suite of software programs				
RSLMC15	Access to and use of printing facilities				
RSLMC16	Help in using search engines for research				
RSLMC17	Access to and use of Internet				
RSLMC18	Help in using presentation software				

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Appendix II

Abadina Media Resource Centre
University of Ibadan
School Library and ICT Usage Questionnaire
(for School Library Media Specialists)

Dear respondent,

This questionnaire has been designed to elicit your response on demographic variables, ICT access, computer self-efficacy, attitude and Use of ICT resources among science teachers in Federal Government Unity Schools (FGUSs) in Nigeria. This is purely for the purpose of collecting data for a doctoral research and any information provided will be treated in strict confidentiality and used only for academic purposes.

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Thanks

K.A. Aramide

Section A: Demographic Information

1. **Name of School:** _____

2. **Date established:** _____

3. **Age range:** a. 20 – 30 years [ ] b. 31 – 40 years [ ]
c. 41 – 50 years [ ] d. 51 – 60 years [ ]
e. 60 years and above [ ]

4. **Gender of respondent:** a. Male[ ] b. Female [ ]

5. **Highest educational qualification**:
a. Diploma in Library studies (DLS) [ ]
b. NCE [ ] c. Bachelor of Library studies (BLS) [ ]
d. Bachelor of Education degree [ ] e. PGDE [ ]
f. Any other, please state _____

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Section B: Availability and Accessibility of ICT Resources

6. Which of these ICT facilities are available in your library? (Please tick as many option as applicable)

	ICT facilities	Available and functioning	Available and not functioning	Not available
AV1	Computer Aided Instructional Software			
AV2	Individualised instruction tutorials (e.g Science for Students etc)			
AV3	Instructional video/audio tapes			
AV4	Multimedia projector			
AV5	Presentation software (Power Point, KidPix)			
AV6	Computers			
AV7	Word Processor			
AV8	E-mail (for Online communication with students)			
AV9	Interactive whiteboard/Smart board			
AV10	Spreadsheet program (Excel etc)			
AV11	Online databases			
AV12	Models/Modeling software			
AV13	Simulation programmes and Games			
AV14	Graphical visualizing tools			
AV15	Concept mapping software			
AV16	Multimedia resources			
AV17	Discussion lists/Newsgroup			
AV18	Web-based Internet laboratories			

7. Which of these ICT facilities are accessible in your library? (Please tick as many option as applicable)

	ICT facilities	Very highly accessible	Highly accessible	Occasionally accessible	Not accessible
ACC1	Computer Aided Instructional Software				
ACC2	Individualised instruction tutorials (e.g Science for Students etc)				
ACC3	Instructional video/audio tapes				
ACC4	Multimedia projector				
ACC5	Presentation software (Power Point, KidPix)				
ACC6	Computers				
ACC7	Word Processor				
ACC8	E-mail (for Online communication with students)				
ACC9	Interactive whiteboard/Smart board				
ACC10	Spreadsheet program (Excel etc)				
ACC11	Online databases				
ACC12	Models/Modeling software				
ACC13	Simulation programmes and Games				
ACC14	Graphical visualizing tools				
ACC15	Concept mapping software				
ACC16	Multimedia resources				
ACC17	Discussion lists/Newsgroup				
ACC18	Web-based Internet laboratories				

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Section C: Role of the School Library Media Centre to Support the Use of ICT facilities for Teaching

8. What do you consider as the major role(s) of school library media resource centre in the use of ICT for teaching of science in your school?

	Statement	Strongly Agree	Agree	Disagree	Strongly Disagree
RSLMC1	Training and capacity building for teachers				
RSLMC2	Acquisition of ICT facilities				
RSLMC3	Maintenance of ICT facilities				
RSLMC4	Subscription to online databases				
RSLMC5	Subscription to software to support science teaching				
RSLMC6	Provision of technical support				
RSLMC7	Provision of support staff to assist in the use of ICT for teaching				
RSLMC8	Development and maintenance of in-house computer-based teaching resources				
RSLMC9	Web access to in-house developed library databases/Online catalogue				
RSLMC10	Subscription to web-based electronic resources, electronic books, databases et cetera				
RSLMC11	Maintaining an organized access to free science-based information gateways				
RSLMC12	Provision of online access to resources				
RSLMC13	Provision of instructional support				
RSLMC14	Provision of ICT information sources such as CD-ROM, Internet, and databases				
ESLMC15	Disseminating useful information on ICT facilities relevant subject teaching				
RSLMC14	Coordinating the use of ICT facilities				

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Appendix III
LIST OF FEDERAL GOVERNMENT COLLEGES

State	Code	Name of College	State	Code	Name of College
Abia	01	FGGC, Umuahia FGC, Ohafia FSTC, Ohanso	Lagos	20	Kings' College, Lagos FGC, Lagos Queens College, Lagos FSTC, Yaba
Adamawa	02	FGC, Ganye FGGC, Yola FSTC, Michika	Niger	21	FGC, Minna FGGC, Bida FGGC, New Bussa FSTC, Shiroro
Akwa-Ibom	03	FGC, Ikot-Ekpene FGGC, Ikot-Ibio-Itong	Ogun	22	FGC, Odogbolu FGGC, Shagamu FSTC, Ijebu Mushin
Anambra	04	FGC, Nise FGGC, Onitsha FSTC, Awka	Ondo	23	FGC, Ibo Ani FGGC, Akure FSTC, Ikare Akoko
Bauchi	05	FGC, Azare FGGC, Bauchi	Osun	24	FGC, Ikirun FGGC, Ipetu Mode FSTC, Ilesa
Benue	06	FGGC, Gboko FGC, Otobi FSTC, Otukpo	Oyo	25	FGC, Ogbomoso FGGC, Oyo
Borno	07	FGC, Maiduguri FGGC, Monguno FSTC, Lassa	Plateau	26	FGC, Jos FGGC, Langtang
Cross-River	08	FGC, Ikom FGGC, Calabar	Rivers	27	FGC, Port Harcourt FGGC, Abuloma FSCTC, Ahoada
Delta	09	FGC, Warri FGGC, Ibusa	Sokoto	28	FGC, Sokoto FGGC, Tambuwal
Edo	10	FGC, Ibillo FGGC, Benin FSTC, Uromi	Taraba	29	FGC, Wukari FGGC, Jalingo FSTC, Jalingo
Enugu	11	FGC, Enugu FGGC, Lejia	Yobe	30	FGC, Buni-Yadi FGGC, Potiskum
Imo	12	FGC, Okigwe FGGC, Owerri	FCT	31	FGC, Kwali FGGC, Bwari FGBC, Garki FGC, Rubochi FSTC, Orozo
Jigawa	13	FGC, Kiyawa FGGC, Kazaure	Bayelsa	32	FGC, Odi FGGC, Imiringi FSTC, Tumgbo
Kaduna	14	FGC, Kaduna FGGC, Zaria FSTC, Kafanchan	Ebonyi	33	FGC, Okposi FGGC, Ezamgbo
Kano	15	FGC, Kano FGGC, Minjibir	Ekiti	34	FGC, Ikole Ekiti FGGC, Efon Alaye FSTC, Usi Ekiti
Katsina	16	FGC, Daura FGGC, Bakori FSTC, Dayi	Gombe	35	FGC, Biliri FGGC, Bajoga
Kebbi	17	FGC, Birnin-Kebbi FGGC, Gwandu FSTC, Zuru	Nasarawa	36	FGC, Keffi FGGC, Keana FSTC, Doma
Kogi	18	FGC, Ugwolawo FGGC, Kabba	Zamfara	37	FGGC, Gusau FGC, Anka
Kwara	19	FGC, Iloring FGGC, Omu Aran			

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Appendix IV

Subject Distribution of Science Teachers in Federal Government Unity Schools in Nigeria

South-South Zone

S/N	Name of School	State	No of Teacher				
			Bio	Phy	Chem.	Maths	Total
1	Federal Government College, Calabar	Cross River	3	5	2	5	15
2	Federal Government College, Warri	Delta	5	8	6	4	23
3	Federal Government College, Odi	Bayelsa	2	2	2	3	09
4	Federal Science Technical College, Tungbo	Bayelsa	3	1	3	7	14
5	Federal Science Technical College, Uyo	Akwa Ibom	2	3	3	4	12
6	Federal Government College, Ikot Ekpon	Akwa Ibom	2	2	2	6	12
7	Federal Government College, Benin	Edo State	3	3	3	7	16
8	Federal Science College, Ogoja	Cross River	1	4	2	3	10
9	Federal Science Tech. College, Ahoada	Ebonyi	2	3	3	9	17
10	Federal Govt. Girls College, Abuloma	Rivers	5	4	2	5	16
11	Federal Govt. Girls College, Imiringi	Bayelsa	3	3	3	4	13
12	Federal Science Technical College, Uromi	Edo	2	4	3	6	15
13	Federal Govt. College, PortHarcourt	Rivers	6	5	5	5	21
14	Federal Govt. College, Ikom	Cross Rivers	5	3	2	8	18
15	Federal Govt. College, Ibillo	Edo	2	2	3	6	13
16	Federal Govt. Girls College, Ibusa	Delta	4	4	4	6	18
17	Federal Govt. Girls College, Ikot Obon Itong	Akwa Ibom	4	6	3	5	18
	Total		**54**	**62**	**51**	**93**	**260**

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South-West Zone

S/N	Name of School	State	No of Teachers				
			Maths	Bio	Phy	Chem	Total
18	Federal Science Tech. Coll., Ikere Akoko	Ondo	7	3	4	2	16
19	Federal Government Girls College, Akure	Ondo	5	5	3	3	16
20	Federal Government Girls College, Sagamu	Ogun	7	4	4	3	18
21	Federal Govt. College, Ikole	Ekiti	4	3	2	4	13
22	Federal Govt. College, Ikirun	Osun	6	5	3	3	17
23	Federal Science Tech. College, Yaba	Lagos	10	8	5	4	27
24	Federal Govt. College, Ijamkin	Lagos	14	5	3	4	26
25	Federal Science Technical College, Ilesa	Osun	8	4	5	3	20
26	Federal Science Technical College, Usi Ekiti	Ekiti	6	2	2	2	12
27	Federal Science Tech. Coll. Ijebu Mushin	Ogun	5	3	4	4	16
28	Federal Government Girls Coll. Efon Alaaye	Ondo	6	3	5	3	17
29	Kings College, Lagos.	Lagos	13	12	13	10	48
30	Queens College, Lagos	Lagos	8	5	6	6	25
31	Federal Government, Coll., Odogbolu	Ogun	10	4	5	4	23
32	Federal Government College, Idoani	Ondo	4	3	2	4	13
33	Federal Government Girls College, Ipetumodu	Osun	7	4	3	4	18
34	Federal Govt. Girls College, Oyo	Oyo	7	3	4	5	19
35	Federal Govt. Coll., Ogbomoso	Oyo	8	5	3	4	20
	Total		**135**	**81**	**76**	**72**	**364**

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North Central Zone

S/N	Name of School	State	No. of Teachers				
			Maths	Bio	Phy	Chem	Total
36	Federal Science Technical College, Orozo	Abuja	9	3	3	3	18
37	Federal Govt. Girls College, Bwari	Abuja	7	4	2	2	15
38	Federal Government College, Keffi	Nassarawa	6	2	3	2	13
39	Federal Govt. Girls College, Keana	Nassarawa	5	1	2	4	12
40	Federal Science Technical College, Doma	Nassarawa	4	3	3	1	11
41	Federal Govt. Girls College, Langtang	Plateau	11	2	3	4	20
42	Federal Govt. Girls College, Kabba	Kogi	6	2	3	5	16
43	Federal Govt. Coll. Ilorin	Kwara	9	4	5	5	23
44	Federal Govt. Coll. Suleja	Niger	10	5	4	3	22
45	Federal Science Tech. Coll., Shinoro	Niger	8	3	6	4	21
46	Federal Govt. Boys Coll., Garki	Abuja	6	3	5	5	19
47	Federal Govt. College, Ugbolawo	Kogi	8	2	4	4	18
1048	Federal Govt. Girls Coll. Gboko	Benue	12	3	6	4	25
49	Federal Govt. Girls Coll., Omu Aran	Kwara	10	4	5	5	24
50	Federal Govt. Coll. Jos	Plateau	13	5	7	2	27
51	Federal Govt. Coll., Bida	Niger	7	6	5	3	21
52	Federal Govt. Coll. Kwali	Abuja	12	4	5	5	26
53	Federal Govt. Coll. Robochi	Abuja	9	3	5	4	21
54	Federal Govt. Girls Coll. Abaji	Abuja	8	4	4	4	20
55	Federal Govt. Girls Coll. Yandeikya	Plateau	7	3	2	2	14
56	Federal Govt. Coll. Otobi	Benue	5	2	1	3	11
57	Federal Science Technical Coll. Otukpo	Benue	7	4	3	2	16
58	Federal Govt. Girls, New Bussa	Niger	6	4	4	2	16
	Total		**186**	**76**	**90**	**78**	**431**

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North-West Zone

S/N	Name of School	State	No. of Teachers				
			Maths	Bio	Phy	Chem	Total
59	Federal Science Technical College, Zuru	Kebbi	7	2	3	2	14
60	Federal Govt. Girls College, Gwandu	Kebbi	7	4	3	4	18
61	Federal Govt. College, Kano	Kano	8	4	5	5	22
62	Federal Science Technical College, Dayi	Kaduna	6	2	1	5	14
63	Federal Govt. College, Kaduna	Kaduna	6	3	5	5	19
64	Federal Govt. Girls College, Gusau	Zamfara	5	5	3	4	17
65	Federal Govt. Girls College, Bakori		4	2	2	3	11
66	Federal Govt. Girls College, Tambuwal	Sokoto	3	6	3	4	16
67	Federal Govt. Girls College, Kazaura		6	3	3	4	16
68	Federal Govt. College, B/yauri		4	4	4	4	16
69	Federal Govt. Girls College, Zaria	Kaduna	5	4	3	5	17
70	Federal Govt. College, Sokoto	Sokoto	5	3	1	4	13
71	Federal Govt. Girls College, Minjibir	Kano	7	2	1	2	12
72	Federal Govt. College, Anka	Zamfara	4	1	1	1	07
73	Federal Govt. College, Daura	Katsina	9	7	6	5	27
74	Federal Govt. College, Kuyawa	Jigawa	6	2	1	4	13
75	Federal Science College, Sokoto	Sokoto	5	4	3	3	15
76	Federal Science Tech. College, Kafanchan		6	2	3	5	16
77	Federal Govt. Girls College, Kazaure	Jigawa	9	2	1	3	15
	Total		**112**	**62**	**52**	**72**	**298**

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South-East Zone

S/N	Name of School	State	No. of Teachers				
			Maths	**Bio**	**Phy**	**Chem**	**Total**
78	Federal Science Technical Coll. Awka	Anambra	8	7	5	6	26
79	Federal Govt. College, Okposi	Ebonyi	4	2	2	3	11
80	Federal Govt. Girls College, Umuahia	Abia	6	6	6	3	21
81	Federal Govt. College, Ohafia	Abia	5	4	2	4	15
82	Federal Science Technical College, Ohanso	Abia	6	3	2	5	16
83	Federal Govt. Girls College, Ezeamgbo	Ebonyi	6	3	4	1	14
84	Federal Govt. College Nise	Anambra	6	4	4	5	19
85	Federal Govt. Girls College, Owerri	Imo	5	6	5	6	22
86	Federal Govt. Girls College Onitsha	Anambra	5	5	6	4	20
87	Federal Govt. College, Okigwe		3	7	6	4	20
88	Federal Govt. Girls College, Legia, Nsukka	Enugu	5	3	4	2	14
89	Federal Govt. College, Enugu	Enugu	7	5	5	5	22
	Total		**66**	**55**	**51**	**48**	**220**

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North-East Zone

S/N	Name of School	State	Name of Teachers				
			Maths	Bio	Phy	Chem	Total
91	Federal Science Tech. Coll. Jalingo	Taraba	4	2	2	3	11
92	Federal Govt. College, Ganye	Adamawa	5	6	3	4	18
93	Federal Govt. Girl College, Bajoga	Gombe	3	3	3	2	11
94	Federal Science Tech. Coll. Lassa	Borno	4	3	3	3	13
95	Federal Govt. Girls College, Yola	Adamawa	4	4	3	3	14
96	Federal Govt. College, Azare	Bauchi	3	2	3	4	12
97	Federal Govt. College, Buni Yadi	Yobe	5	4	4	4	17
98	Federal Govt. College, Biliri	Gombe	4	4	4	3	15
99	Federal Govt. College, Maiduguri	Benue	5	2	2	1	10
100	Federal Govt. Girls College, Bauchi	Bauchi	3	1	2	2	08
101	Federal Govt. College Wukari	Taraba	9	2	2	2	15
102	Federal Science Tech. Coll. Michika	Taraba	3	1	1	2	07
103	Federal Govt. Girls College, Jalingo	Taraba	2	3	1	2	08
104	Federal Govt. Girls College, Potiskum	Yobe	4	4	5	5	18
105	Federal Govt. Girls College, Monguno	Borno	5	2	3	2	12
	Total		**63**	**43**	**41**	**42**	**189**
	Grand Total		**616**	**379**	**361**	**405**	**1761**

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Appendix V

Federal Unity Schools Selected for the study

S/N	State Code	State	Name of FGUS	Geographical zone
1	02	Adamawa	Federal Government College, Ganye	NE
2	03	Akwa-Ibom	Federal Government Girls College, Ikot-Obio-Ibong	SS
3	04	Anambra	Federal Science Technical College, Awka	SE
4	06	Benue	Federal Government Girls College, Gboko	NC
5	07	Borno	Federal Government Girls College, Monguno	NE
6	09	Delta	Federal Government College, Warri	SS
7	10	Edo	Federal Science Technical College, Uromi	SS
8	12	Imo	Federal Government Girls College, Owerri	SE
9	14	Kaduna	Federal Governement Girls College, Zaria	NW
10	16	Katsina	Federal Government College, Daura	NW
11	17	Kebbi	Federal Government Girls College, Gwandu	NW
12	19	Kwara	Federal Government College, Ilorin	NC
13	20	Lagos	Queens College, Lagos	SW
14	21	Niger	Federal Government Girls College, New Bussa	NC
15	22	Ogun	Federal Science Technical College, Ijebu Mushin	SW
16	24	Osun	Federal Government College, Ikirun	SW
17	25	Oyo	Federal Government Girls College, Oyo	SW
18	27	Rivers	Federal Government Girls College, Abuloma	SS
19	29	Taraba	Federal Government Girls College, Wukari	NE
20	30	Yobe	Federal Government Girls College, Potiskum	NE
21	31	Abuja	Federal Government Boys College, Abuja	FCT
22	32	Bayelsa	Federal Government Girls College, Imiringi	SW
23	34	Ekiti	Federal Government College, Ido Ani	SW
24	35	Gombe	Federal Government Girls College, Bajoga	NE
25	37	Zamfara	Federal Government Girls College, Gusau	NW

Source: Preliminary Survey, 2011

Key: NC = North Central; NE = North East; NW = North West; SE = South East; SS = South South; South West

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Appendix VI

Response rates from FUSs in Nigeria

Geopolitical zones	Name of School	Teachers		School Librarian	
		No. of questionnaire administered	No. of questionnaire returned	No. of questionnaire administered	No. of questionnaire returned
North East	FGC, Ganye, Adamawa State	18	15	1	1
	FGGC, Monguno, Borno State	12	7	1	-
	FGGC, Wukari, Taraba State	15	14	1	1
	FGGC, Potiskum, Yobe State	18	14	1	1
	FGGC, Bajoga, Gombe State	11	10	1	1
	Total	**74**	**60**	**5**	**4**
North West	FGGC, Zaria, Kaduna State	22	18	1	1
	FGC, Birni Yauri, Kebbi State	18	17	1	1
	FGC, Dura, Katsina State	27	24	1	1
	FGGC, Gusau, Zamfara State	11	15	1	1
	Total	**84**	**74**	**4**	**4**
North Central	FGGC, Gboko, Benue State	25	12	1	1
	FGC, Ilorin, Kwara State	23	8	1	1
	FGGC, New Bussa, Niger State	16	13	1	1
	FGBC, Apo-Garki, Abuja	19	13	1	1
	Total	**83**	**46**	**4**	**4**
South East	FSTC, Awka, Anambra State	26	25	1	1
	FGGC. Owerri, Imo State	22	15	1	1
	Total	**48**	**40**	**2**	**2**
South South	FGGC, ikot Obio Itong, Akwa Ibom State	18	14	1	1
	FGC, Warri, Delta State	23	20	1	1
	FSTC, Uromi, Edo State	15	12	1	1
	FGGC, Imiringi, Batelsa State	13	13	1	1
	FGGC, Abuloma, Rivers	16	13	1	1
	Total	**85**	**72**	**5**	**5**
South West	FSTC, Ijebu Mushin, Ogun State	16	13	1	1
	FGC, Ikirun, Osun State	17	10	1	1
	FGGC, Oyo, Oyo State	19	16	1	1
	FGC, Ido Ani, Ondo State	13	12	1	1
	Queens College, Lagos	25	19	1	1
	Total	**90**	**61**	**5**	**5**
Grand Total		**464**	**353**	**25**	**24**

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