**A COMPARATIVE ASSESSMENT OF THE USE OF "ICT" IN TEACHING BIOLOGY IN SOME SELECTED SECONDARY SCHOOLS**

**ABSTRACT**

This study assesses the Use of "ICT" in Teaching Biology in Some Selected Secondary Schools in Mushin Local Government Area of Lagos State. It investigates the use, importance and significance of ICT in teaching Biology in secondary schools in Mushin LGA of Lagos. The purpose of this research was to determine students performance in Biology within a non-ICT equipped secondary school system; to determine students performance in biology within an ICT equipped secondary school system; to account for the disparity in students performance within the two contexts of secondary schools if there is any and indicate the serious need for a comprehensive ICT-aided teaching of Biology in secondary schools in Nigeria. Two questions were stated for this study, the research design was comparative research method in nature. The work generated three research questions and three hypothesis. Quasi-experimental research design was adopted using experimental and control groups and also pretest-posttest. Purposive sampling technique was used to select 50 sample population as respondents who were drawn from two secondary schools both in Mushin. The study collected data through Biology Achievement Test (BAT) and ICT assessment scale from the two groups (experimental and control). The instrument used for data collection was validated by three experts from the field of Measurement and Evaluation, Biology Education and Educational Technology with reliability index of 0.85. The mean, standard deviation and t-test were used to analysed the data collected. Result shows that the mean scores of the experimental group improved in the posttest in comparison to the pretest. There was no significant difference based on gender in the students’ academic performance. The result also revealed that there was low usage of ICT for teaching of Biology in the study area. From the findings of the study, the researchers are of the opinion that students regardless of gender should be given equal opportunity in science and technology without fear or favour. It could also be emphatically deduced that the use of ICT in teaching will improve students’ academic performance. The work also identified some of the challenges militating against the effective integration of ICT in teaching and learning. The researchers conclude by making some recommendations on how to reduce if not eliminate the challenges identified as militating against the use of ICT in teaching and learning process.

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**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background to the Study**

Biology is a widely studied subject. The knowledge of it calls for a balanced secondary school education. Biology as a school subject may be a factor in improving the lives of students and their immediate environment.

In a developing country like Nigeria, the use of "ICT" in the teaching of Biology should be promoted in all secondary schools, since the national policy on education states that "the broad aims of secondary education within overall National objectives should be preparation or higher education". In specific terms, secondary education should equip students so that they can be able to live effectively in our modern age of science and technology.

Information Communication Technology (ICT) has positively transferred effectively and efficiently every aspect of human lives such as Education, Aviation, Agriculture, Manufacturing etc. In Nigeria, it appears that most students and schools lack facilities such as Information Communication Technology facilities, the influence of media devices such as projectors, perhaps may improve the teaching-learning process of the subject, Biology.

ICT is an acronym Information Communication Technology. They are a diverse set of technological tools and resources used to communicate, and to create, disseminate, store and manage information. These technologies include computers, the internet, broadcasting technologies(radio and television), and telephony(Volman,2005).In recent years, there has been a groundswell of interest in how computers and the internet can best be harnessed to improve the efficiency and effectiveness of education at all levels and in both formal and non-formal settings (www.en.m.wikibooks.org). But ICTs are more than just these technologies; older technologies such as the television, radio and telephone which are now given less attention, have a longer and richer history as instructional tools.

The use of computers and the internet is still in its infancy in developing countries, if these are used at all, due to limited infrastructure and the attendant high cost of access. ICTs are making dynamic changes in society. They are influencing all aspects of life. The influences are felt more and more at schools. ICTs provide both students and teachers with more opportunities in adapting teaching and learning to individual needs, society is forcing schools to aptly respond to this technical innovation. Tinio (2002), states the potentials of ICTs in increasing access and improving relevance and quality of education in developing countries. He further stated that ICTs greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for biology and the poor. One of the greatest hardships endured by the poor, and by many others, who live in the poorest countries, is their sense of isolation and ICTs can open access to knowledge in ways unimaginable not long ago.

In Watson’s (2001) description, ICTs have revolutionized the way people work today and are now transforming education systems. As a result, if schools train students with yesterday’s skills and technologies, they may not be effective and fit in tomorrow’s world. This is a sufficient reason for ICTs to win global recognition and attention. For instance, ICTs are dependable tools in facilitating the attainment of one of the Millennium Development Goals (MDGs), which is achievement of Universal Basic Education by the year 2015. Kofi Anan, the former United Nations Secretary General, points out that in order to attain the goal of Universal Primary Education by 2015; we must ensure that information and communication technologies unlock the door of education systems. This indicates the growing demand and increasingly important place that ICTs could receive in education. Since ICTs provide greater opportunities for students and teachers to adjust learning and teaching to individual needs, society is forcing schools to give appropriate response to this technical innovation.

The uses 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 reveal that students using ICT facilities mostly show higher learning gains than those who do not use.

ICT offers an array technical tools that improve the academic experience, creating a potential for variety, diversity and better organization in education. Like all other courses of study, Biology Education offers a creative field on which the opportunities offered by ICT can be explored.

Scientific research especially in the 21st century has greatly increased the understanding of the world around us. This has brought a lot of changes in different areas of human endeavor, like in the area of Education, Health, Power, Industry, Environment etc. It has promoted better living and good practices. There has been tremendous increase in research which led to a lot of discoveries in science and technology. All these innovations and developments are interrelated and dependent on each other. Natural science has witnessed a lot of improvement recently and science in this century had displayed a lot in the area of innovation and technology and has shown a great potential in transforming human life and the world around him. The development of science and technology is of paramount importance to the society and the nation at large, that is why a lot of emphasis is being placed on it recently in our schools.

It is no gainsaying that biology cannot thrive in this modern day without the informative and communicative edge neither can biology education graduates be globally competitive without having being imbued with ICT skills. It is against this background that this researcher investigates the regularity and effectiveness of ICT use among biology education students.

**1.2 Statement of the problem**

There is a need for steady evaluation of the impact of ICT in the teaching of essential subjects such as Biology.

It has fully come to the attention of biology education stakeholders, the invaluable importance of ICT tools such as computers, audio-visual equipment, internet facilities etc. to the course. They are however not sure whether this technological opportunity is being most effectively and optimally exploited and explored. Information Communication Tools are an integral part of biology and biology education and their extensive use, especially in recent years, is gradually being implemented in undergraduate training. Furthermore, many universities and their libraries across Nigeria are rapidly incorporating ICT tools such as computer and internet into their programmes for the use of students. The problem of this study is therefore to investigate the effectiveness and regularity of ICT use among biology education students.

This is with a view to ascertaining the level of success recorded in terms of students performance in Biology with the increased wave of computer based education system in Nigeria.

**1.3 Purpose of the Study**

In specific terms, this study is intended to achieve the following objectives:

1. To determine whether or not SS2 Biology Students taught with the use of Computer Assisted Instruction will perform better than those taught without it.
2. To determine the gender-related effect of the use of ICT driven Instruction on academic performance amongst SS2 Biology students in the study area.
3. To investigate the extents to which ICT facilities available for teaching and learning in secondary schools in Mushin are put use.

**1.4 Research Questions**

This study specifically seeks to provide answers to the following research questions:

1. What is the performance means score of SS2 Biology Students in the experimental and control groups before and after been taught using Information and Communication Technology (ICT)?
2. What is the performance means score of SS2 Biology Students exposed to ICT based on gender?
3. To what extent do teachers use ICT in teaching SS2 Biology students in Mushin Area of Lagos State?

**1.5 Research Hypotheses**

The following hypotheses were formulated to guide the study:

**HO1:** There is no significant difference in the achievement mean scores between the experimental and control groups after being exposed to ICT driven instruction in teaching Biology.

**HO2:** There is no significant difference in the achievement mean score between male and female SS2 Biology students in the experimental group when they were exposed to treatment.

**HO3:** There is no significant difference in the performance mean scores in the experimental and control groups based on the use of ICT in the study area.

**1.6 Significance of the Study**

The importance of this study cuts across several levels of the nation educational system, ranging from the policy makers, stakeholders down to the major beneficiaries who are the students. The significances are carefully enumerated as follows:

This study will hopefully make the Federal, States and Education Authorities to know the extent to which ICT facilities are available in secondary schools for teaching and learning process as well as know the level of usage/utilization of these facilities by teachers and students for effective teaching-learning process. More so, it is hoped that the study will bring out areas of inadequacies of the Computer Assisted mode of Instruction in secondary schools with the hope that the authorities will help them to overcome challenges to increase learning amongst students.

Teachers will find this study helpful in so many ways. Specifically, some teachers who are reluctant to embrace this innovation or illiterate in the use and knowledge of ICT will see the need for it, if they want to remain relevant in the teaching profession and also ensure the success of their students academically. In addition, teachers who are faced with the problem of overcrowded classrooms can be supported with computer assisted mode of instruction to carry out their teaching effectively without much ado. In fact, this study will be an eye opener and image booster for teachers if they adopt this instructional strategy because lessons can be planned and be taught without the teacher being necessarily present all-through in the classroom. More so, it has an added advantage of reducing the burden of teachers to more or less a facilitator in the classroom.

Students, especially those offering Biology as a subject in schools who have been exposed to ICT will learn how to independently explore information in Biology and this will in turn increase their skills and performance in examinations. Learning becomes easier, real and concrete for students when teachers use computer assisted mode of instruction to teach. Students on their own part who have knowledge of ICT can engage in individualized learning at home for better understanding of concepts.

More importantly, ICT has introduced a new concept in the teaching and learning process known as ‘edutainment’ (educate through entertainment) which needed to be explored.

**1.7 Scope of the study/delimitation**

Six secondary schools in Mushin Local Government Areas of Lagos State were used for this study as time and cost did not permit examining all schools within the selected local government areas.

# **1.8 Limitations of the study**

The use of ICT in teaching and learning is considered to be very crucial and therefore little time for the respondents to respond to the questionnaire would make the findings absolute. The principals, teachers and students may have given responses that seemed not to portray the actual phenomena in the study because most of the schools were in their early phase of ICT integration into teaching and learning characterized by patchy and coordinated provision and use. Further, the schools were far apart and therefore, the long distance associated with poor road network within the district would negatively affect the study. It was also not possible to relate improvement in teaching and learning on only the use of ICT because many unobservable factors might also influence better outcomes of teaching and learning in schools.

# **1.9 Organization of the study**

The study is organized into five chapters. Chapter one presents a general introduction and includes the background to the study, the statement of the problem, purpose of the study, objectives of the study, research questions, significance, limitations, delimitations, basic assumptions of the study, definition of significant terms and the organization of the study. Chapter two covers literature reviews on us of ICT in teaching and learning in secondary schools, the theoretical background in use of ICT in teaching and learning and the conceptual framework of ICT use in secondary schools. Chapter three describes the research methodology to be used. This included the research design, target population, sample and sampling procedure and data analysis techniques. Chapter four focused on data analysis, interpretation and discussion of findings. Chapter five contains the summary, research findings, discussions, conclusions and recommendations of the study.

**CHAPTER TWO**

**LITERATURE REVIEW**

# **2.1. Introduction**

This chapter discussed literature on what ICTs in teaching and learning entail, theoretical back-ground in use of ICT in teaching and learning, global overview of ICT, ICT in education in African context, ICT education in the Kenyan context, conceptual framework of the study and theoretical framework. Specifically, this review provides a framework of understanding regarding this study.

**2.2. The concept of ICT integration**

The term Information Communication Technology (ICT) has had a long history in its evolution process. According to Pelgrum and Law (2003), towards the end of 1980’s, the term ‘computers’ was replaced by IT (Information Communication Technology). This signified as shift of focus from computing technology to the computer’s enhance capability to store and retrieve information. This was followed by the introduction of the term ‘ICT’ around 1992, when e-mail started to become available to the general public. The concept of Information Communication Technology consists of three words. The term ‘Information’ refers to any communication or representation of knowledge such as facts, data or opinion in any medium. ‘Communication’ is an integral part of human existence. It refers to the process of transferring information from a sender to a receiver with the use of a medium in which the Communication Information is understood by both. ‘Technology’ is the practical form of scientific knowledge or the science of application of knowledge.

Therefore, Information Communication Technology (ICTs) are commonly defined in education as ‘a diverse set of technological tools and resources used to communicate, create, disseminate, store and manage information’ Blurton, (2000). These technologies include computers, the internet, broadcasting technologies (Radio and Television), and (Mobile) telephony. Basically ICT is a tool. It can be hardware (such as Computers, Digital cameras), software (such excel, discussion forum) or both.

**2.2.1. ICT integration**

Integrating ICT in to teaching and learning is not a new concept. It may be as old as other technologies such as radios or televisions. However, with the rapid development of emerging technologies, such as web technology, ICT integration has increasingly attracted the attention of educators. Technology should be used not because it is available or it has been shown effective in some cases. It should be used to enable the process and enhance learning because inappropriate use of technology can lead to negative effects Russel, (1999).

Integration has a sense of completeness or wholeness (Earle, 2002), by which all essentials elements of a system are seamlessly combined together to make a whole. In education, simply handing out to students a collection of websites or CD-ROM programmes, taking your students to the computer lab once a week or using an electronic worksheet is not necessarily ICT integration. In a properly prepared ICT integrated lesson, ICT and other crucial educational components such as content and pedagogy are molded into one entity. As a result, the objective of the lesson may be achieved: but if the ingredients were taken away from the ICT integrated lesson, the quality of the lesson would be somehow be diminished William, (2003).

Instead, technology is integrated when it is used in a seamless manner to support and extend curriculum objectives and to engage students in a meaningful learning. It is not something one does separately; it is part of the daily activities taking place in the classroom. Based on the above, within the education sector in Kenya. ICT is defined as the seamless incorporation of technology to support and enhance students’ engagement in meaningful learning and for attainment of curriculum adjectives.

ICT integration is more of a process rather than a product. The computer should be fitted into the curriculum not the curriculum into the computer Earle, (2002). Therefore, effective ICT integration should focus on pedagogy design by justifying how the technology is used in such a way and why. Effective ICT integration into learning process has the potential to engage learners. Additionally, ICT can support various types of interactions in the learning environment: learner – content, learner- learner, learner-teacher and learner-interface. These types of interactions make the learning process more interactive and learners more active and engaged Wong et al, (2006).

**2.3. Effects of ICT on students academic performance**

As with ICT more generally, direct casual effect are not easily identifiable. Furthermore, drawing clear conclusions on the effect of ICT from the range of research evidence and studies can be problematic. There are a number of factors that limit effective comparison, such as difference in sample size, methodologies and effects, not to mention many differences between education systems in different countries. Notwithstanding these reservations, a number of proven effects of ICT in terms of learning outcomes emerge. They include:

**2.3.1. ICT and student performance**

When considering the effects of ICT in education, there tends to be a focus on whether and to what extend ICT can raise student performance. According to research conducted by the British Educational Communication and Technology Agency Becta, (2000), there is evidence of a statistically positive association between ICT and higher achievement. Lowe, (2001) supports this view by arguing that computer based education positively affected students achievement when compared to traditional classroom instruction.

**2.3.2. Individual learner interactivity**

Recent trends towards cognitive approach on teacher-learner integration suggest that the learning process can be enhanced through the use of ICT. For effective use of ICT in instruction, the pedagogical practices used by teachers will need to change from teacher based to learner based Underwood, (1998).

Furthermore due to the interactive nature of ICT, it is well situated for creative learning approach in which experimentation and critical thinking are emphasized World Bank, (2004)

**2.3.3. Engage students by motivation**

Studies carried out in UK by impaCT2, (2000) on student attainments revealed that there is a positive effect on behavior, motivation, communication and process scales when teachers use ICT in teaching and learning. This is most often linked to a shift in the attitude of students and greater involvement in learning activities. This view is further emphasized by the e-learning Nordic, (2006) which places a strong emphasis on ICT impact on student’s motivation, engagement and creativity. Moreover, ICT is seen as increasing students confidence and motivation by making school work more enjoyable, considered as fun and not a regular education and hence students enhance their learning capacity.

**2.3.4. Increasing learner independence**

ICT allows for greater differentiation (especially in primary schools), with programmes tailored to individual students’ needs. In other words, ICT provides teachers with the opportunity to provide various learning tasks within the same classroom for the benefit of the individual students’ e-learning Nordic study, (2006). It further stated that students assume greater responsibility for their own learning when they use ICT working more independently and effectively.

**2.3.5. Enhancing efficiency and effectiveness of education administration** New technologies can help improve the quality of administrative activities and process including human resource management, student registration and monitoring student’s achievements in assessment tests Mugenda, (2006).

**2.3.6. Active learning and authentic assessment**

In many classroom situations, it is difficult to allow students to be sufficiently active as participants. Typically, students are often passive spend a lot of time listening and reading. But with the use of ICTs students are more likely to be interested and attentive and will achieve a wider range of learning outcomes if they can be active, learning by doing Committee on Developments in the Science of Learning , (2000).

 **2.3.7 Teachers pedagogical skills in teaching and learning processes** 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. They are sometimes appear to be an assumption that using ICT to support learning requires change for all whereas clearly some teaching have been creating appropriate learning environment for the years without using ICT, However, teacher need to use ICT because it is believed that in doing so, they will provide ever better learning environments Becker et al, (1999). The use of ICT in teaching and learning has varied impact on teachers. Some general areas of impact may be identified as:

**2.4. Impact on the role of teachers**

The link between technological development and the transformation of learning is clear in history. Among the pervasive changes in professional practice is emerging as a result of the implementation of ICT in teaching and learning. The role of teachers as changed and continues to change from being an instructor to be coming a facilitator, coach and creator of learning environments. This view is supported by Collis, (1989) who points out that teachers will always need to be instructional leaders in teaching and learning process. Additionally, Becker, (1994) emphasize that the teacher’s pedagogical practices best supported by computers –use should result in improvement in student academic competencies.

In view of the above, it is clear that ICT heralded a paradigm shift in education in that its use in schools is changing how teachers teach and how students learn. Riel, (1990) suggests that teachers require new competencies to be able to integrate the use of ICT in teaching and learning. In assuming their new roles, teachers are expected to upgrade their knowledge and acquire new skills in their pedagogical practices and curriculum development to be able to integrate ICT in teaching and learning effectively.

**2.4.1. Access to information**

ICT gives teacher access to information to support them in trying new strategies, thinking, reflecting on practice and engaging with new materials Committee on Development in the Science of Learning, (2000).

Teacher needs support in making use of new technologies to enhance their personal work before learning to use them in their teaching. Much of this support may be accessed more readily using ICT Reginald Gregorie Inc. et al, (1996).

**2.4.2 Teacher-students relationship**

The Norwegian (2006) Pilot study emphasized on the role of the teacher as being more of an advisor, critical dialogue partner and leader for specific subject domains; thereby promoting greater independence of learning. This point out that teachers use ICT to change the way they interact with their students; emphasizing student-centered approach. It is further affirmed by Scardamallia, (2002) that the nature of teachers’ role has the strongest impact on the student’s role to enhance learning outcomes. The teaching and learning outcomes were dependent on whether teachers and students are engaged in meaningful classroom activities focusing on the lesson objectives.

**2.5. Teachers’ attitude of the application of ICT in teaching and learning**

Underwood, (2006) provides evidence that teachers use ICT to support existing pedagogies. On supporting this view, Romboll Management, (2005) illustrates the current dilemma concerning the pedagogical use of ICT in the classroom. He states, “Even though a large number of teachers have gained more pedagogical knowledge (through better access to ICT-based materials and pedagogical concept via training and discussion), teachers have increased the use of ICT in teaching and learning”. Similar positive results are affirmed by Haggins (2005) by stressing that an overwhelming majority of teachers have confidence in using ICT in classroom.

ICT gives teachers access to information to support them in trying new strategies, thinking, reflecting on practice and engaging with new materials, committee on development in the science of learning, (2000). There is no doubt that teachers who use ICT in classrooms have to demonstrate high levels of energy, hard work and confidence, Lanksher & Snyder, (2000).

In addition, a number of studies have found that, “personal access for teachers to a computer for the purpose of preparation and planning is one of the strongest influence on the success of ICT training and subsequent classroom use”, office for standards in Education, (2002). Becta, (2002), also supports that enthusiastic and visionary leadership has a positive impact on teachers’ attitudes and behaviours.

**2.6. Student’s attitude towards use of ICT to enhance teaching and learning**

The use of ICT in schools should have a positive impact on students in terms of supporting their learning and providing them with relevant technological literacy. In addition, ICT should increase the engagement of students and in most cases increase their independence, so that students are not only required to use ICT completely but may also be required to adjust to change in their role. In many cases, the students’ role becomes more; i) Independent and responsible ii) Co-operative and collaborative, and iii) Directive and negotiate.

It follows from the above that there is need to develop students’ computer literacy because research studies indicate that students assume greater responsibility for their own learning when they use computer, working more independently and effectively, Becta, (2002).

Eurydice (2005) argues that students’ ICT skills cannot only be learnt in school but also in informal content, at home and with friends. It is emphasized that students’ informal learning and experiences in using ICT are far more attractive than the school can offer. As a result, students face few challenges using ICT in school. Rockman and Chessler, (2000) found in their studies that students’ computer literacy improves their academic achievements and positive attitudes in learning. Research studies further indicate that learners participate more actively when ICT is used in learning. However, some students may become frustrated when they perceive that their ICT skills are being under-estimated and under-utilized, Becta (2002). Therefore, teachers are required to use ICT integration in teaching and learning effectively in order to realize the objective of ICT integration. The e-learning Nordic, (2006) studies also places a strong emphasis on ICT, positive impact on what might be called secondary or indirect variables such as motivation, concentration, engagement, cognitive processing, creativity, critical thinking, independent learning and teamwork. According to Comber, (2002), and Higgins, (2005) increased motivation goes together with a positive learning and leads for example to more attention during lessons with students being involved in learning activities.

Teamwork between students is greater when they use ICT for project work, Romboll Management, (2006), Kezzel (2005).The above affirms that ICT enhances a more student-centered learning approach which is of important benefit to learners. They further identified that involvement and increased effectiveness of learning is also a key impact of ICT in the classroom. It also helps students to reflect on what and how they have learnt and thus a catalyst for reflection. Romboll Management, (2006) indicates that learners with special needs or behavioral difficulties also gain in different ways from the use of ICT. Finally, there can be a positive impact on students when ICT is used appropriately in learning.

**2.7. Challenges affecting the use of ICT in enhancing teaching and learning attitude**

Brooks, (1999) believes that many educators perceive computers as just another burden, commenting on the lack of awareness among educators of the potential offered by computers in education context, and noting that education have tended in consequence to confine the possibilities of computer use towards processing and e-mail. Other researchers such as Pascopella, (2001) emphasize that some educators felt that computers served only a recreational function, with learners being allowed, for instance, to play games after computing work. However, Potosky and Bobko, (2001) demonstrated that computer use has a positive impact on teaching and learning.

**Teachers Training in ICT use**

Hakkarien, (2001) analyzed the relations between teachers’ skills in using the new ICTs; their pedagogical thinking and their self-reported practices. The results indicated that only a small percentage of teachers had adequate technical ICT skills. Furthermore, Veen, (1993) suggested that lack of initial training of teachers was a serious obstacle to ICT implementation.

 **Access to ICTs and other related infrastructure**

Cuban, (1993) suggested that placement of computers within the reach of teachers and within supportive school cultures was very important so that teachers and students can improve their ICT potential. This view was supported by, Preston and Cox, (1999) in their study carried out to examine factors relating to the uptake of ICT in learning. The results showed that teacher who are regular users of ICT have confidence in using ICT, perceive it to be useful for their personal work and for their teaching.

**Administrative support of ICT in schools**

According to Anderson and Dexter, (2000) unrestricted access to training would amount to effective use of computers if teacher are expected to use ICT in a meaningful way. In this regard, they suggested that strong leadership is critical to computer integration and ICT implementation in teaching and learning in general. However, many leaders and administrators are not ICT literate thought they have gained little experience or knowledge that make them use computers only for basic functions such as word processing and PowerPoint presentation.

**ICT policy in education**

Hawkins notes that while in many ministries of education around the world have made the commitment to computerize schools, few have developed coherent strategies to fully integrate the use of computers as a pedagogical tool in the classroom. Educational institutions are required to develop an ICT strategy that incorporates the goals of institution and how this will be met using ICTs, provide a supporting framework for the development of ICT in the institution and outline how the full potential of ICT is to be exploited to support all aspects of teaching and learning. Chisenga, (2006)

 **Funding for ICT investment in education**

Cost is an important factor that guides the adoption and growth of ICT in a country. Most developing countries are constrained by resource scarcity. Even where the importance of ICT is recognized, allocation for the development of ICT is often inadequate. Mugenda, (2006) points out that one of the greatest challenges in ICT use in education is balancing educational goals with economic realities.

 **Inadequate time to prepare to teach with ICTs in classrooms**

According to Labourde, (2002) adequate time must be allowed for teachers to develop new skills, explore their integration into their existing teaching practices and curriculum, and undertake necessary additional lesson planning, if ICTs are to be used effectively. Rose and Weil, (1995) reports that lack of time required to successfully integrate ICT into their curriculum is a major obstacle in integration in ICT teaching and learning.

 **2.8. Summary**

The use of ICT in teaching and learning is most definitely not a cheap solution for secondary education, but by facilitating the creation of new modes of teaching and learning and provision of education resources, it is believed to have a significant role to play in education sector. To date the integration of ICT tools into teaching and learning has not been successful. However, emphasis has been put across the continent to provide teachers and students with relevant ICT skills in the hope that this will mystically enable them to embrace the use of ICT positively in teaching and learning in learning institutions.

**2.9. Theoretical framework**

According studies carried out by scholars such us (Mishra, 2002, Villalba and Romiszowsski, 2001) three schools of thought have been widely used in the use of technology to support teaching and learning. These include; behaviorism, cognitive psychology and constructivism. However, (Hung, 2001) points out that constructivist learning theory has been identified as the most suitable one for the use of ICT in teaching and learning. Constructivist learning theory is based on education psychology. Jean Peaget (1896-1980) was the first theorist who regarded children as “builders of their intellectual structures”. Another soviet psychologist Le Semanovitch Vygotsky (18961934) studied how children learn through communication with others (such as parents and peers). He posits that learning takes place by learners completing tasks for which support (scaffolding) is initially required. This support may include a tutor, peer or a technology such as the applications of computers. This has led to the term computer supported learning. Computer supported learning environments are those in which computers are used to either maintain a learning environment or used to support the student learner in this Vygotskian sense. These educational theories have further been developed by a number of constractivists (Wilson, 1996, Duffy and Jonassen, 1993 Papert, 1980) in the recent years.

According to (Lou, 2005),the rapid development of ICTs, especially computer-supported teaching and learning, several teaching models based on the constructivist theory such as Problem Based Learning (PBL) and Case Based Learning (CBL) have widely been adopted. The aim is to create learning environments centered on students as learners and a believe that they learn more from what they do and think about rather than from what they are told.

In comparison with other teaching methodologies, approaches based on constructivist have certain characteristics. These include:

* 1. Student centered learning: Students have more control on their study.
	2. Group-work: Students are divided into groups when they are learning which in turn can help them improve their communication skills.
	3. During the process of learning, knowledge, the ability to learn is developed; with tables such as; seeking meaning, forming opinions, evaluating information and thinking critically, (Lou, 2005).

 In a constructivist learning environment, the role of the teacher shifts from being the source of knowledge to facilitating learning. (Khine, 2003) argued that students should not be left to explore alone but teachers should provide support, coaching and modeling the students to make certain learning takes place. Unlike the teacher-centred model in which teachers impart knowledge to students, “knowledge for constructivism cannot be imposed or transferred intact from one knower to the mind of others, (Kargiorgi and Symeou, 2005). Against this theoretical background, it is important to investigate the various applications of ICTs in enhancing teaching and learning in secondary schools.

**CHAPTER THREE**

**RESEARCH METHODOLOGY**

**3.1 Research design**

The research design adopted in this study was quasi experimental with interest in pretest - posttest.

**3.2 Population of the study**

The sample population was divided in to two equivalent groups, designated as ‘Experimental Group’ (EG) and ‘Control Group’ (CG). With regards to this study the target population consisted of 1000 SS2 Biology students in Mushin Local Government Area of Lagos State. The subjects predominantly come from farming, trading and civil service families.

**3.3 Sampling of the study**

The sample of this study consisted of 50 SS2 Biology students drawn from two secondary schools in Mushin area of Lagos State. The sample comprises of both male and female, Christians and Muslims and with the average of 17 years.

**3.4 Sources of Data**

The data for this study were generated from two main sources; Primary sources and secondary sources. The primary sources include questionnaire, interviews and observation. The secondary sources include journals, bulletins, textbooks and the internet.

**3.5 Instrumentation**

This is a tool or method used in getting data from respondents. In this study, questionnaires and interview are research instruments used. Questionnaire is the main research instrument used for the study to gather necessary data from the sample respondents. The questionnaire is structured type and provides answers to the research questions and hypotheses therein.

This instrument is divided and limited into two sections; Section A and B. Section A deals with the personal data of the respondents while Section B contains research statement postulated in line with the research question and hypothesis in chapter one. Options or alternatives are provided for each respondent to pick or tick one of the options.

**3.6 Reliability**

The researcher initially used peers to check for consistence of results. The researcher also approached senior researchers in the field. The research supervisor played a pivotal role in ensuring that consistency of the results was enhanced. The instrument was also pilot tested.

**3.7 Validity**

Validity here refers to the degree of measurement to which an adopted research instrument or method represents in a reasonable and logical manner the reality of the study (Prince Udoyen: 2019). Questionnaire items were developed from the reviewed literature. The researcher designed a questionnaire with items that were clear and used the language that was understood by all the participants. The questionnaires were given to the supervisor to check for errors and vagueness.

**3.8 Method of Data Collection**

The data for this study was obtained through the use of questionnaires administered to the study participants. Observation was another method through which data was also collected as well as interview. Oral questioning and clarification was made.

**3.9 Method of data analysis**

The data collected obtained were analyzed using mean, standard deviation and t-test for the research questions and hypotheses on a Statistical Packages of Social Sciences (SPSS).

The mean and t-test were used to answer the three research hypotheses. The null hypotheses were tested at 0.05 level of significance, which formed the basis for the hypotheses to be either accepted or rejected.

**CHAPTER FOUR**

**RESULSTS AND DISCUSSION**

**4.1 Results**

**Research Question One**

What is the performance mean score of SS2 Biology Students in the experimental and control groups before and after been taught using Information and Communication Technology (ICT)?

**Table 1: Comparison of pretest and posttest mean scores of experimental and control groups**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Group Type of Test  SD**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Experimental Pretest 13.20 3.11

 Posttest 22.32 4.28

Control Pretest 15.28 4.94

 Posttest 16.28 4.75

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The table above shows descriptive statistics of the performance of SS2 Biology students in the pretest and posttest. The mean scores of the experimental group indicate that there was improvement in the result of the post-test in comparism to the pretest. The mean increased from 13.20 to 22.32 showing achievement gain of 9.12 and the standard deviation increase from 3.11 to 4. 28. While the mean scores of the control group also increased from 15.28 to 16.28 giving an achievement gain of 1.00 and standard deviation decreased from 4.94 to 4.75

**Research Question Two**

What is the performance mean score of SS2 Biology Students exposed to ICT based on gender?

**Table 2: Comparison of experimental group before and after treatment based on gender**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Gender Type of Test  SD**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Male Pretest 12.67 4.24

 Posttest 23.87 5.36

Female Pretest 14.00 4.52

 Posttest 22.06 6.10

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The result of the analysis in table two shows that the mean of male students in pretest improved from 12.67 to 23.87 with standard deviation increasing from 4.24 to 5.36 while the mean scores of females improved from 14.00 to 22.06 with a standard deviation of 4.52 to 6.10 the result shows that the achievement gain between male and female in the posttest was negligible, hence the achievement is the same.

**Research Question Three**

To what extent do teachers use ICT in teaching SS2 Biology students in Mushin Area?

**Table 3: Comparison of extent of use of ICT among teachers in teaching Biology**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Level N Percent (%)**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

High 10 20

Moderate 15 30

Low 25 50

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The result above shows that 10 respondents representing 20% are of the opinion that the use of ICT in teaching Biology in the study area is high while 15 respondents making 30% are of the view that the rate of use of ICT in teaching Biology is moderate and 25 respondents constituting 50% felt that the use of ICT in teaching Biology in the study area is low. From the foregoing, the researcher deduced that the use of ICT in teaching SS2 Biology Students in Mushin area of Lagos state is low

**Hypothesis Testing**

1. There is no significant difference in the achievement mean scores between the experimental and control groups after been exposed to ICT driven instruction in teaching Biology.

**Table 4: Comparison of the experimental and control group**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Group N  SD DF t-cal t-critical**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Experimental 25 24.72 4.75

 24 3.8 0.01

Control 25 20.04 3.40

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The result of the t-test analysis as shown in table four above reveals the null hypothesis is rejected since the calculated t-test analysis of 3.8 is greater than the table t-test also known as t-critical of 0.01. It means that there is a significant difference between the experimental and control groups when the experimental group was exposed to ICT in teaching and learning of Biology.

1. There is no significant difference in the achievement mean score between male and female SS2 Biology students in the experimental group when they were exposed to treatment.

**Table 5: Comparison of students’ performance taught using ICT based on gender**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Gender N  SD DF t-cal t-critical**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Male 15 22.4 3.5

 14 0.111 0.914

Female 10 22.6 4.5

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

The result of the analysis in the table above reveals that the null hypothesis was retained meaning there is no significant difference in the achievement mean scores between male and female students who were taught Biology using ICT. This is shown in the table where the t-test calculated is 0.111 less than the t-test critical of 0.914; based on the foregoing, the null hypothesis is retained.

1. There is no significant difference in the performance mean scores in the experimental and control groups based on the use of ICT in the study area

**Table 6: Comparison of the two groups on the use of ICT in the study area**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Group N  SD DF t-cal t-critical**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Experimental 25 24.72 4.75

24 3.8 0.001

Control 25 20.04 3.40

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The result of the analysis in table six is evident that the researcher rejected the null hypothesis and accepted the alternative hypothesis, meaning there is a significant difference on students’ responses on the use of ICT for teaching and learning in the study area. This was achieved from the computation where the t-test calculation of 3.8 is greater than the t-test critical at 0.001 hence the researcher accepted the alternative hypothesis that there is significant difference in the performance mean scores in the experimental and control groups based on the use of ICT in teaching of Biology in the study area.

**4.2 Discussion**

The main purpose of this study was to determine the effect of Information and Communication Technology (ICT) in teaching of Biology and SS2 students’ academic performance in Mushin area of Lagos State.

It is evident from the findings that students taught using ICT perform significantly better than those taught without ICT. This therefore confirmed the view of the following literature Harrison (2002), IIomaki and Rantanen (2007) who were of the opinion that ICT has the potential of improving student academic performance. The researchers therefore are of the opinion that ICT is to be used as a method of instruction in the teaching and learning of Biology in the study area.

Furthermore, findings from the study reveal that students’ gender has no significant effect on students’ performance. This also confirmed the findings of the following literature; Nwoke and Uzoma (2011), Nwike and Chukwudum (2011) who find that students gender has no significant effect on students’ academic performance. The researchers are of the opinion that students regardless of gender should be given equal opportunity in teaching and learning of all subjects. Again finding from this study reveal that the extents of the utilization of ICT in the teaching and learning of Biology is low, this also agrees with the work of Yusuf, Kajuru and Musa (2013) who reported that only few schools used computer in the teaching and learning of science subjects. The researchers therefore are of the opinion that teachers should employ the use of ICT in the teaching and learning of Biology and other science and technology related courses for the benefits of the teaching profession.

This study was conducted on the Effect of Information and Communication Technology (ICT) on students’ academic performance. The study aim at examine how the use of ICT in teaching could impact on the academic performance of SS2 Biology students in Mushin Area of Lagos State. The study adopted quasi-experimental design, specifically, the experimental and control groups (pretest and posttest). The sample population which was purposively drawn for the study consisted of 50 SS2 Biology students from two secondary schools within the study area.

Data for the study were collected using principally Biology Achievement Test (BAT) and ICT assessment scale. The researcher developed ICT assessment scale while Biology Achievement Test (BAT) was randomly drawn from several past WAEC Biology question papers. The instrument was validated by experts and had a reliability index of 0.85.

One of the groups involved in the collection of the data for this work called control group was taught Biology using the traditional (conventional) method of teaching popularly known as talk and chalk, while the other group which was the experimental group was taught with ICT facilities. The study generated three research questions and three hypotheses. The mean, standard deviation and t-test were used for data analysis. Result revealed the following:

1. The mean scores of the experimental group indicate that there was improvement in the result of the posttest in comparison to the pretest
2. There was no significant difference based on gender in the students’ academic performance
3. There was low usage of ICT for teaching of Biology to SS2 students of Mushin area

It is therefore safe to conclude that though the use of ICT in the study area was reported to be low, it has positive impact on the academic performance of students.

**CHAPTER FIVE**

**CONCLUSION AND RECOMMENDATION**

**5.1 Conclusion**

Poor students’ academic performance in science related courses in the Mushin area of Lagos State motivated the researchers to embark on this research work titled “The Effect of Information and Communication Technology (ICT) in Teaching of Biology on Students’ Performance in SS2 in Mushin LGA- Lagos State”. From the results and findings of the study it was safe to conclude that though the use of ICT in the study area is low, it has positive and significant impact on the academic performance of students and there was no significant difference in the performance of male and female students of the study area. In the circumstance, the researchers are of the opinion that students regardless of gender should be given equal opportunity in science and technology without fear or favour.

**5.2 Recommendations**

1. Government should ensure that ICT policy statements in education are translated into reality. An ICT policy implementation commission should be created. This commission should be funded and given the power to provide ICT facilities in Nigerian Secondary schools and also empowered to monitor their usage.
2. The ability to acquire the ICT devices and appendages rest squarely on what is available to the school management as fund. The Federal, State, Local, Non-Governmental Organizations as well as Philanthropists are encouraged to support secondary schools by providing ICT facilities as there is inadequate funding of the secondary schools in Nigeria.
3. Teachers should ensure that both male and female students are equally encouraged in science and technology and there should not be any form of discrimination especially against the female students.
4. ICT in Education should be a core course for teachers’ training programme to adequately prepare teachers on how they can effectively domesticate ICT in their respective discipline while in the classroom.
5. Teachers already in the field should be given time frame within which they should be ICT compliant. Better still, ministry of education or the authorities concern should organize workshop, orientation, seminar and conferences on ICT in education for teachers.
6. The Federal Ministry of Works, Housing and Power should work towards stabilizing electricity supply in Nigeria and to also ensure all secondary schools are electrified and connected to the national grip.
7. Computer studies being offered as a course today in secondary schools should be more of practical (hands-on-computer) than theory as observed in the course of this work, as practical computer skills will reduce if not eliminate computer phobia among the students.

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**QUESTIONNAIRE**

**PLEASE TICK [√] YOUR MOST PREFERRED CHOICE AND AVOID TICKING TWICE ON A QUESTION**

**SECTION A**

**PERSONAL INFORMATION**

**Gender**

Male [ ] Female [ ]

**Age**

13-15 [ ]

15-17 [ ]

17 and above [ ]

**Study Group**

A [ ]

B [ ]

**SECTION B**

1. Does your school have a computer Laboratory?
2. Yes [ ]
3. No [ ]
4. Not sure [ ]
5. Does your school have a Biology Laboratory?
6. Yes [ ]
7. No [ ]
8. Not sure [ ]
9. Do you often make use of the Biology Lab?
10. Yes [ ]
11. No [ ]
12. Not sure [ ]
13. How often do you make use of the computer Lab?
14. Very Often [ ]
15. Less Often [ ]
16. Never [ ]
17. Do you think teaching Biology is better with computers?
18. Yes [ ]
19. No [ ]
20. Not sure [ ]
21. Do you think your understanding of Biology is better with computers aid?
22. Yes [ ]
23. No [ ]
24. Not sure [ ]
25. Would you like to be taught biology using computer assisted tools.
26. Yes [ ]
27. No [ ]
28. Not sure [ ]
29. How often do your biology teacher teach biology with computer assisted aids.
30. Yes [ ]
31. No [ ]
32. Not sure [ ]
33. Do you think about boys learn biology better than girls when taught biology using computer?
34. Yes [ ]
35. No [ ]
36. Not sure [ ]
37. Do you agree that girls understand biology better than boys when they are taught with biology?
38. Yes [ ]
39. No [ ]
40. Not sure [ ]

**TEST FOR THE STUDENTS IN GROUP A** (Using computer)

1. Search for the human heart and identify its various parts.
2. Browse for the chemical elements and write down 20 of them.
3. Browse the human eye and identify its various parts.
4. Browse and identify the causes of respiratory problem in humans.

**TEST FOR THE STUDENTS IN GROUP B** (Without Computer)

1. What is the human heart? Write the various parts.
2. What are chemical elements? Write down 20 of them.
3. What is the human eye? Write down its various parts.
4. What are the causes of respiratory problems in humans?