EFFECT OF INTERNET-BASED TOOLS ON PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN BIOLOGY IN KADUNA STATE, NIGERIA

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DECLARATION

I hereby declare that this thesis entitled "Effect of Internet – Based Tools on Performance of Senior Secondary Schools Students in Biology in Kaduna State, Nigeria, has been written by me (Zainab Zubairu) in the Department of Educational Foundations and Curriculum under the supervision of Dr. RB..Bako, Dr. S.U EL –Yakub and Dr G. Sa'ad. The work has not been presented in any previous application for a higher degree. All sources of publication and information are specifically acknowledged by means of references.

_____	_____	_____
Zainab ZUBAIRU	Signature	Date

CERTIFICATION

This dissertation entitled "**Effect of Internet – Based Learning Tools on Performance of Senior Secondary School Students in Biology in Kaduna State, Nigeria."** Meets the regulation governing the award of degree of Ph.D (Curriculum and Instruction) of Ahmadu Bello University and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research is dedicated to my Daughters K hadija, Aisha (Amira) and Ruqqayat and my sons Khalifa, and Ibrahim you are always in my heart.. May Allah continue to bless them, protect them and continue to give them wisdom, and direction towards the right path.

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ABSTRACT

The study is designed to find out the effect of internet – base tools on performance of senior secondary school students in biology in Kaduna state. The study try to establish the computer skills of students to determine if there is any significant difference in the performance of learners when exposed to the traditional approach and those exposed to learning Biology with the Internet – Based Learning Tools. The research design is experimental study. Four schools were randomly selected, two schools were urban while the other two were rural schools, and two also out of the selected schools were private schools while the two were public schools in order to determine school type and location. One of the schools was boys only while the other school was girls only to determine gender, 100 students were used for the experimental study, twenty five students each in a class. The pre-test post-test control group design was carried out. The experimental group was exposed to a blend of three approaches which includes direct teaching with the internet tool integration, while control group had the traditional method. The t -test analysis of the post test revealed that there is a significant difference in the performance of learners taught using the Internet – based learning tool. The use of the Internet – Based Learning Tools can make a significant difference in the performance of learners in Biology as compared to the traditional chalk and talk approach. Those in urban areas have more advantages than those in rural areas in terms of availability and easy access to the internet facilities which enhances their performance. Both there is no differences in the performance of both Male and Female Biology Students with the integration of Internet –based learning tools. Subject combination has great influence on the performance of the students with the integration of the internet – based learning tools. The Internet – Based Learning Tools has significant effect on the students performance in Biology teaching, the education stake holders in Kaduna state are to ensure that learning becomes fully blended with the Internet – Based Learning Tools.

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Operational Definition of Terms

Internet – Based: Is an arrangement of connected computers which lets the computer users all over the globe exchange data. The internet is an extraordinary entertainment and learning tool that may be utilized in a number of modes to increase the ability of a user to collect information..

Internet Learning Tools: Are those learning platforms on the Internet that provides teaching and learning materials and other academic information, the internet also served as a medium for collaborative interaction and learning with others across the globe. The learning platforms are the learning tools.

ABBREVIATIONS

AIS	-	African Information Society
CD – ROM	-	Compact Disc Read – Only Memory
CRCD	-	Collect, Relate, Create, Donate.
DSS	-	Digital Satellite System
ETF	-	Education Trust Fund
FME	-	Federal Ministry Education
FRN	-	Federal Radio of Nigeria
ICT	-	Information and Communication Technology
MIU	-	Mobile Internet Unit
NEPAD	-	New Partnership for African Development
NITDA Agency	-	Nigerian National Information Technology Development
RPGs	-	Role Playing Games
UBE	-	Universal Basic Education
UNESCO	-	United Nations Educational Scientific – Cultural Organization
WAN	-	Wide Area Network
WBLE	-	Web Base Learning Environment

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The introduction of western education in Nigeria in the early 19th century has brought with it variety of teaching methods and instructional materials. Instructional materials were meant to assist the teacher in presenting the lesson in a manner that will be well understood by students. Indeed part of a teacher's professional responsibility is to prepare his lesson properly, and major component of writing the lesson is the selection of appropriate instructional materials to ensure effective lesson delivery. Some of the initial teaching aids used by the teachers included maps, charts, flip charts and physical objects. In the corvette of time and with the development in technology, there was the introduction of slides, transparencies, audio materials and videos. Mhlolo (2007), says, this enhanced the ability of teachers to teach more effectively and for the students to learn in more concrete ways.

The importance of curriculum materials in teaching and learning Biology in secondary schools cannot be over emphasized, some of the importance includes; stimulation of the learners interest, making teaching and learning more productive, making teaching become more concrete, real and immediate, contributing to performance analysis, stimulation of problem solving in students and helping to clarify complex events and situation among others.

According to National Policy on Education (2009), one of the aims and objectives of teaching Biology in secondary schools is the ability to communicate the skills of Biology to ensure that

Biology students acquire the process and skills of Biology as a science subject. This cannot be effectively achieved unless students are exposed sufficiently to practical work and laboratory experiments. The creative use of curriculum materials by teachers has increased the probability that the students will learn more, retain better what they learn and improve the performance of the skills that they develop. The aims of secondary Education according to the NPE are to equip the students to live effectively in the modern age of science and technology. The Biology Curriculum recognizes the utilization of discovery approach in the teaching and learning of Biology. This involves demonstration, individual practical work, group discussions, field work, project work and building models.

Nwagwu (2006), says, over the years, West/North Television (WNTV) was established in order to reduce teaching deficiencies in subject such as sciences, provide examples of good teachings, helped to upgrade the general quality of classroom instructional activities and enrich contents. Biology theorist and practitioners have always made concerted efforts to facilitate students learning through each phase of learning Biology by enhancing the quality of learning experiences through the use and proper application of instructional materials to each of the Biology phases of learning.

Aladejana (2008), says, Nigeria witness a gradual improvement on the quality of teaching with the introduction of computers, later the internet based learning tools were introduced into the Educational system especially in the field of science which has changed the way teaching and learning takes place in our secondary schools today. The invention of the telegraph, telephone, radio, and computer set the stage for unprecedented Integration of capabilities. The Internet based learning tool is the wholesome integration of modern telecommunications equipment and ICT resources into the educational system. Internet based learning tools as aspect of ICT is relatively new in Nigeria's educational system. It is a departure from the use of conventional tools for curriculum implementation.

The introduction of the computer opened another opportunity for the Biology Education sector; most secondary schools in Nigeria today are using the computers as learning tool, the World Wide Web created a wider platform for the teaching and learning of Biology in secondary schools. Today there are several instructional materials and learning tools that have made the Classroom to become boarder less. Yusuf (2005), says, the primary purposes of curriculum implementation are to achieve the objectives of instruction and achieve retention and transfer of knowledge. Evoh (2007), says, Internet based tools are used as instructional medium that permits alternative approaches to curriculum implementation. With the internet based learning teachers no longer need to be worried about whether an instructional material is appropriate for the lesson to be taught, its relevance, simplicity simplification of concepts and the accuracy of the teaching aids, because the materials are seen as in real life, real situation and the information is quiet accurate.

Portrayal (2010), says, the professional teachers development opportunities are easily provided where the pedagogy of learning and teaching of both the relevant Biology topics and its digital representations are available with the Internet – Based Learning Tools, then teachers see the immediate pedagogic benefit to students learning even with the weakest link of the class. . On the other hand interactive technology encourages active learning; hence teaching should no longer center around transfer of content from teacher to student. With the advent of Internet based learning, the features, functions, physiology of different organs, life styles of different animals, ecology etc could be seen life and in action, while some are viewed as Animation, simulations etc as seen in real life, answers that students' assume is impossible to be answered are answered. The internet based learning tools arouse learning, stimulate interest, motivate and promote the spirit of research among learners. The internet based learning tools can provide the students with examples of real life situations with specific knowledge required in addition to sound, color, and movements and stimulate the student's sensorial apparatus and bring a sense of enjoyment to the learning process. The development and expansion of the modern technology which involves the

use of the internet –Based Learning Tools has now become part of the teaching and learning in Nigerian Secondary Schools, Colleges of Education, Polytechnics and Universities. However in spite of these expansions is not every school that uses these tools in their teaching. In order to use the recent technology in Kaduna State in recognition of its importance and as one of the measures to reduce the high rate of failures in biology subject in the West African Examination Council (WAEC), National Examination Council (NECO), the Government of Kaduna State have made several efforts to ensure that all its secondary schools are ICT compliant by providing computers and installation of Internet facilities in all its Secondary Schools across the state. The Internet – Based Learning Tools are those Educational platforms that provide academic information via the wide web world, offering free lessons, and information's, teaching and learning strategies, promoting research activities, academic presentations for both the teachers and students. Some of these Internet – Based Learning Tools include, Dassault, Centegage, Khan Academy, Encarta Micro Soft, Wikipedia, ERASYAPP, Slide rule, Google scholar etc .

In addition to the State efforts, the Federal Government of Nigeria, Education Trust Funds (ETF), International organizations, philanthropists in support of education in Nigeria also donated computers to all the secondary schools in country. Computer literacy programs and seminars were organized for Secondary School teachers to compliment the efforts made by the above mentioned bodies to ensure full compliant. However despite the opportunity provided the effectiveness of the internet based learning tools has not yet been established and documented especially in Biology teaching in Kaduna State. Despite the expansion and efforts made by the Kaduna State Government and the Federal Government is not every teacher and every school that has adopted the use of the Internet –Based Learning Tools in their teaching and learning of Biology.

This attracts the researcher to take on this study to find out the effectiveness of the Internet Based Learning Tools in the improvement of teaching of Biology in Kaduna State and as well the factors that may hinder its effectiveness, now that all attentions of Education stakeholders, the societies,

parents and even the Students of Kaduna State is geared and focus towards ways and measures to be taken to improve the standard of Education in State and the country at large.

1.2 Statement of the Problems

Biology has been taught at schools for years, the teachers have been facing a problem on how to get students to fully understand Biology. Many students perceived Biology as too wide and too difficult to comprehend, while the Biology textbooks are too difficult to read and understand which has contributed to the fluctuating results of Biology in NECO and WEAC. The call for application of internet- based learning tools in Biology teaching in Kaduna State Senior Secondary Schools is to infuse and inject efficiency and effectiveness in Biology curriculum implementation. The effective integration of internet- based learning tools in the implementation of Biology Curriculum and its pedagogy require the schools readiness, and the proficiencies of its teachers. However even the developing countries like Nigeria; internet -based learning is challenged with problems of inadequate and functional computers, absence of the internet itself can be as a result of it high cost of installation and maintenance, problem of power supply has consistently been poor in Nigeria. Lack of trained Biology Teachers on ICT to effectively utilize the Biology soft ware's for effective teaching of Biology. Inadequate infrastructures and poor environment for internet based learning to take place effectively among others. The current method of teaching Biology in our secondary schools may be too static and boring due to lack of adequate teaching aids, the internet has made provision of different categories of the teaching aids required for every topic in Biology, the question is how effective are those Internet – Based Learning Tools in assisting the performance of the student's in Biology? Despite the above mentioned problems secondary schools in Kaduna State employ some of the internet based learning tools for teaching of Biology. The study therefore intends to find out the effectiveness of the Internet – Based Learning Tools employed by the Kaduna State Senior Secondary Schools in the teaching of Biology.

1.3 Objectives of the Study.

To guide this study, the following objectives are formulated:

1. determine the effect of Internet-Based Learning Tools on the Performance of Senior Secondary School Students in Biology in Kaduna State, Nigeria.
2. find out the impact of Internet – Based Tools on Performance of Senior Secondary School Students taught Biology Internet-Based Learning Tools with respect to gender difference in Kaduna State, Nigeria
3. examine the extent to which Internet-Based Learning Tools affect Senior Secondary School Students' Performance in Biology as a result of school location difference in Kaduna State, Nigeria
4. verify the effect of Internet-Based Learning Tools on the Performance of Senior Secondary School Students in Biology with regard to school type in Kaduna State, Nigeria
5. determine the extent to which Internet-Based Learning Tools affect Senior Secondary School Students' Performance in Biology as a result subject combinations difference in Kaduna State, Nigeria

1.4 Research Questions

In order to provide the research with sense of direction or focus, the following research questions are put forward:

1. What is the effect of the use of internet – based learning tools on the performance of senior secondary school students in Biology in Kaduna State?
2. Are there any gender differences in the performance of students taught Biology using Internet – Based Learning Tools ?

3. Are there any differences in the performance of students from rural and urban centers taught Biology using Internet – Based Learning Tools in Kaduna state?
4. Are there differences in the performance from private and public schools taught Biology using the Internet – Based Learning Tools in Kaduna State?
5. Does the use Internet – Based Learning Tools affect the performance Students of Arts or science subject in Biology in Kaduna state?

1.5 Hypotheses

The following Hypotheses are postulated and will be tested in the course of study:

Ho_1: there is no significant difference between performances of students taught Biology with traditional method, and those taught with Internet – Based Learning Tools.

Ho_2: there is no significant difference between performances of boys and girls taught Biology with the Internet – Based Learning Tools.

Ho_3: there is no significant difference between performance of students from rural location and those from urban location taught Biology with Internet – Based Learning Tools.

Ho_4: there is no significant difference between performances of students in private school and public school taught Biology using Internet – Based Learning Tools.

Ho_5: the use of Internet – Based Learning Tools has no significant effect on the performance of Senior Secondary Schools Students of different Subject combination.

1.6 Basic Assumptions

1. Internet – based Learning tools are available and utilized in some senior secondary schools in Kaduna state.

2. The performance of both boys and girls taught Biology with the use of the Internet – Based Learning tools is the same with no indication of Gender difference.
3. Students' from the Urban area taught Biology using the Internet – Based learning Tools is commensurate to the performance of the students from the rural area.
4. Both Private and Public Secondary School Students perform the same after being taught Biology with the Internet – Based Learning Tools.
5. Arts, commerce and science Students perform the same and well with the integration of Internet – Based learning Tools in the teaching and learning of Biology

1.7 Significance of the Study

The need to promote stimulates, encourage, motive and foster effective teaching of Biology in Senior Secondary Schools in Kaduna State. Over the years, stakeholders of Education in Kaduna State like the State education board, NGO's on educational development, Education Trust Fund, Parents Teachers Association, philanthropist, Teachers Associations, Ministry of Education and other governmental and non- governmental associations too numerous to mention are worried over the poor academic performance of students in science subjects. The inculcation of Internet Based Technology Tools into the teaching of Biology will be of great importance. Teachers are the implementers of the curriculum in the classroom and it's expected that their sound knowledge of the use of Internet and how to use the Internet tools in teaching and learning of Biology would not only go a long way in achieving this goal, but also improve the standards of Biology education towards achieving excellence.

This study is therefore significant to the major beneficiaries who are the students by improving their understanding of the Biology as a subject, because they see things as in real life. It will as well increase their motivation and inculcate in them the spirit of research and give them the freedom to expose their inner talent which will also be beneficial to the country's development, the use of the internet – based learning tools will give the students the opportunity to communicate and interact

with other students or teachers across the globe and compete with them effectively. It will as well give the students some sense of responsibility to be able to take of their learning and reduces too much dependent on teachers for answers to their questions. The use of the internet – based learning tools will enhance their performance leading to a better result in their both their internal and external assessment. Teachers are also beneficiaries, because when students understanding and performance is enhanced, it promotes the teachers spirit and motivate the teacher. The teachers work is also made easy because the students are taking the responsibility of some aspect of their learning. It assist the teacher by providing understanding of the lesson in addition to different approaches and other teaching and learning techniques employed by the teachers. The study will serve as another reference material for effecting reforms in the Value and effectiveness of integrating Internet Based Tools in teaching and learning of Biology in secondary schools in Kaduna State. Among other things the study will be significant in the following ways:

- create more awareness of the opportunities offered by the use of Internet- Based Tools as an important educational tool in effective teaching and learning of Biology in Senior Secondary Schools in Kaduna State especially to schools that are yet to recognize and understand the importance of the internet – based learning tools for fast delivery of instruction and quick understanding response by the students..
- promote the harmonization of Biology teaching and learning activities approach to be same with other senior secondary schools across the globe through collaborative learning by sharing different information as well as improving the spirit of research in biology. Through individual researcher work or cooperative research work ideas can be shared and the utilization of the idea can be uniform, others are as well given the opportunity to improve on it. Biology is a subject that is full of discovery and has given so many opportunities for research work.

- enhance or promote collaborative, group studies, and interactive learning among Biology students' from different part of the country. This will enhance their further understanding and retention of biology content, leading to the development of new ideas and understanding. With collaborative learning, students exchange ideas, share experiences and develop new concepts suitable for their studies. With collaborative learning students can exchange ideas and information's without travelling wide through the internet.

- facilitate the development and use of Internet Based Tools as a pedagogical tool for teaching and learning of Biology and for the professional development of Biology teachers in Senior Secondary School in Kaduna State. The internet – based platforms provide teachers with the opportunities to develop themselves as well as the students, private classrooms are provided.

- enhance or promote of an integrated e – learning to support the presences of Internet Based Tools in Biology laboratories for the teaching of Biology in Senior Secondary Schools in Kaduna State.

- serve as a motivator to the students by channeling them towards the proper direction to perceive the integration of Internet- Based tools into teaching and learning Biology in the proper perspective and study it with appreciation and recognition of its importance to the society.

- provide state governments with comparison on the effect of use of internet – based learning tools on the performance of senior secondary school students in Biology with other schools within same zone, which could facilitate effective and urgent action towards providing and making their schools ICT compliant.

- attainment of the goals and objectives of the National Policy on education of (2004), and the successful implementation of the educational road map for the education sector (2009), as well as well as the ideal for universal basic education program (2004) and the Millennium Development Goals on education, declaration 2 and 3 in Nigeria, and UN ECOSOC Ministerial declaration (2000) which provided special attention to the application of ICT and urgent and concerted actions from all regions. The above policies were initiated towards the improvement of education; the effect of use of internet – based learning tools on the performance of the senior secondary school students is another step towards the attainment of the goals of the above policies.

1.8 Scope of the Study

The mission of this study is to find out effectiveness of the Internet – Based Learning Tools on the performance of Senior Secondary School Student's in Biology in Kaduna State. It strive to find out the extent to which the Internet – Based Learning Tools affect the student's performance, whether gender differences has any effect on the student's performance using the Internet – Based Learning Tools in Teaching Biology, others also include school location, school type whether private or public senior secondary schools and subject combination of the student has any effect on the Student's performance using the Internet – Based Learning Tools in Kaduna State. The study would be conducted in Senior Secondary Schools in Kaduna State. The study would be centered on Internet Based Tools and Biology teaching and those factors that contribute to the effective integration of Internet Based Tools and Biology in the Senior Secondary Schools in the State.

The study is limited to the Biology SS11 Biology Students who are the key players in the performance objectives of the study. The study will consider the SS11, who are more familiar with the subject than the SS1. The SS3 are not considered because they will be busy with both Qualifying examinations and external examinations. The study will also make use of the downloaded

programs from the Internet – Based Learning Tools using the CD – ROM and projectors in most cases, this is due to differences in time when the internet platforms are transmitting, electrical problems is also a hindrance factor, lack of internet services at the time the lesson is expected to take place. The selection for the sampled students used (25 students each) was a result of the limited number of efficient, adeuquate number of computers to effectively use for the experiment, and also the number of computers with internet connections.

CHAPTER TWO

REVIEW OF RELATED LITRATURE

2.1 Introduction

This chapter is about the review of the literature in relation to this research. The chapter reviewed the work of other people who has also written in direct relation to the topic or indirectly. The Chapter is to discuss theoretical Frame Work, the Nigerian Information Communication (ICT) Policies, Biology Education Curriculum, teaching Methods used Biology teaching. Others include: Early use of ICT in Teaching, Internet, Internet – Based Learning Tools, Internet – Based Learning Tools use in Senior Secondary Schools in Kaduna and Empirical studies

2.2 Theoretical Framework

The study is hinging on constructivism learning theory founded by Jean Piaget in 1967as cited by Vygotsky (2011), in his article titled Philosophy of constructivism as its frame work. It was founded on the premise that reflecting on what we see and touch gives us the experience and knowledge of the unknown, which assist us to create, construct, modify, giving us a better understanding of how and what we want to be in life. The frame work is linked to the present study because the blending of internet based learning tools to the teaching of Biology is associated with the constructivist idea; the internet is a cognitive stimulant, while the constructivist believe that meaningful learning is a cognitive process which has to do with brain stimulation. The cognitive process include memorization understanding, remembering, analyzing what is learned and drawn, a conclusion to give the individual the sense of living in relation to what was learned. Internet based learning tools enhances such cognitive learning, and achievement of mastery goals and also improving the level of competence.

Early educational philosophies did not place much value on what would become constructivist ideas; children's play and exploration was seen as aimless and of little importance. Jean Piaget did not agree with these traditional views, however. He saw play as an important and necessary part of the student's cognitive development and provided scientific evidences and his views. Formalization of the theory of constructivism is generally attributed to Jean Piaget who articulated mechanisms by which knowledge is internalized by learners. He suggested that through processes of accommodation and assimilation, individuals construct new knowledge from their experiences.

When individuals *assimilate*, they incorporate the new experience into an already existing framework without changing that framework. This may occur when individuals' experiences are aligned with their internal representations of the world, but may also occur as a failure to change a faulty understanding; for example, they may not notice events, may misunderstand input from others, or may decide that an event is a fluke and is therefore unimportant as information about the world. In contrast, when individuals' experiences contradict their internal representations, they may change their perceptions of the experiences to fit their internal representations. According to the theory, *accommodation* is the process of reframing one's mental representation of the external world to fit new experiences. Accommodation can be understood as the mechanism by which failure leads to learning: when we act on the expectation that the world operates in one way and it violates our expectations, we often fail, but by accommodating this new experience and reframing our model of the way the world works, we learn from the experience of failure, or others' failure. Without the social interaction with other more knowledgeable people, it is impossible to acquire social meaning of important symbol systems and learn how to utilize them. Young children develop their thinking abilities by interacting with other children, adults and the physical world. From the social constructivist viewpoint, it is thus important

to take into account the background and culture of the learner throughout the learning process, as this background also helps to shape the knowledge and truth that the learner creates, discovers and attains in the learning process (Wertsch 1997).

It is important to note that constructivism is not a particular pedagogy. In fact, constructivism is a theory describing how learning happens, regardless of whether learners are using their experiences to understand a lecture or following the instructions for building a model airplane. In both cases, the theory of constructivism suggests that learners construct knowledge out of their experiences. However, constructivism is often associated with pedagogic approaches that promote active learning, or learning by doing. There are many critics of "learning by doing" (a.k.a. "discovery learning") as an instructional strategy. Several cognitive psychologists and educators have questioned the central claims of constructivism. It is argued that constructivist theories are misleading or contradict known findings. Matthew, (1993) attempts to sketch the influence of constructivism in current mathematics and science education, aiming to indicate how pervasive. It is maintained that if the requirements of the concept to be understood exceeds the available processing efficiency and working memory resources then the concept is by definition not learnable.

This attitude toward learning impedes the learning from understanding essential theoretical concepts or, in other words, reasoning. Therefore, no matter how active a child is during learning, to learn the child must operate in a learning environment that meets the developmental and individual learning constraints that are characteristic for the child's age and this child's possible deviations from her age's norm. If this condition is not met, construction goes astray.

Several educators have also questioned the effectiveness of this approach toward instructional design, especially as it applies to the development of instruction for novices. Mayer, 2004; Kirschner, Sweller, and Clark, 2006) While some constructivists argue that "learning by doing" enhances learning, critics of this instructional strategy argue that little empirical evidence exists to support this statement given novice learners (Mayer, 2004; Kirschner, Sweller, and Clark, 2006). Sweller and his colleagues argue that novices do not possess the underlying mental models, or "schemas" necessary for "learning by doing" (Sweller, 1988). Indeed, Mayer (2004) reviewed the literature and found that fifty years of empirical data do not support using the constructivist teaching technique of pure discovery; in those situations requiring discovery, he argues for the use of guided discovery instead.

Mayer (2004) argues that not all teaching techniques based on constructivism are efficient or effective for all learners, suggesting many educators misapply constructivism to use teaching techniques that require learners to be behaviorally active. He describes this inappropriate use of constructivism as the "constructivist teaching fallacy". "I refer to this interpretation as the constructivist teaching fallacy because it equates active learning with active teaching." (Mayer, 2004, p.15). Instead Mayer proposes learners should be "cognitively active" during learning and that instructors use "guided practice."

Almost all those who advocate major reforms of schooling, particularly through the use of computers have the view that learning needs to be more informed by constructivism (e.g Clouse & Nelson 2000), in Siemens (2005), often arguments for school reforms involve constructivist concepts such as the need for students to develop higher order thinking skills and the failure of current schooling methodologies to provide opportunity. In extreme the technologies of the information age are perceived to be an irresistible force in Education within the context of linking the use of computer technologies with reforming schooling.

Constructivism has its roots in the psychology – based traditions going back to Dewey (1966) Bruner (1962; 1996), Piaget (1970) & Vygotsky (1987) in Vygostky (2000). However, more recently this is supported by Biological science based theory in neuroscience. There is often misguided belief among teachers that constructivism means that all learning must be entirely by discovery and that the teacher and curriculum materials have no place. Perkins (1992), describes two constructivist positions on teaching/learning paradigms as Without the Information Given (WIG) constructivism and Beyond the Information Given (BIG) constructivism.

It is an advocate that blends of both approaches are employed. De Corte (1990) in Potrayal (2010), discussed this balance of approaches in the context of using computers in schools

> "A powerful computer learning environment is characterized by a good balance between discovery learning and personal exploration on one hand, and systematic instruction and guidance on the other hand, always taking into account the individual differences in abilities needs and motivation between students" (p.74.).

According to the constructivist view, meaningful learning is a cognitive process in which individuals make sense of the world in relation to the knowledge, which they already have constructed and this sense – making process – involves active negotiation and consensus building. The writers who influenced Constructivism includes: John Dewey, Maria Montessori, Wladyslaw Strzeminski, Jean Piaget, Lev Vygotsky, Heinz Von Foerster, George Kelly Jerome Bruner, Herbert Simon, Paul Watzlawick, Ernst Von Glasersfield, Edgar Morin, Humberto Maturana.

2.3 Nigerian Information and Communication Technology (ICT) Policies

Information and communication Technologies is define as 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, and broadcasting technologies (radio and television) and telephony. Blurton (2000). Helmut (1998) in Aggarwal (2006), states that, of the technological changes that have influenced our lives in recent years information technology (IT) has had the greatest impact. This will continue at least until the end of first half of the century, when other major technological breakthroughs in the area of new materials, biotechnology, or energy, may provide entirely new ways of living.

The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning, and research (Yusuf, 2005). A great deal of research has proven the benefits to the quality of education (Al-Ansari, 2006). ICTs have the potential to accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change (Davis and Tearle, 1999; Lemke and Coughlin, 1998; in by Yusuf, 2005).

Annan (2002) notes that information society is a way for human capacity to be expanded, built up nourished, and liberated by giving people access to tools and technologies, with the education and training to use them effectively. There is a unique opportunity to connect and assist those living in the poorest and most isolated regions of the world. Information of society is a major hurdle that most nations, especially developing countries are encountering.

The information society or information age is a phenomenon that began after 1950 which brings challenges as we seek to integrate and expand. The African information society (AISI) document (2005) argues that Africa should build by the year 2010, information society in which every man, woman, child, village, public and private sector office has secured access

to the use of computers and telecommunications media. The objective is to provide every African with the possibility of using the communication of data processing services available everywhere else, just like any other citizens of the world.

UNDP (2001) asserts that even of sustainable economic growth facilities the creation and diffusion of useful innovations, technology is not only the result of growth but can be used to support growth and development. Mikre (2011), in Tinio (2002), says, ICTs are making dynamic changes in society. They are influencing all aspects of life. The influences are felt more and more at schools. Because ICTs provide both students and teachers with more opportunities in adapting learning and teaching to individual needs, society is forcing schools aptly respond to these technical innovations. Tinio (2002) states the potentials of ICTs in increasing access and improving relevance and quality of education in developing countries.

Tinio further states the potential of ICT as follows:

- 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 business and the poor. One of the greatest hardships endured by the poor and many others, who live in the poorest countries in their sense of isolation, and ICTs can open access to knowledge in ways

  Unimaginable not long age.

Watson's (2001), in Shivinina (2002) says, ICTS have revolutionized the way people work today and are now transforming education systems. As a result if schools train children in yesterdays 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. ICTs are dependable tools in facilitating the attainment of one of the millennium Development Goals

which is achievement of universal primary Education by the year 2015. Kofi Annan the former United Nation Secretary General points out that in order to attain the goal of UPE by the year 2015 we must ensure that information and communication technologies (ICTs) unlock the door to education systems.

This indicates the growing demand and increasingly important place that (ICTs) unlock the door of education system. Since ICTs provide greater opportunity for students and teachers to adjust learning and teaching to individual needs. Society is forcing schools to give appropriate response to these technical innovations. Even though ICTs play significant roles in representing equalization strategy for developing countries, the reality of the digital divide – the gap between those who have access to and control technology and those who do not, make a huge difference in the use of ICTs.

Learning in information age requires a new change role for the classroom teacher especially in Biology. Biology teachers cannot continue using the traditional tools such as chalk, textbooks, alternative to practical and other traditional instructional material. The end of time when the overhead projector with slides was the latest equipment found in schools, ICT integration is the topical requirement of everyday life, its plays an important role in society globalization. (Akpore 2006).

They have to use technologies of the day such as computers, interactive video, CD – ROM, satellite communications and develop new teacher roles. According to Gambari and Chike – Okoli (2007), said that these technologies have become central to contemporary societies, whether one is talking on phone, sending an e- mail, going to the bank, using a library, listening to sports coverage on the radio, watching the news on television, working in an office or in the field, going to the doctor, driving a car or catching a plane, one is using ICTs. The Nigerian Education Sector considering the importance of the ICT in the Global world and in enhancing its education came up with a policy on its application to learning.

Although computer entered into the country's education system in the late 70's and early 80's, no concrete policy was evolved for its entry into the nation's education system until the evolvement of the National Policy on Computer Education in 1988 (Federal Republic of Nigeria, FRN, 1988). The 1988 document contained information on the application of computer at various levels of the country's education, and with issues related to basic objectives, hardware and software requirements. The document also made a statement on teacher training, specifically, for the secondary school level. The implementation of the policy was kick started with a training programme conducted for 197 teachers from across the country. In addition, computer systems were introduced into the federal unity schools and armed forces secondary schools. However, the initial enthusiasm gave way and little was achieved about the set objectives. (Yusuf 2005).

Further impetus for ICT integration in the Nigerian school system came with the 2001 National Policy on Information Technology, tagged "Use IT". It was a major step in the integration of ICT in all facets of the country's life. The document, among others, recommended a start up grant of at least $158m and two percent allocation from the total national budget for articulating the vision of the document. The Nigerian National Policy on IT (FRN, 2001) has within its purview the vision, mission, general objectives and strategies for the implementation of the policy, and sectoral application for all sectors (health, agriculture, tourism and so on.) was also embedded. Ironically, education was subsumed under human resource development. The document, in the areas of education, among others, envisaged the development of IT curricula for all levels of Nigerian education, the facilities, and IT dedicated institutions.

Although the document is a step in the right direction, however, it is inadequate to impact positively on the Nigerian education as the philosophical frame of reference is market driven and its little emphasis on the real integration and infusion of ICTs in the country's education system (Yusuf, 2005a). In addition, the document was silent on the education of the disabled and other disadvantaged. The revised National Policy on Education (FRN, 2004) emphasized the need for ICTs

at all levels of Nigerian education. For instance, the document stated inter alia in Section 11 sub-section 102 (a) that "All states, Teachers Resource Centres, University Institutes of Education, and other professional bodies shall belong to the network of Information and Communication Technology (ICT)" (p. 53). The document noted further in Section 11 sub-section 102 (d) "Government shall provide facilities and necessary infrastructure for the promotion of Information and Communication Technology at all levels of education" (p. 53). Another major aspect of the document that is ICT related is the national virtual library project aimed at the rejuvenation of the Nigerian schools through provision of easy access to current books, journals, and other information resources using digital technology (FRN, 2004). It must be emphasized, however, that little or no efforts have been made to implement the ideas set out in these 2001 and 2004 documents.

Another major policy document on ICTs use in education is the Ministerial Initiative on Education for the Nigerian Education System (Federal Ministry of Education, FME, 2004). The document contains information on the theoretical framework for e-education in Nigeria, analysis of the Nigerian situation, that is, factors inhibiting or promoting the integration of ICTs in education, components of e-education in Nigeria, e-education blue print, elements of the blue print strategies, decade goals (2015), mid-decade goals (2009) and the action plan, among others. The ministerial initiative document though not encompassing enough to address ICTs integration in Nigerian schools, contained policy statements, which could leapfrog the integration of ICT in Nigerian schools. However, the removal of the Minister of Education who initiated the document, probably accounts for non-implementation of the document,

The Federal Ministry of Education has launched an ICT-driven project known as School Net (www.snng.org) (Federal Republic of Nigeria, 2006; Adomi 2005; Okebukola, 2004), which was intended to equip all schools in Nigeria with computers and communications technologies. In June 2003, at the African Summit of the World Economic Forum held in

Durban, South Africa, the New Partnership for African Development (NEPAD) launched the e-Schools Initiative, intended to equip all African high schools with ICT equipment including computers, radio and television sets, phones and fax machines, communication equipment, scanners, digital cameras, and copiers, among other things. It is also meant to connect African students to the Internet. The NEPAD capacity-building initiative will be executed over a ten-year period, with the high school component being completed in the first five years. Three phases were envisaged, with fifteen to twenty countries in each phase. The phases were to be staggered, and an estimated 600,100 schools were expected to benefit. The aim of the initiative is to impart ICT skills to young Africans in primary and secondary schools, and to harness ICT to improve, enrich, and expand education in African countries (Aginam, 2006).

The Nigerian Federal Government has commissioned a mobile Internet unit (MIU) operated by the Nigerian National Information Technology Development Agency (NITDA). The MIU is a locally-made bus that has been converted into a mobile training and cyber centre. Its interior has ten workstations, all networked and connected to the Internet. The MIU is also equipped with printers, photocopiers, and a number of multimedia facilities. Internet is provided via VSAT with a 1.2m dish mounted on the roof of the bus. It is also equipped with a small electric generator to ensure regular power supply. The MIU takes the Internet to places areas and various primary and high schools (Ajayi, 2003). The number of buses is so small, however, that most rural areas and schools have not yet been covered. Although efforts have been made to ensure that ICTs are available and used in Nigerian secondary schools, the level of uptake is still low. It has been observed by Goshit (2006) that most schools, both private and government, do not offer ICT training programs.

NEPAD has scored the level of African continent students' experience with ICTs and their proficiency in using them very low. Fifty-five percent of students within the continent, including Nigeria, Algeria, Burkina Faso, Cameroon, Republic of Congo, Egypt, Gabon, Lesotho, Mali, Mauritius, Mozambique, Rwanda, Senegal, South Africa, and Uganda (who are participating in the first phase of the NEPAD e-Schools initiative), stated they had no experience at all in using computers. Other findings included that the typical African school environment provides neither opportunity nor training in using ICTS, and that 75 percent of responding teachers have no or very limited experience and expertise regarding ICT educational applications.

Okwudishu (2005) in Esherene (2010) discovered that the unavailability of some ICT components in schools hampers teachers' use of ICTs. Lack of adequate search skills and of access points in the schools were reported as factors inhibiting the use of the Internet by secondary school teachers (Kaku, 2005). The absence of ICT equipment in most Nigerian secondary schools leads students to resort to cybercafés for Internet access. Most cybercafé clients in Nigeria are students (Adomi, Okiyi and Ruteyan, 2003) in Adomi (2012).

2.5 Biology Education Curriculum.

Nigeria operates on the existing national Biology curriculum as a national policy for all schools to operate on for uniformity. The External examination bodies in the country use the same curriculum to set up their examination questions. The Nigerian Biology Curriculum and the national policy regarding the study of Biology in the Nigerian secondary schools were also reviewed for the sake of the study as follows;

Aladejana (2008). Says, modern Biology thrives on casual chains that permit the understanding of physiological evolutionary process in terms of physical activities entities such as molecules, cells

and organisms. Spiritual divine forces were accepted as both and necessary until the end of the 18th century.

The objectives of the Biology Curriculum are to prepare pupils to acquire:

- adequate laboratory and field skills in Biology.
- meaningful and relevant knowledge in Biology.
- ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture.
- reasonable and functional scientific attitudes apart from the general objectives, an array of performance objectives are easily measurable. Jenkins (1981), states that curriculum is one of the educational fields that are taken as problematic. What should be planned, taught and learned in schools. For Jenkins, it is a central and centralizing study organized around the choice facing the practitioner.

The Biology curriculum also recommended the use of the guided discovery approach which involves the use of various activities such as demonstration, individual practical, group discussions, field work, project work, and building models. Odunusi (1993), in Adeyeye (2005), said the content of the Biology curriculum consist of thirty major topics focused mainly on seven concepts in Biology, the seven concepts are in Appendix A as prescribed by the Nigerian Biology Curriculum.

2.6. Teaching Methods used in Biology Teaching

In education there are three domains which must be attained if such an education is to claim that it is sufficiently balanced. Three domains are cognitive domain, effective domain and psychomotor domain. These domains can only be achievable through an effective teacher

and effective teaching through the application of appropriate method of teaching as well as adequate teaching materials. For Biology to be effectively understood by students proper teaching methods needs to be applied by teachers, that is why after careful study and observation the NPE pinpointed some teaching methods that capable of transmitting the required information.

Ben (2002), says, after designing a particular curriculum in terms of organization and integrating the learning experiences and content it is important to apply the appropriate method of implementing the curriculum/ Recommendation of a particular method of teaching will enable the evaluator to be aware of the frame reference they could work on. According the NPE (2009) the recommended method of teaching Biology in Secondary Schools is the activity child centered and discovery method of teaching.

2.6.1 Activity/Child Centered

The philosophical basis for this type of teaching method is derived from the work of Jean Jacques Rousseau who declared education as the outcome of personal experience, for learning to occur, one must be personally involved through purposeful activities. The activity/ child centered or experience curriculum design is based on the needs of the learner in which the organization favored learning through activity. This pattern organization provided for individual differences among students taking care of their needs and interest. Adeyeye (2005)

Morrison (2009), says, on child-centered education is occurring as society in general is becoming more interested in the whole child and efforts to address all of children's needs, not just their academic needs. As a result, there is much more concern for encouraging children to be healthy and lead healthy lifestyles. Providing children with medical immunizations and seeing that all children are fully immunized by age two have received a lot of attention, and programs to help

children be free of drugs are common in early childhood and primary programs. Concern for the welfare of children in all areas of their growth and development is evident and attests to the public's growing awareness of their basic rights.

Merrill (2009), says, all great educators have believed in the basic goodness of children; the teacher is to provide the environment for this goodness to manifest itself. A central theme of Luther, Comenius, Pestalozzi, Froebel, Montessori, and Dewey is that we must do our work as educators well, and we must really care about those whom we have been called to serve. This indeed is the essence of child-centered education. All great educators have believed in the basic goodness of children; the teacher is to provide the environment for this goodness to manifest itself. Armstrong (2012), says that, a central theme of Luther, Comenius, Pestalozzi, Froebel, Montessori, and Dewey is that we must do our work as educators well, and we must really care about those whom we have been called to serve. This indeed is the essence of child-centered education.

Student-centered learning puts students' interests first, acknowledging student voice as central to the learning experience. In a student-centered classroom, students choose what they will learn, how they will learn, and how they will assess their own learning. Hannafin & Hannafin (2010) in their note says, this is in contrast to traditional education, also dubbed "teacher-centered learning", which situates the teacher as the primarily "active" role while students take a more "passive", receptive role. In a teacher-centered classroom, teachers choose what the students will learn, how the students will learn, and how the students will be assessed on their learning. In contrast, student-centered learning requires students to be active, responsible participants in their own learning and with their own pace of learning. Johnson (2013), says that, the usage of the term "student-centered learning" may also simply refer to educational mindsets or instructional methods that recognize individual differences in learners. Student Centered Learning Reform (2014), says, in this sense, student-centered

learning emphasizes each student's interests, abilities, and learning styles, placing the teacher as a facilitator of learning for individuals rather than for the class as a whole

Kember (2009) says that, the activity or experienced curriculum requires teachers with wide range of experience, broad education with training in educational psychology coupled with; there should be the provision of physical facilities such as large classroom, reads and flexible building to allow for many activities and free play. Vygotsky (1980), says, in addition the learners are highly motivated to learn as what they are learning is an outcome of their desire rather than adult prescribed content. The motivation is a directed result of relevance, reality, and meaningfulness of what is being studied. The problem solving activities or techniques of instruction emphasized in the activity curriculum provide the students with the process skills that they much need so as to be able to cope effectively with life outside the school. With process skills developed, the students will be able to utilize them to solve other problems.

2.6.2 Discovery Method

The teaching method prescribed by the Nigerian Biology Curriculum is discovery/laboratory and experimental method of teaching, the discovery method of teaching according to Ughamdu (2006) is a method of teaching where the classroom teacher provides the learner necessary opportunities to discover new facts, new rules, methods or techniques of solving problems as well as new rules, new values for themselves. Mccarthy (2005), says, Modern science curricular emphasizes learner's involvement in science activities through discovery method. The label of discovery learning can cover a variety of instructional techniques. According to a meta-analytic review conducted by Alfieri, Brooks, Aldrich, and Tenenbaum (2011), says, a discovery learning task can range from implicit pattern detection, to the elicitation of explanations and working through manuals to conducting simulations. Rachael

(20004), discovery learning can occur whenever the student is not provided with an exact answer but rather the materials in order to find the answer themselves.

Kim (2005), says, discovery learning takes place in problem solving situations where the learner draws on his own experience and prior knowledge and is a method of instruction through which students interact with their environment by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments.

Abdullahi (1982), says, a discovery method involves an unstructured exploration in the laboratory in which student, through his mental processes such as deserving, measuring, classifying, can draw general conclusions from data which he has generated. From the instructional point of view two discovery methods are recognized which are Guided inquiry and unguided inquiry. The guided inquiry involves instructional modes which can either be deductive or inductive in nature. The guided inquiry is employed when a learner is expected to use principle in order to discover solution to a particular problem. Unguided inquiry is adopted when neither the general principle nor the solution is given; the student is expected to discover both principles and the solution. The unguided inquiry is also called “pure discovery”. Mayer (2009), says that, a discovery method equip the learner with the vital meaning means of acquiring knowledge on his through active and he develops his own mind by using it to solve problems.

2.6.3 Lecture Method

For several years lecture method was the most popular and regularly used instructional strategy by most schools. Especially in Nigerian Secondary Schools were the population of the classroom is above 100. Cashin (1990), says 80% of all united state colleges in the late 70s used lecture method. The lecture method is an important way to communicate large amount of information to an over populated class, or wide range of listeners.

The disadvantage of the traditional lecture method is that it limits student's participation and curtails feedback which provides an unrealistic level of assumption of students understanding and comprehension of the lesson taught. The lecture method often extricates students from the learning process leading to dissemination of information quickly. The lecture method is best used when teaching Basic Ecological Concept which does not require much illustration or diagram for its implementation.

2.6.4 Demonstration Method

Demonstrations help to raise student interest and reinforce memory retention because they provide connections between facts and real-world applications of those facts. The demonstration method provides things close to real life event, results are seen and answers are given immediately with the demonstration method. Bruce (2009) defines demonstration as the process of teaching through examples or experiments. For example, a science teacher may teach an idea by performing an experiment for students. A demonstration may be used to prove a fact through a combination of visual evidence and associated reasoning. Demonstrations are similar to written storytelling and examples in that they allow students to personally relate to the presented information by the teacher. Erick (2007) further says that, Memorization of a list of facts is a detached and impersonal experience, whereas the same information conveyed through demonstration, becomes personally relatable. Involves showing by reason or proof, explaining or making clear by use of examples or experiments. Put more simply, demonstration means 'to clearly show. Catherine (2009), says that, In teaching through demonstration, students are set up to potentially conceptualize class material more effectively as shown in a study which specifically focuses on chemistry demonstrations presented by teachers. According to McKee et al (2007), Demonstrations often occur when students have a hard time connecting theories to actual practice or when students are unable to understand application of theories.

Tutor vista (20013), says, Teachers not only demonstrate specific learning concepts within the classroom, they can also participate in demonstration classrooms to help improve their own teaching strategies, which may or may not be demonstrative in nature. Although the literature is limited, studies show that the effects of demonstration classroom teachers

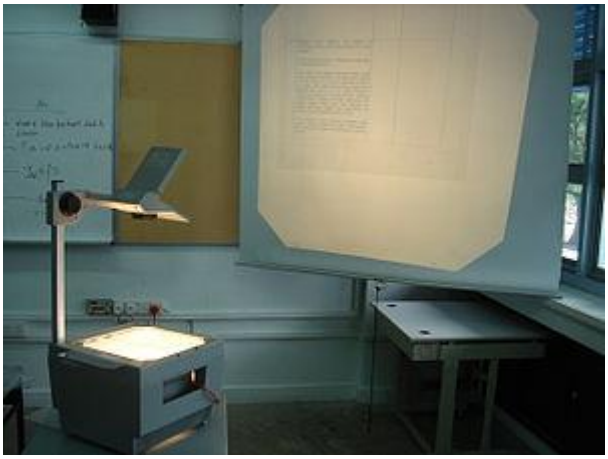
includes a change of perspective in relating to students, more reflection in the teachers' own classroom strategies, and more personal responsibility for student learning. Richard (2011) also says that, Demonstration, or clearly showing (a gamut that ranges from mere pointing to more sophisticated strategies such as chemical reactions), can possibly be used in portraying ideas such as defining words. At first, simple observation and communication through pointing to an object, area or place, like the sun, moon, or a large mountain top, occurs. Demonstrations help to raise student interest and reinforce memory retention because they provide connections between facts and real-world applications of those facts. The demonstration method is usually used in the laboratory for experiments example dissecting of animals etc.

2.7 Early use of ICT in Teaching

In early days the Education sector witnessed the introduction of has some Information Communication Tools as teaching aids to support the ones that were existing in practice to enhance teaching and learning and as well ease the teachers struggle and frustration of trying to properly introduce his lesson to the students. With time due to the changes in the education sector as a result of researchers carried out some these earlier ICT aids became old and were replace with the new ones. Some of the old ICT thus are still in use but more modernize and digitalize to meet the global digital and electronic learning brought in as a result of ICT enhancement, the chalk board are among those digitalize. Some the earlier used ICT in teaching and learning includes:

2.7.1 Overhead Transparencies

The overhead projector or transparencies is the most popular presentation device still in use today despite all the development. Overhead transparencies are the most widely used, times new roman or Arial font styles are considered to be the easiest to read on transparencies.



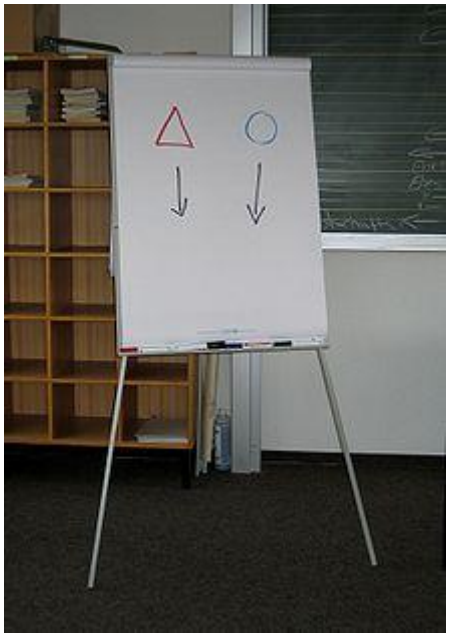
Overhead projector, with a transparency. (Wikipedia 2013)

Lee (2001), says that, the transparency, also known in industrial settings as a "viewfoil" or "foil", is a thin sheet of transparent flexible material, typically cellulose acetate, onto which figures can be drawn. These are then placed on an overhead projector for display to an audience. Serlin (1992), says, many companies and small organizations use a system of projectors and transparencies in meetings and other groupings of people, though this system is being largely replaced by video projectors and interactive whiteboard. Certain classes, such as those associated with Biology, mathematics etc used transparencies to illustrate a point or problem. Math classes in particular use a roll of acetate to illustrate sufficiently long problems and to create illustrations a computer cannot, due to a lack of math symbols on a standard computer keyboard.

This problem is typically limited to Secondary Schools and higher institutions-level. According to the National Museum of American History (2015), says that, in recent years, more and more colleges is switching to digital projectors and power point presentations. The transparencies are time wasting, because with huge material to be presented, it involves regular paper page change. With digital projectors and power point, images are clearer, reality scenes can be projected, animation can also be projected while with the transparencies there is no motion pictures, it only project drawings and diagrams. Biology teaching has gone far beyond showing the students diagram, motion is needed to illustrate how organs function, how blood circulate, how reproduction takes place, Animal behavior in their ecosystem etc. Biology is about reality not fiction. The transparencies where used to teach the physiology of animals and plants (structures of organs). http://www.Life 123.com/technology/home – electronics/projectors.

2.7.2 Flip Chart

A flip chart is a stationery item consisting of a pad of large paper sheets. It is typically fixed to the upper edge of a whiteboard, typically supported on a tripod or four-legged easel. Such charts are commonly used for presentations. The flip chart is thought to have been invented by Peter Kent who built one to help him in a presentation.



Jeffery (2014) further stated that, although most commonly supported on a tripod, flip charts come in various forms. Some of these are:

- stand-alone flip chart: resembles a big isosceles triangle box that usually sits on a table. Imagine a book that you would open at 270° angle and then lay on a table. The paper is flipped from one side of the top of the triangle box to the other.
- metallic tripod (or easel) stand: usually has 3 or 4 metallic legs that are linked together at one extremity. A support board is attached to two of these legs to support the large paper pad. This is the most common type of flip chart stand.
- metallic mount on wheels: usually has a flat base to support the paper pad and is mounted on one or two legs that then have a set of wheels. The advantage of these more recent forms of stands is that it is easier to transport the flip chart from one location to another.

Gilomor (2013), says, a text is usually hand written with marker pens and may include figures or charts. A sheet can be flipped over by the presenter to continue to a new page. Some flip charts may have a reduced version of the page that faces the audience printed on the back of the

preceding page, making it possible for the presenter to see the same thing the audience is seeing. Others have teaching notes printed on the back.

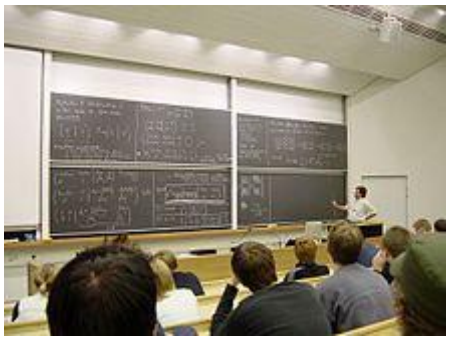
Flip charts are used in many different settings such as:

- in any type of presentation where the papers pads are pre-filled with information on a given topic
- for capturing information in meetings and brainstorming sessions
- in classrooms and teaching institutions of any kind
- to record relevant information in manufacturing plants
- a creative drawing board for Art students
- a palette for artists in “life-drawing” classes
- for strategy coaching for sports teams
- for teaching. (Http://www.staples.co.uk/searc Engine-flip chart)

A variety of paper sizes are used from the floor standing through to the smaller table-top versions, subject to the country's adopted paper sizes. These include A1, B1, 25" x30" through to 20" x 23" Recently, scientists have developed a digital self writing flip chart which writes word for word everything it is instructed to record. Gilmore (2013), says that, the disability action group "Armless" has stated that this is a significant step forward for disabilities groups to have conferences like people without disabilities. Also being released into public sale is a flipchart which is self heightening. This system is known as the POGO system. The Flip Chart might have helped to communicate some instructional messages in the previous years, but with the advance of ICT and different Internet tools Flip chart has little or no value. It may have in other subjects but not with Biology. Visual effects are welcomed when it comes to the teaching and learning of Biology, some diagrams cannot really portray the real image of a particular Biology scenario. http://www.staples.co.uk/search Engine (2010).

2.7.3. Chalkboard

The chalkboard is as old as education or man creation, which has been playing an important role in the classroom, despite the advancement of many more new technologies chalkboard is still part of the classroom. The British called it blackboard while the US called it chalkboard, which is a reusable writing surface on which text or drawings are made with sticks of calcium sulphate or calcium carbonate, known, when used for this purpose, as chalk.

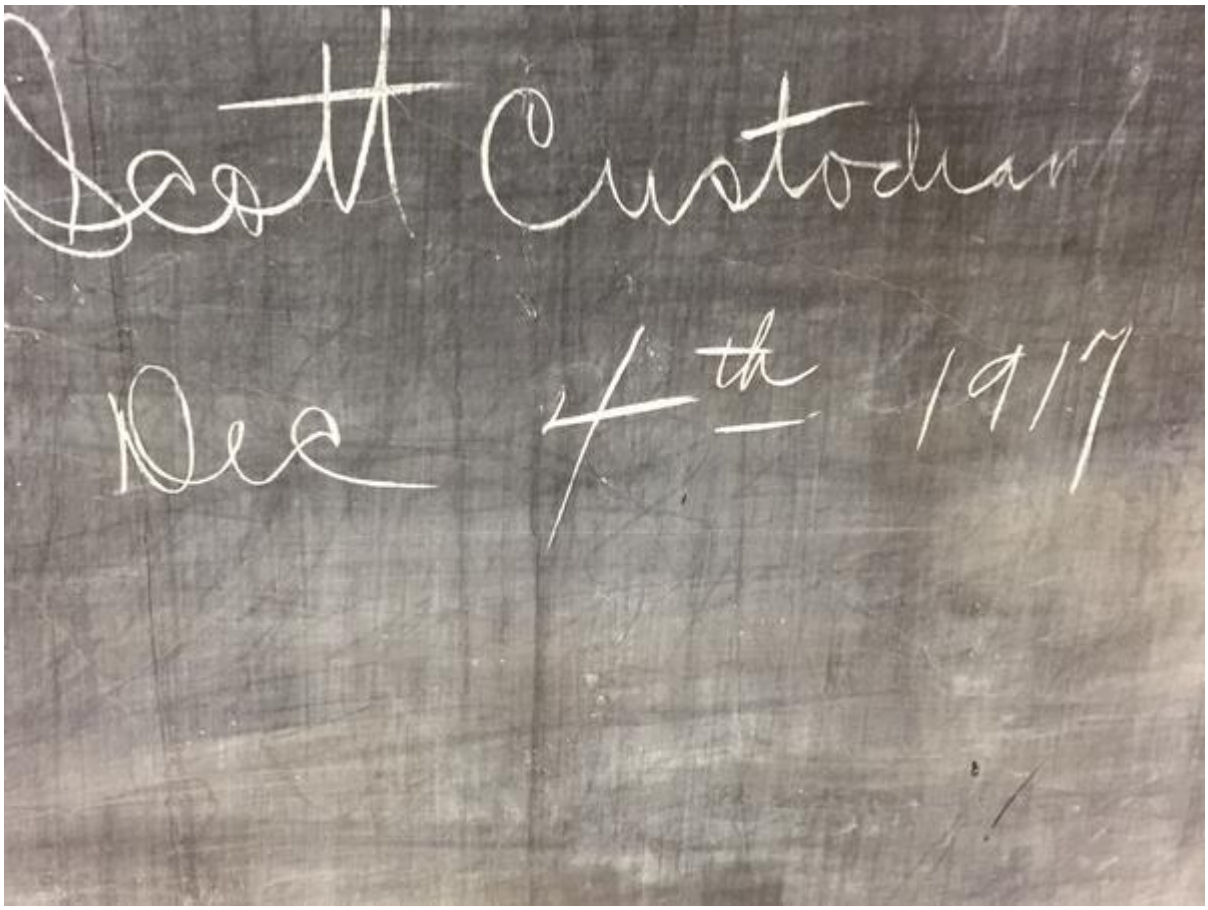


Peggy (2000), says, the blackboards were originally made of smooth, thin sheets of black or dark grey slate one. Modern versions are often green because the colour is considered easier on the eyes.



A blackboard can simply be a piece of board painted with matte dark paint (usually black or dark green). A more modern variation consists of a coiled sheet of plastic drawn across two parallel

rollers, which can be scrolled to create additional writing space while saving what has been written. David (2008), says, the highest grade blackboards are made of rougher version porcelain enameled steel (black, green, blue or sometimes other colors). Porcelain is very hard wearing and blackboards made of porcelain usually last 10–20 years in intensive use. Even the computers contain boards for it instruction, the blackboard is still vital in the classroom, students/teachers can use it to practice in cases where there is power failure, or computer, internet problems etc. it is difficult to erase the use of the blackboard completely from the classroom as a teaching aid. Stephen (1999), says that, the advent of the digital blackboard has reduced the dependence on the traditional chalkboard. The use of marker has reduced the risk of upper respiratory infection teachers were prone to. Most of the above mentioned teaching methodologies are outdated and cannot function properly in this world of digital technology.



2.7.4. Laboratory/Experimentation

An experiment is an orderly procedure carried out with the goal of verifying, refuting, or establishing the validity of a hypothesis. Experiments provide insight into cause-and-effect by demonstrating what outcome occurs when a particular factor is manipulated. Experiments vary greatly in their goal and scale, but always rely on repeatable procedure and logical analysis of the results. There also exist natural experimental studies. A child may carry out basic experiments to understand the nature of gravity, while teams of scientists may take years of systematic investigation to advance the understanding of a phenomenon. Experiments and other types of hands-on activities are very important to student learning in the science classroom. Experiments can raise test scores and help a student become more engaged and interested in the material they are learning, especially when used over time Experiments can vary from personal and informal natural comparisons (e.g. tasting a range of chocolates to find a favorite), to highly controlled (e.g. tests requiring complex apparatus overseen by many scientists that hope to discover information about subatomic particles). Uses of experiments vary considerably between the natural and human sciences.

Dooley (2014), says, experiment is a study involving a comparison group in which the investigator intentionally alters one or more risk factors in order to discover or demonstrate some fact or general truth. Dooley classified the experiments into:

Control experiment

One made under standard conditions, to test the correctness of other observations.

Controlled experiment one in which an exact replica of the animals experimented on are kept without any treatment in order to show what changes occurred in normal animals, reinforcing the view that the observed changes in the experimental animals were in fact the result of the treatment administered.

Factorial experiment

One set up in such a way that all levels of each intervention or treatment occur with each level of response.

Field experiment

One carried out in normal circumstances and environment, e.g. on the farm or in the cattery rather than in an experimental institution where many of the factors affecting the occurrence or severity of a disease may not operate.

Laboratory experiment

Carried out in a laboratory where conditions can be almost completely controlled.

Latin square experiment

Connard & Liu, (2004), says that, a method of laying out a field experiment in such a way as to avoid bias by physical location.

t -those carried out to see what happens if certain influences are applied to an animal or a group of animals. Retrospective experiments are those which set out to explain events that have already been observed.

1. A test under controlled conditions that is made to demonstrate a known truth, to examine the validity of a hypothesis, or to determine the efficacy of something previously untried.

2. The process of conducting such a test; experimentation.

3. An innovative act or procedure.

4. The result of experimentation.

Adeyeye (2002), says, Biology is conventionally taught in the laboratory; a well designed and prepared adequate room with adequate facilities for scientific inquiries. Biology laboratories are expensive to construct and maintain. The laboratory method is an activity carried out by students in order to make personal observations of processes, products or events. Reid &Shah (2007), says that, Laboratory/experiments method helps the students to develop manipulative skills, such as:

- It leads to better retention of information and also development of favorable attitude to school subjects.
- Students are active participants and acquire more knowledge by performing experiments.
- The method makes the students to become familiar with such mental processes as observing, inferring, classifying, measuring, and data interpretation.

Outdoor laboratory method is important in the teaching of Biology. Outdoor is the natural environment of living organisms such as fields, riverside, ponds etc. where living things can best be studied from ecological point of view. Outdoor laboratory method in teaching ecology, some of these ways are

- It is best to study organisms in their natural environment
- It doesn't seem to cost much harness to the resources of such laboratory, especially in schools that are located in the rural and semi rural areas.

Nwagbo (1995), says that, outdoor laboratory experience enables the science teacher to

- Teach for acquisition of scientific skills which is a major goal of science education
- Apply scientific concepts, ideas and principles properly.
- Communicate effectively in science
- See the tentativeness of ideas and principles in science which he passes on to his students.
- Use science in explaining naturally occurring phenomenon;
- Use daily for his actions, thoughts and utterances;
- Better organize his teaching in terms of content, methodology and assessment;
- Have more confidence in teaching
- See the outdoor laboratory experience as the most effective way of promoting science education;
- Make valid contributions to educational issues/policies in science;
- Teach science for effective functioning in the society;
- Concretize science through meaningful explanation and activity;
- Have the skills for resourcefulness and improvisation among others.

The indoor laboratory is a forum for science teachers and their students within a building to interact with materials, under controlled conditions, when seeking answers to problem in a nature. Science is concerned with finding answers to problems in a bid to understand and interpret natural phenomena. Portrayal (2007), says, biology is a hand on science, and Biology students are usually to spend some time in the laboratory. The type of activities a student will perform vary depending on the exact field they are in for example plant geneticist, spend more time in the field gathering plants, even so there are some basic technique that all beginning lab students should understand. This method is still functional and will stay functional for more time to come, the integration of the internet based learning tools in the Biology laboratory which makes it a virtual laboratory,

therefore making it more effective for teaching and learning of Biology. It is good for independent study, research work and group work.

2.7.5 Over Head Projector

Also called a "viewgraph," the overhead projector was created by Jules Duboscq, a French inventor, in the 1870s. It was first used for police work, and used a cellophane roll over a 9-inch stage allowing facial characteristics to be rolled across the stage. The U.S. Army in 1945 was the first to use it in quantity for training as World War II wound down. It began to be widely used in schools and businesses in the late 1950s and early 1960s.

A major manufacturer of overhead projectors in this early period was the company 3M, where engineer Roger Appledorn had developed a transparency projection system. As the demand for projectors grew, Buhl Industries was founded in 1953, and became the leading US contributor for several optical refinements for the overhead projector and its projection lens. In 1957, the United States' first Federal Aid to Education program stimulated overhead sales which remained high up to the late 1990s and into the 21st Century

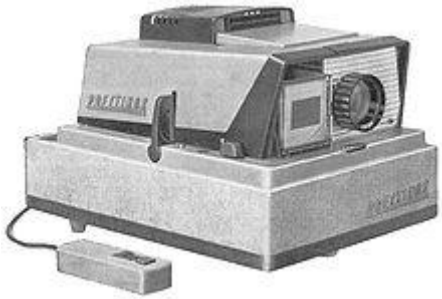
Phil (1999) says that, an overhead projector is a very basic but reliable form of projector. The overhead projector display images onto a screen or well. It consists of a large box containing a cooling fan and an extremely bright light, with a long arm extended above it. Lee. (2001), says, an overhead projector, stated that at the end of the arm is a mirror that catches and redirects the light towards the screen. An overhead projector can be used to enlarge images into the projector to be viewed by both the audience and the speaker. The overhead projector was once a common feature in both classrooms and business meetings. Recently it has seen a decline in use as more sophisticated computer based projectors are favored.

Lantern (2013), says, the overhead projector was first seen during the World War 11. It was used as a tool to train large numbers of servicemen. In the 1950s and 60s it crossed over to the classroom as an educational tool; and then into the business world as a training tool. This allows the teacher to type notes or diagrams to give to students and make transparencies of. Students can follow along on their work sheet while looking at the projected images, while teaching DNA replication.

Other types of overhead projectors include:



Opaque Projector by Lantern (2013)



Slide projector by Murphy (1973)

2.7.6 Television

Television, commonly referred to as TV, telly or the tube is a telecommunication medium used for transmitting sound with moving images in monochrome (black-and-white), colour, or in three dimensions. It can refer to a television set, a television program, or the medium

of television transmission. Television is a mass medium, for entertainment, educational television, news and advertising .

Television became available in crude experimental forms in the late 1920s. After World War II, an improved form became popular in the United States and Britain, and television sets became commonplace in homes, businesses, and institutions. During the 1950s, television was the primary medium for influencing public opinion. In the mid-1960s, color broadcasting was introduced in the US and most other developed countries. The availability of storage media such as VHS tape (1976), DVDs(1997), and high-definition Blu-ray Discs (2006) enabled viewers to watch recorded material such as movies. At the end of the first decade of the 2000s, digital television transmissions greatly increased in popularity. Another development was the move from standard-definition television, with 576 interlaced lines of resolution and 480i to high-definition television (HDTV), which provides a resolution that is substantially higher. HDTV may be transmitted in various formats: 1080p, 1080i and 720p. Since 2010, with the invention of smart television, Internet television has increased the availability of television programs and movies via the Internet through services such as Netflix, iPlayer, Hulu, Roku and Chromecast.

Diggs (2011), says that, the fastest agents to bring the information from place to place are radio and television, the main function of the two transmitting media is entertainment, but there most important function is education. With radio and television, the world itself has become a large school of formal and informal education. As far as formal education goes radio and television programs go a long way to broadcast programs to supplement the school syllabus, there are even channels which are exclusively for students. Segrave (1996), says that, the entertainment channels too broadcast programs which are calculated to help students in their school work. Details of the plant in African bush can be brought to the school room or to one's home in an instant, whereas

reading about such information provides the students with a lot of details. There are many great films of Biological topics for use in the classroom.

Everson (1994), says, a television set, also called a television receiver, television, TV set, TV, or telly, is a device that combines a tuner, display, and speakers for the purpose of viewing television. Introduced in late 1920's in mechanical form, television sets became a popular consumer product after World War II in electronic form, using cathode ray. The addition of color to broadcast television after 1953 further increased the popularity of television sets and an outdoor antenna became a common feature of suburban homes. The ubiquitous television set became the display device for the recorded media in the 1970s, such as VHS and later DVDs and Blu-ray Disc. Schatkinz (2001), says that a major TV manufacturers announced the discontinuation of CRT, DLP, plasma and even fluorescent-backlit LCDs by mid 2010s. Televisions since 2010s mostly use LEDs. LEDs are expected to be gradually replaced by OLEDs in near future.







Alexandra (2009), says, documentaries from television or special programs on public television could also taped to show a class. Example, animal planet, showing animal behaviors in their

habitant, besides visiting tropical forest which is obviously not feasible. Through television it is possible to give the viewer a realistic experience which is next in quality only to a real experience.

Glinsky, (2001), says, it has long been established by educationists the worlds over that student learn better if they see rather than just listen. In this sense television is more effective than just picture because television is moving pictures.

2.7.7 Computer

Computer is a technology with many functions, one which is to assist in classroom instruction. Landu (2003), says, computer as an object of instruction and vehicle for instruction, object of instruction when learning about the computer itself, and a vehicle for instruction when it is used to deliver instruction in classroom either partially or total delivery of instruction via computer. Computer assisted instruction (CAI), this is where the teacher is substituted with computer and the learner interacts directly with the system, while computer managed instruction (CMI), is where records of the child's learning experiences and needs. Phil (2000), says, a sny discussion about the use of computer system in schools is built upon understanding of the link between schools, learning and computer technology when the potential use of computers in schools was first mooted, the predominant conception was that students would be taught by computers. (Mevarech & Light 1992) in chamber (2000). During the 1980s, computers became more affordable to schools permitting a rapid decrease in student – to – computer ratios. While tutorial and D&P Software continued to develop (Chamber2002).







A range of other educational software developed that was not based on the premise of teacher replacement, for example simulation software, modeling and tool software. Hannafin & Savenye (1993); Hussein (1996), says that, the major rational for having computers in schools was more concerned with the need to use computers to improve students' learning. Broadly speaking, computer literacy is a component of technology education, which is distinct from using technologies such as computer systems to support learning and teaching processes. The latter is generally referred to as educational technology; and is applied to a wide range of technologies such as blackboards and chalks, pencils, books and slides – rules to television, facsimiles and computers. (Hyman 1985).

Sony SXRD 4K Projector, (2008), says that, the computer programs didactic aid is often described in didactic literature all over the world. They are made to be an independent source of reliable easily

comprehensible information given in a way that motivates students. To various functions and tasks of didactics aids applied in the process of teaching – learning Biology with each other, but only to interfere skillfully. It is underlined that school practice requires methodologically grounded application of these aids in the process of teaching and learning of Biology.

2.7.8 Compact Disc Read – Only Memory (CD – ROM)

Midmarket (2012), described the CD – ROM as a pre – pressed compact disc which contains data. The name CD – ROM is an acrimony, is an adaptation of the CD that is designed to store computer data inform of text and graphics, as well as hi – fi stereo sound. The original data format standard was defined by Philip and Sony (1983), says, yellow book, other standards are used in conjunction with it define directory and file structures, including is09060, HFS (hierarchal file system, for Macintosh computers) and hybrid HFSO – ISO. Format for CD – ROM is the same as for audio CDs: a standard CD is 120mm (4.75 inches) in diameter and 1.2mm (0.05 inches) thick and is composed of a poly carbonate plastic substrate (under layer – this is the main body of the disc) one or more thin reflective metal usually aluminum layers and a lacquer coating.

CD – ROM Data Storage

The drivers of the CD and CD – ROM are principally the same there is a difference in the way data storage is organized. Two sectors were defined mode 1 is storing computer data and mode 2 for compressed audio or video/graphics.

CD – ROM Mode 1: Mode used for CD – ROMs that carry data and applications only, in order to access the thousands of data files that may be present on this type of CD, precise addressing is necessary. Data is stored in sectors which hold 2,352 bytes of data with additional number of bytes used for error detection and correction code, because CD – ROM are not as faulty tolerant as audio CDs, must drivers support CD – ROM XA photo CD.

CD – ROM Mode 2: Used for compressed audio/video information and uses only tw**o** layers of error detection and correction, the same as the CD – DA. The mode 2 format offers a flexible method for storing graphics and video. It allows different kinds of data to be mixed together, and become the basis for CD – ROM XA. Mode 2 can be read by normal CD – ROM drivers in conjunction with the appropriate drivers.

Data Encoding and Reading: The CD – ROM has data encoded in a spiral track beginning at the center and ending at the outer most edge of the disc. The spiral track holds approximately **650** MB of data. That's about 5.5 billion bits. The track pitch can range from 1.5 to 1.7 micron.

Constant Linear Velocity: The principle states that the read head must interact with data track at a constant rate, whether it is accessing data from the inner outermost – portions of the disc. This is affected by varying rotation speed of the disc, from 500pm at the center to 200, pm at the outside. Rouse (2005).

2.8 Internet

The Internet is so far one of the greatest inventions of all time. The Internet has made it possible for us to do lots of things. People can shop in online stores like eBay, communicate with family and friends via Skype or Facebook, watch the latest videos on YouTube, blog and make money from it, and so much more. The Internet has proven to be very useful and has come with lots of advantages. Peter (2009), says, the history of teaching aids in the teaching and learning is as old as the history of education itself. Teachers before the appearance of engineering tools for the teaching and learning find it difficult to develop teaching aids that would be suitable for the topic they intend to teach. The teaching aids used then were flip charts, maps, illustrations, model, field trips and drawings. Teachers were then faced with lot of frustrations when choosing the appropriate teaching aids taken into consideration the age, level of education, environment and availability of the teaching aids. Some teachings aids require money to prepare them, the poor

funding of schools has also contributed to the teacher's frustrations. Inadequate or lack of enough classrooms, teachers end up with over populated classes, aids prepared for the lesson became less visible to those at the rear seats of the class, as the teacher try to go round to explain to each row the importance of the aids to the topic others engage in noise making, the class becomes rowdy leading to lost of interest. Some drawings are not well presented especially in Biology the student view the drawing from different perspective, perceiving it to be something else. The field trips especially to the zoo to see the animals performing either one action or the other as most animals have time for their different activities before the student could make it to the zoo the animals may be at rest so no activity is seen by the students .Jonathan (2014). The teaching aids helps to make active the three domains of education (Affective, cognitive, and psychomotor domain). The brain requires an attractive stimulant before learning of any nature takes place; therefore there is need for application of proper teaching aid that can enhance the stimulation.

The teaching and learning of Biology that requires the use of many teaching aids as possible was more of verbatim with so much dependent on text books and the teachers knowledge. Ward (2009), says, with the internet learning tools, new development and discoveries in world of biology can be known to students within 24hrs of discovery, but with the outmoded teaching strategy it usually take years for the Biology books to be reviewed and release to schools and take more years to reach African schools. Specimens, species (either marine, plants, insects etc) that cannot be found in this part of the world are visibly seen and identified by the Biology students through the use of the internet based tools. Dinosaurs that went into extinction whose part were recently discovered and posted on the internet is also an example of the effectiveness and value of the internet based learning tools. The advent of the internet has change the way the teaching and learning of Biology is done across the world. Most of lessons prepared by teachers are not lacking in content, but the way the lesson is presented. Biology is full of fun, because it study is full of motion, pictures new discoveries which encompasses all human and animal activities, that are very

exciting and amusing to watch and learn if the lesson is well prepared with adequate aids to help in the transfer of learning.

Teaching methodologies are always employed by the classroom teacher to suit the topic he/she is to teach. When teaching method are poorly applied it make it impossible for the objectives of the lesson to be achieved. More theories and researches have been conducted on the proper application and chose of teaching methodology especially in the field of Biology to ensure effective transfer of knowledge. Bill (2000), says, many problems that arise from teaching are as a result of poor selection and application of teaching method. Some of the teaching methods are outdated and require to be replaced with the new technology to meet the global challenges in education and give room for researches as well as innovations in the field of Biology. The teaching methods used in the 20th century are out dated in the 21st century. The integration of the internet-based learning tools is a welcome idea in the teaching of Biology in Kaduna State of Nigeria.

2.8.1 History of the Internet

The Internet technology was created by Vinton Cerf in early 1973 as part of a project conducted by the Advanced Research Projects Agency, part of the United States Department of Defense. By early 2000, access was available in over 200 countries and encompassed around 100 million users by the end of 2002, more than 100,000 networks and 120 million users were connected via the internet. The internet and its technology continued to have profound effect in promoting the sharing of information making possible rapid transactions among businesses, and supporting global collaboration among individuals and organizations. (Bako 2005).

According to Oxford Dictionary the internet is an arrangement of connected computers which lets the computer users all over the globe exchange data. The internet is an extraordinary entertainment and learning tool that may be utilized in a number of modes to increase the ability of a user to collect information. The principal components of the internet are the World Wide Web (www) and e – mail. With passage of time, the internet has become the most effective business tool in the contemporary world it can be described as a global meeting place where people from every corner of the world can come simultaneously.

Gromovg (1995), says that, internet is a global network connecting millions of computers, more than 100 countries are linked into exchange of data, news and opinions. Unlike online services which are centrally controlled, the internet is decentralized by design. Each internet computer called the host is independent; its operators can choose which internet services to use and which local services to make available to the global internet community. It is composed of many interconnected computer networks. Each network may link thousand of computers enabling them to share information. The internet developed from software called the ARPANET which the United State military had developed. It was also restricted to military personnel and the people who developed it.

Tracy (1995) defines internet as the international network of communication in which computers in the Wide Area Network (WAN) talks to each other. Shivinina (2002), defines ICT as all digital technologies including computer, scanner, printer, telephone, internet, digital satellite system (DSS), direct broadcast satellite (DBS), pocket switching, fibre optic – cables, laser disc, microwaves and multimedia systems for collection, processing and dissemination of information all over the world.

Richmond (1997), as in Shivinina (2002), says that there is a great link between the curriculum and internet and that there are three major areas that the internet can influence learning including:

(i) Presentation, demonstration and the implementation of data using the productivity tools.

(ii) Use of curriculum specific applications such as educational games, drills and practice, simulations, tutorials, virtual laboratory, visualization and graphics, representation of abstract, concepts, musical composition and expert system

(iii) Use of information and resources on CD – ROM online encyclopedia, interactive maps and atlases, electronic journals and other references.

If used wisely internet tools empower students to take responsibility for their own learning. Shneiderman (2013), says, the internet provides teachers with a powerful framework, collect, relate, create, donate (CRCD) for designing students learning opportunities using computers. In particular Shneiderman's (CRCD) frame work emphasizes the importance of social aspects of learning generating creative work. The CRCD projects, students' research for information, work collaboratively to create meaningful product that demonstrate their learning and contribute that project to a larger community. Sheneiderman design the CRCD frame work as a vehicle for preparing young people for a 21st century world where innovation, creativity and collaboration will be more highly priced than retention and repetition.

Internet is also defined as a rich multi layered, complex ever changing textual environment. The internet provides several opportunities for the academia. It is a mechanism for information, dissemination and a medium for collaborative interaction between individuals and their computers without regard for geographic limitation of space Leiner (2000). It has become imperative to evaluate the effectiveness of internet based learning tools and how it contributed to the enhancement of Biology Education in North West Geo Political Zone of Nigeria, towards preparing our own students for the world of innovation, creativity and collaboration for the 21st century.

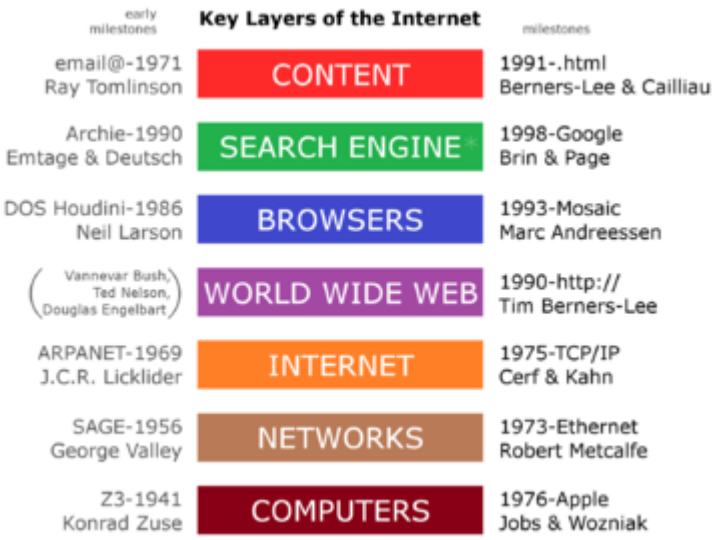
Sminorva (2008), says, traditionally, education focused on the three "Rs" of "reading, `riting and `rithmetic." But these core skill sets must now be matched by an additional 3 Rs of information literacy: rigor, relevance and relationships. Rigor refers to the developed skill of discerning the accuracy and validity of information accessed on the Internet, along with meeting the demands of copyright, protection of intellectual property and creative commons requirements. Pestel (1981), says, relevance involves the ability to identify online information that relates directly to the topic of study or research using a full array of online information sources and tools, while avoiding the potential for disruptive tangents that the Web offers. Relationships refer to the ability to network and identify communities of like-minded people and to collaborate and contribute to an informational commons. Hauben (2004), says, this new set of skills and its vast potential for collaboration offers new hope for an informed global society with a civic view of the goals of education. While therefore serving the prospects for democracy, this new reality complicates outmoded notions of individual achievement

Search engines can be considered to be the last layer of technology that turned the Internet into the extremely useful tool that it is today. Hafner (1998), says, even before the World Wide Web, there were search engines that attempted to organize the Internet. The first of these was the Archie search engine from McGill University in 1990, followed in 1991 by WAIS and Gopher. All three of those systems predated the invention of the World Wide Web but all continued to index the Web and the rest of the Internet for several years after the Web appeared. There are still Gopher servers as of 2006, although there are a great many more web servers.

Ruthfields (1995), says, as the Web grew, search engines and Web directories were created to track pages on the Web and allow people to find things. The first full-text Web search engine was WebCrawler in 1994. Before WebCrawler, only Web page titles were searched. Another early search engine, Lycos, was created in 1993 as a university project, and was the

first to achieve commercial success. During the late 1990s, both Web directories and Web search engines were popular—Yahoo! (founded 1994) and Altavista (founded 1995) were the respective industry leaders. By August 2001, the directory model had begun to give way to search engines, tracking the rise of Google (founded 1998), which had developed new approaches to relevancy ranking. Directory features, while still commonly available, became after-thoughts to search engines.

Gromovg (1995), says, Database size, which had been a significant marketing feature through the early 2000s, was similarly displaced by emphasis on relevancy ranking, the methods by which search engines attempt to sort the best results first. Lohr (2013), says, relevancy ranking first became a major issue circa 1996, when it became apparent that it was impractical to review full lists of results. Consequently, algorithms for relevancy ranking have continuously improved. Google's Page Rank method for ordering the results has received the most press.



2.8.1 Ways to connect to the Internet

There are different ways to connect to the internet, which can be divided into two, fixed and mobile. Fixed access is usually much faster and reliable than mobile and is used for connecting homes/offices. The main Access mechanisms are:

ADSL over traditional Phone Lines (most common).

Cable (limited to cable TV areas)

Fibre broadband – Currently being Rolled out

Mobile Internet

When travelling away from the fixed location mobile access is used. The main access mechanisms are:

Mobile broadband over 3G Network (common but slow) or 4G

Public/ Private Wii-FI (common)

Bako (2005), says that, there are basically four ways to connect to the Internet:

1. Host access: this is usually carried out via dial – up telephone lines and modems combined with the internet software on a personal computer and allow the computer that is accessed to function fully as an internet host.
2. Network access: this is similar to host access, expect that it is done via a leased line or an "always – on" link such as Digital Subscriber Line (DSL) or Etherloop. In this case, all attached computers are made into internet hosts.

3. Terminal access: this is usually carried out via dial – up telephone lines and modems combined with terminal emulation software on a personal computer. It allows interaction with another computer that is an internet host.
4. Gateway access: this is similar to terminal access, but is provided via on – line or similar proprietary services that give the user the ability to exchange e- mail with the internet

2.8.2 The Advantages of the Internet

In the history of mankind the internet is the greatest development in the domain of communication industry. Similar to each and every invention, the internet carries a number of advantages and disadvantages. The advantages of internet according to Oxford are:

a. Information. The biggest benefit offered by the internet is information. It functions as a valuable resource of information. You can find any type of information on any subject with the help of the search engines like Yahoo and Goggle.
b. Communication. The primary goal of the internet is communication. It has done extremely well in this field, however the development process is still going on to make it more dependable and quick. By sending an e – mail, we can contact a person who is physically present thousands miles away within the fraction of a second's time.
c. Entertainment. Internet functions as a popular medium of entertainment. A wide variety of entertainment including video games, music, movies, chat room, news and others can be accessed through internet.
d. E – Commerce. E Commerce is the idea that is implemented for any form of commercial strategy or business transactions that entails transmission of data from

one corner of the world to another. E commerce has become a fantastic option through which you can shop.

e. Formation of Communities Internet helps in formation of communities or forums. Here a number of people can participate in different types of debates and discussions express their views and gather valuable knowledge.
f. Services. A variety of services are offered via internet, for example job searching, online banking, buying movie tickets, hotel reservations and consultation services e.t.c. when you avail these services offline they become more expensive.

According to Robert (1995), says, the internet provides the education sector varieties of Web Based Learning Tools to enhance the quality of education in schools at all levels all over the globe. It has a strong effect on the cognitive domain, by stimulating the brain for long time memory retention, improve understanding, arouse curiosity of the students, and promotes their interest towards the topic or subject to learn the internet has provide platforms for collaborative learning and research work etc. the challenge the internet throw at its uses lead them towards developing the interest to complete assigned task and achieve the intended goal of the study. Such challenge if positively utilize ensures achievable objectives.

Remy (1993), says that, collaborative learning in a composition classroom can unite students when assigned open-tasks. Kenneth Bruffer introduced the learning method, Classroom Consensus Group, in which the instructor allocates groups of three to five (three being ideal) students and assigns a problem to be solved or question to be answered. There are two directions the non foundational task can be presented: as an indistinct, no right answer that generates discussion or proposes an answer and request questions and a process of how the answer came to be. Once the task is assigned, the instructor backs off in order to resist the urge to intervene in students' conversation. The goal is to remove focus of the instructor's authority. The instructor must keep time to ensure the students are centered on analogizing, generalizing, and bridging their

comprehension with others. Following group discussion, the instructor is to evaluate, not judge, the students' work. Ideas should be presented to the entire class thus allowing the small groups to come together as a whole. It is then that the answers can be compared, gaps can be filled, and authority is not on one individual.

Motivation is usually applied to describe the phenomena involved in the operation of drives, incentives and motives. Mukherjee (1978) in Siemens (2005). The Encarta dictionary definition of motive is that it is an affective – co native factor which operates in determining the direction of an individual's behavior towards an end goal, consciously apprehended, or unconscious. Kendra (2010) also define motivation as the force that initiates, guides and maintain goal – orientated behaviors, the forces that lie beneath motivation can be biological, social, emotional or cognitive in nature. When a successful person is asked in whatever he or she is doing what motivates him or her and the very likely answer is "Goals". Goal setting is extremely important to motivation and success. Interest is an important motivator for students.

Curiosity is a response to any novel and extraordinary idea that drives students to discover. Curiosity can be stimulated by using technical events to attract the learner's attention, e.g., animation on a computer screen or unexpected results caused by user interaction. Highlighting incompleteness or inconsistency is another technique that arouses curiosity. In addition, the provision of unpredictable or random events may motivate learners to continue the learning processes. Malone and Lepper (1987), says, distinguish between sensory curiosity and cognitive curiosity. Using computer technology to simulate various events, e.g., changes in view angles when playing a car racing computer game, can promote sensory curiosity. The environment should make students believe that their existing knowledge structure is either not well formed or adequate can stimulate cognitive curiosity and motivate learners to pursue a cognitive structure that is well formed.

Understanding and retention are products of meaningful learning when teaching is effective and meaningful to the students, Bichi (2002), says, Retention is the ability to retain and remember things experienced or learned by an individual at a later time. It takes place when learning is coded into memory. Thus appropriate coding of incoming information provides that index that may be consulted so that retention takes place without an elaborate search in the memory lane (Oyedokun 1998 in Bichi 2002). The nature of the materials to be coded contributed to the level of retention. Materials are related to the quality of retention in terms of their meaningfulness, feminity, concreteness and image evolving characteristics.

Several factors are known to influence retention, Blair Et al (1968) in (Bichi 2002), says that anything that aids learning should improve retention while things that lead to confusion or interference among learned materials decrease the speed and efficiency of learning and accelerate forgetting.

Stimulation is the action of various agents (of stimuli) on nerves, muscles, or a sensory end organ, by which activity is evoked; especially, the nervous impulse produced by various agents on nerves, or a sensory end organ, by which the part connected with the nerve is thrown into a state of activity, whether everyday general physical activity. Stimulation is often connected with psychological stimulation, which concerns how a stimulus affects a person's thinking process. The word is also often used metaphorically. For example, an interesting or fun activity can be described as "stimulating", regardless of its physical effects on nerves. *Stimulate* means to act as a stimulus to; *stimulus* means things that rouse to activity.

Stimulation in general refers to how organisms perceive incoming stimuli. As such it is part of the stimulus response mechanism. Simple organisms broadly react in three ways to stimulation: too little stimulation causes them to stagnate, too much to die from stress or inability to adapt, and a medium amount causes them to adapt and grow as they overcome it. Similar categories or effects

are noted with psychological stress with people. Thus, stimulation may be described as how external events provoke a response by an individual in the attempt to cope.

Engaging in activities that challenge the learners' abilities may enhance intrinsic motivation. However, it is important that the level of both the activity's challenge and the learner's skills are matched. Once an appropriate match of challenge and ability is realized, learners may experience ''flow,'' defined as ''the holistic sensation that people feel when they act with total involvement''. When learners' experiences flow, they are extremely involved with the tasks at hand and may even lose awareness of time and space. Flow status happens only when the challenge of activities matches the skills possessed by learners. Learners get bored if the challenge is too easy to meet and tasks that are too difficult make learners fail frequently, feel frustrated, and cease learning. Ideally, tasks should be designed so that there is an ongoing adjustment between the level of a task's difficulty and the level of a learner's developing skills. Learners who achieve challenging goals feel that they are becoming more competent and are apt to set new, even more challenging goals, a process that serves to maintain intrinsic motivation. Malone and Lepper (1987), says that, three characteristics of activities that can provide a challenge to learners: (1) the identification of proximal goals; (2) a guarantee of uncertain outcomes; and (3) the presentation of frequent, clear, constructive, and encouraging feedback. These challenge-oriented strategies are frequently employed within the context of Role-Playing Games (RPGs). Players in RPGs gain experience by achieving proximal goals and by gradually approaching the final goal. The attainment of experience enhances the players' confidence and encourages them to conquer the next goal. For learning activities to encompass these principles, the curriculum should be divided into smaller segments and students should be encouraged to finish each part with clear feedback especially with Biology subject that is perceived as being bulky by the students and difficult. The internet based learning tools is capable of challenging the students ability by promoting curiosity towards a certain phenomenon.

Understanding also called intellection is a psychological process related to an abstractor physical object, such as a person, situation, or message whereby is able to think about it and use concepts to deal adequately with that object. Understanding is a relation between the knower and an object of understanding. Understanding implies abilities and dispositions with respect to an object of knowledge sufficient to support intelligence behavior. Understanding is a mental grasp meaning comprehension especially the capacity to apprehend general relations of particulars. Understanding is explanation and interpretation. An understanding is the limit to conceptualization to understand something is to have conceptualized it to a given measure. Gregory Chiatin, a noted computer scientist, propounds a view that comprehension is a kind of data compression in his essay "The Limits of Reason" he argues that understanding something means being able to figure out a simple set of rules that explains it.

Memory is the mental faculty of retaining and recalling past experiences, the act or instance of remembering recollection. Learning takes place when they retain and utilize past memories. Learning and memory are attributed to changes in neuronal synapses thought to be mediated by long term potentiating.

There are three types of memory, which are:

Sensory Memory

Short Term Memory

Long term Memory

Long Term Memory – Is used for storage of information over long time information from short or long term. Memory is transferred after a short period, unlike short term memory; long term memory has little decay. Long term potential is an enhanced response at the synapse within the hippocampus. It is essential to memory storage. The limbic system isn't directly involved in the long

term memory necessarily but it selects them from short term memory consolidate these memories by playing them like a continuous tape. There are two types of long term memory, the episodic memory and semantic memory.

Episodic Memory represents our memory of events and experiences in a serial form. It is from this memory that we reconstruct the actual events that took place at a given point in our lives. Semantic memory on the other hand is a structured record of facts, concepts and skills that we acquired. The information in the semantic memory is derived from our own episode memory, such that we can learn new facts or concept from experiences. There three main activities that are related to long term memory, which are, storage, deletion and retrieval. Information for short term memory is stored in long term memory by rehearsals. The repeated exposure to stimulus or the rehearsal of a piece of information transfers it into long term memory. Experiments also suggest that learning is effective if it is distributed over time. Deletion is mainly caused by decay or interference.

2.8.3 The Disadvantages of Internet

The fact that the Internet has become a market place has also seen a rise in fraud cases. Credit/debit card details are particularly vulnerable. This calls for extreme caution when transacting online. Make sure to use a reliable payment processor instead of sending your details directly to an individual or business. Some of the disadvantages includes:

a. Spanning. Spanning denotes distribution of unsolicited e – mails in large numbers. They are meaningless and they unnecessarily block the whole system. These activities are treated as illegal
b. Theft of personal details. While using internet, there is high probability that your personal details like name, address and credit card number may be accessed by con artists and used for fraudulent purposes.

c. Pornography: Pornography is definitely harmful for the children. There are numerous pornographic sites available over the internet and watching any of those can have very bad influence on the mental health of the children.

d. Virus threat: virus is a program that interrupts the usual operation of your personal computer system. PCs linked to the internet have high probability of virus attacks and as a result of this your disk can crash, giving a lot of trouble.

e. Spamming is the sending of unwanted and useless emails to random people. These emails obstruct the recipient needlessly. They are illegal and can cause frustration because they make it hard for people to access their email accounts. Bots are used to bombard your inbox with endless advertisements. This is quite perplexing as it always gets mixed up with important emails. Luckily, most email service providers have a security system in place to prevent spam emails from going to your inbox. All emails that are deemed suspicious get their email ID or IP address blocked or sent to the Spam folder.

2.9 Internet Based Learning

Internet-based training (sometimes called e-learning) is anywhere, any-time instruction delivered over the Internet, intranet to browser-equipped learners. There are two primary models of Internet - based instruction: synchronous (instructor-facilitated) and asynchronous (self-directed, self-paced). Instruction can be delivered by a combination of static methods (learning portals, hyperlinked pages, screen cam tutorials, streaming audio/video, and live Web broadcasts) and interactive methods (threaded discussions, chats, and desk-top video conferencing).

According to Hossein (2002), says, Learning is the act or process of developing skill or knowledge. Modern, web-based learning and computing provides the means for fundamentally changing the way in which instruction is delivered to students. Multimedia learning resources combined with CD-

ROMs and workbooks attempt to explore the essential concepts of a course by using the full pedagogical power of multimedia. Many Web sites have nice features such as interactive examples, animation, video, narrative and written text. Artino (2008), says that, these web sites are designed to provide students with a "self-help" learning resource to complement traditional textbook. A Web-based learning class is more effective learning experience, since the learner is participating in learning process and receives individual attention. Though the instructor and the learner are at different locations, this participation in learning is by itself a positive learning experience. The Web-based learning atmosphere allows more effective interaction between the students and instructor. Therefore, it can be effective as traditional classroom learning environment where the space, seating, etc., could be inadequate.

. Butcher (2002), says, the new information and communication technologies can facilitate this development but only if policy makers are sensitive to the opportunities, especially at an international level. Web-based teaching and learning call for a serious reconsideration of the effectiveness, especially in light of increased demand for education and the opportunities for increased student motivation by new technologies if integrated with knowledge-based design sites. The operational infrastructure for the effective delivery of a Web-based learning program is critical to its success. Yet all too often this element is overlooked or seen as incidental to the design and quality of the learning materials themselves. These are the key success factors in teaching/learning that is oriented towards students, who will become autonomous self-learners using the media and the support services. Starr (2000), says that, the high quality of the Internet education process means the molding of abilities to learn. Other issues related to students include their psychological reactions to the new way of learning. They may have a fear of technology. Others may have a low level of technology skills, though this is changing as more university are training students more thoroughly. Some students may struggle with independent learning and feel insecure with an amorphous teacher.

Change may not be easy, but it is necessary, inevitable and often beneficial. Whether your students succeed or fail depends in part upon how well you leverage your full intellectual capital -- and your Web-based course is taking a starring role. Also, think about engaging students in implementing such a learning environment - share your teaching and students learning together. Keeping interactivity with students, and following the factors outlined in this site will help to ensure a comprehensive, well-thought-out Web-based teaching and learning system -- and helps to safeguard you in the process.

Mary (2001) in her article titled “Wired, Warp and Woop, says that, the Internet is affecting the twin disciplines of knowledge management, and content management. Knowledge management is the thinking process of converting information to useful knowledge, while the content management is the published information. The author of a Web site must provide the efficient content management, and the visitor who uses a Web site must have the mental ability for an effective knowledge management. Jill (1994), says that, the authors need to learn more about the contents alongside the usability of their sites. On the other hand, the new state and federal policies, advances in services to students, new costing of technology methodologies, evolving accreditation and quality assurance issues, new e-learning projects and new institutional practices. For example, the impact of class size is of concern to all parties involved on Web-based learning/teaching. It takes 2 or 3 times as much time to teach an on-line course as a face-to-face course. An on-line course that works for 10 or 20 students may be impossible with 100 or 200 students. With face-to-face courses where the students are met simultaneously, the repetition in providing student feedback may be much less than in asynchronous teaching. Thus, on-line teaching may not scale as well as face-to-face teaching?

Traditional Education emphasizes learning content; learning the "what." The information age, however, requires people who are competent learners, who understand the process of learning,

the "how." The teaching material and teaching style must reflect the change in the real world, which students may not know because they have not been there yet. Unfortunately, some instructors are still using their well over 10-years old notes. Adding to this problem by doubling the difficulties for students, some instructors are devoting not some but most of class time for giving notes to students and group work. The instructor does not want to teach most of the time. A few do the extreme opposite "I know, you don't, and I'm going to tell you." Some instructors may buy a reputation by many false means such as giving good grades to all (sometimes all A's), not giving any exams/test or projects.

2.9.1 Internet – Based Teaching Tools

learning tool is defined as *any software or online tool or service that you use either for your own personal or professional learning, for teaching or training.* Mioduser, D. (1999) in Bako (2009), says that, the innovative companies are helping to shape the global engineering education trends and practices, they encourage the next generation of engineering practitioners through innovative engineering education products and services aimed at teachers and students around global. Bako (2009), says, there are so many internet – based information and communication platforms providing access to search engines e.g. Google scholar, database (Library of congress, e-journals, Qustia), *cyber – labs, software's (Encarta) and other learning applications. These tools use the power of social media to help students learn and teachers connect. Examples of companies who provide WBLE platforms also suitable for Biology teaching and learning include: Autodesk, Agilent Technologies, Dassault systems, National Instruments. Sun-micro systems, Cengage Learning, Infosys, Bosch. Other Biology platforms include BlogSpot .com, Webcrawler search engine for Biology, ERASYSAPP, Web quest provide information on cell division, model-Apps for phones collaborative learning tools concept maps and community initiative, a web quest epidemics provide students with information on disease conditions.

The Web Quest is an Engine for Biology education. Concept mapping is a recommended teaching strategy for Biology education. Because of the wideness of Biology topics most of these search engines limit themselves to a particular topic example cellular biology (study of the cells), Botany (study of plants), zoology (study of animals), Anatomy and Physiology (study of the body organs and their functions) etc. The Biology teachers can choose from any of tools to suit their lesson, such Web site should be checked by the Biology teacher prior to the lesson to ensure that the tool is capable for producing whatever information the teacher wants her students to know. The Biology teacher can also download the information using a CD – ROM and projector after editing to transfer the information needed.

Locating materials and resources is routinely cited by teachers as an important activity in the first stages of planning and has been rated as a key aspect of their planning process (Turner, 2003). In describing the attributes of successful teachers, Turner (2003), says, the abilities of these teachers to gather content for their courses from multiple sources. However, teachers have consistently expressed a need for assistance in locating materials and view their lack of proficiency in this area as a factor that limits their classroom teaching effectiveness (Hedtke et al., 2001 in Turner (2003).

Ball and Cohen (1999) draw a link between teachers' access to resources and effective planning practices and argue that "materials influence instructional capacity by constraining or enabling students' and teachers' opportunities to learn and teach" (2). Studies of teacher planning also highlight the shortage of time and the subsequent detrimental influences on their decision-making. The pedagogical changes science teachers have made to create authentic and active learning environments require access to more resources, but this need, coupled with a lack of time and skill to be able to find and use them, creates a tension for teachers. The Internet, with its seemingly endless array of educational resources, potentially exacerbates the situation. It is not feasible for teachers to spend large amounts of time searching for resources online and, in fact, five in ten

teachers say that it is hard to find Web sites to meet their classroom needs (Recker et al., 2004; VanFossen, 2001). The challenge in finding online resources for highly specific topics arises when teachers are searching for curricular materials (VanFossen, 2001). It is not realistic to assume a quick search in Google will always locate educational, age-appropriate, and credible resources.

The Biology teachers can choose from any tool to suit their lesson, such Web site should be checked by the Biology teacher prior to the lesson to ensure that the tool is cable for producing whatever information the teacher wants her students to know. The Biology teacher can also download the information using a CD – ROM and projector after editing to transfer the information needed. The lesson planning tools can also serve as a guide to the chose of proper tools for the intended lesson. Teachers need to be well knowledgeable in the use of ICT facilities to achieve the objectives of the lesson. Some Internet educational tool that provides free information about educational resources for example includes:

2.9.1 Google Scholar

Google scholar enable users for the total numbers of citation of authors, google also allows one to search across a wide range of academic literatures. It allows an information from journal, publishers, university repositories. Is a freely accessible web search engine that indexes the full text or metadata of scholarly literature across an array of publications. According to Madrigal (2012) in Wikipedia (2014) Google is an online, freely accessible search engine that lets users look for both physical and digital copies of articles. It searches a wide variety of sources, including academic publishers, universities, and preprint depositories looking for:

- Peer-reviewed articles
- Theses
- Books

- Technical reports
- Abstracts
- Reprints

While Google Scholar does search for print and online scholarly information, it is important to understand that the resource is not a database. A database, such as those on the under graduate Library find Article page, is a subscription-based resource that searches for articles that have been published. The Google Scholar has the following characteristics:

- is easy to search if you are familiar with the Google search engine
- provides some basic and advanced search options, like a database
- attempts to help you find the most useful scholarly resources by ranking articles in order of relevance
- you can search a specific article title in Google Scholar to see how many times it has been cited
- provides direct access to full text of articles if they are available for free online
- can link to library catalogs (including the University of Illinois catalog), helping you find resources within your own library and beyond.
- does not contain an easy way to sort articles in your results list
- may charge you to view the full text of an article you've found
- does not clearly specify what type of material (academic journal, magazine, newspaper etc.) is in the results list
- provides full text of some electronic articles but is not as helpful in tracking down print articles. (James 2013).

The Google Scholar as a browser can provide huge information about the current stage of the Biology world. Information can be sourced immediately a discovery is made. Students can use the

web browser to acquire information; can also be used for individual work, assignments, research work etc. teachers can use it to plan their lessons. The Google Scholar can also be useful in the laboratory for experimentation.

2.9.2 Khan Academy

Khan Academy is nonprofit educational organization created in 2006 by educator Salman Khan to provide a free world – class education for anyone, anywhere. Its website features thousands of educational resources including a personalized learning dashboard over 100,000 practice problems and over 6,000 micro lectures via video tutorials stored via YouTube teaching Medicine, Mathematics, History, Biology, Health care, etc. All resources were available for free to anyone around the world. By 2013 there were used by about 10 million students per month.

Thompson (2011). In his article "How Khan Academy is changing the Rules of Education" says, Khan Academy started with remotely tutoring his cousin interactively using Yahoo Doodle.



Khan Academy has thousands of resources translated in other languages. All videos hosted via You Tube are available in Khan Academy's own web site which contains many other features such as progress tracking, practice exercise and variety of tools for teachers in public schools. Logging into the site can be done via Google or Face book. Khan Academy also provides a web – based exercise system that generates problem for students based on skill and level of performance. The Khan

Academy provide services for science teachers, teachers improvement, exchange of ideas between teachers across the global, provision of online learning materials for both teachers and students. The Biology teachers can use the tool for teaching respiration in plants and animals, the digestive system, the carbon cycle plus the nitrogen cycle as the Academy provides videos and practice exercises.

2.9.3 Skype

Although Skype is a commercial product, its free version is being used with increasing frequency among teachers and schools interested in global education projects Cimmino (2014), says, For example, Skype is being used to facilitate language exchange: Students in different parts of the world are paired off, and each is a native speaker of the language that the other wishes to learn. In conversations over Skype, they alternate between the two languages. Teachers are using Skype in unique ways to fulfill educational goals. Ben (2014), says, the video conferencing aspect of the software is valuable in that it provides a way to connect students who speak different languages, hold virtual field trips, and reach out to experts in varying fields of study. These experiences allow students a chance to apply what they are learning in the classroom to real-life experiences, and it also achieves further learning opportunities. (Ansell 2014). Skype have helped people from geographically segmented countries to interact and share ideas.

As such, people are able to share their thoughts and views on matters affecting the globe. The Internet acts as common global platform where people explore ideologies and cultures without limitation. Andrea (2006), says that, Skype in the classroom is another free tool that Skype has set up on its website. It provides teachers with a way to make their classrooms more interactive and interesting. Skype in the classroom is a service that teachers can sign

up for that will allow students to meet other students, talk to experts, and share ideas. Teachers can collaborate with other teachers around the world and design different learning experiences for their students. There are various Skype lessons, in which students can participate. Teachers can also use Skype's search tool and find experts in the field of their choice.

Tong (2014), says, in his article narrated that, Skype is for doing things together, whenever you're apart. Skype's text, voice and video make it simple to share experiences with the people that matter to you, wherever they are. With Skype, you can share a story, celebrate a birthday, learn a language, hold a meeting, work with colleagues – just about anything you need to do together every day. You can use Skype on whatever works best for you - on your phone or computer or a TV with Skype on it. It is free to start using Skype - to speak, see and instant message other people on Skype for example. You can even try out group video, with the latest version of Skype. If you pay a little, you can do more things, in more ways, with more people – like call phones, access WiFi or send texts. You can pay as you go or buy a subscription, whatever works for you. And in the world of business, this means you can bring your entire ecosystem of workers, partners and customers together to get things done. (Kingwell 2014)

Kniskern (2013) in Skype news says, hundreds of millions of people are already using Skype to do all sorts of things together. Skype is good for collaborative work, Research project; interactivity etc. with Skype from where you are one can attend classroom lectures in another country, complete your assignment and submit via other media's. It is a good tool that allows the teacher to watch his/her student's reaction to particular event. It can also be good for demonstration method of teaching from a distance; a teacher can be performing an experiment while the student watches. It is expensive to use, but simple to operate, it is a

tool that is almost close to the traditional classroom. The students' and the teacher can communicate any time of the day.

2.9.4 Wikipedia

The earliest known proposal for an online encyclopedia was made by Rick Gates in 1993, but the concept of a free-as-in-freedom online encyclopedia (as distinct from mere open source or fermium) was proposed by Richard Stallman in December 2000. Crucially, Stallman's concept specifically included the idea that no central organization should control editing. Andy (2012), says, the Wikipedia was launched on Monday 15 January 2001 by Jimmy Wales and Larry Sanger: however, its technological and conceptual underpinnings predate this. Giles (2005) further stated that this "massively multiplayer characteristic was in stark contrast to contemporary digital encyclopedias such as Microsoft Encarta Encyclopedia Britannica, and even Bomis's Nupedia, which was Wikipedia's direct predecessor. According to New York Times (2005), in 2001, the license for Nupedia was changed to GFDL, and Wales and Sanger launched Wikipedia using the concept and technology of a wiki pioneered in 1995 by Ward Cunningham. Initially, Wikipedia was intended to complement Nupedia, an online encyclopedia project edited solely by experts, by providing additional draft articles and ideas for it. In practice, Wikipedia quickly overtook Nupedia, becoming a global project in multiple languages and inspiring a wide range of other online reference projects. As of July 2014,

Larry (2005), says that, Wikipedia includes over 32.4 million freely usable articles in 287 languages that have been written by over 47 million registered users and numerous anonymous contributors worldwide. According to Alexa Internet, Wikipedia is the world's sixth-most-popular website. Wikipedia's total worldwide monthly readership is

approximately 495 million; according to comScore, Wikipedia receives over 85 million monthly unique visitors from the United States alone. Wikipedia has contributed so much to education, all questions are provided with answers, and students can use the tool for practical experiments, field exercise, to solve problems that may arise as a result of individual learning improving the quality and quantity of knowledge. Sometimes the information is so much and cannot be edited within a short period of time, need more time than necessary to get exact information you may need.

2.9.5 Encarta Premium

Before the emergence of the World Wide Web for information browsing, Microsoft recognized the importance of having an engine that supported a Multimedia Mark up, full text search, and extensibility using software objects According to Grall (2009) in his article "What was Encarta' says that, Microsoft Encarta was a digital multimedia encyclopedia published by Microsoft Corporation from 1993 to 2009. In 2008, the complete English version, *Encarta Premium*, consisted of more than 62,000 articles, (Encarta Information 2009) indicated that numerous photos and illustrations, music clips, videos, interactive contents, timelines, maps & atlas and homework tools. It was available on the World Wide Web by annual subscription or by purchase on DVD or multiple CDs. Many articles could also be viewed free online with advertisements.

Microsoft. Com (2013) published similar encyclopedias under the *Encarta* trademark in various languages, including German, French, Spanish, Dutch, Italian, Portuguese and Japanese. Localized versions may contain contents licensed from available national sources and may contain more or less content than the full English version. For example, the Dutch version had content from the Dutch *Winkler Prins* encyclopedia. In March 2009, Microsoft announced it was discontinuing the Encarta disc and online versions. The MSN Encarta site was closed on October 31, 2009 in all

countries except Japan, where it was closed on December 31, 2009. Microsoft continued to operate the Encarta online dictionary at dictionary.msn.com until 2011.

. The hypertext display hyper linking and search software was created by a team of CD ROM Division developers in the late 1980s who designed it as a generalized engine for uses as diverse as Interactive Help, document management point and as ambitious as a multimedia encyclopedia. *Encarta* was able to use various Microsoft technologies because it was extensible with Soft Ware Component for displaying unique types of multimedia information. For example, a snap in map engine is adapted from its Map Point software. More information on the hypertext and search engine used by Encarta may be found in the Microsoft Bookshelf article. The Biology teacher can use the Encarta premium to teach concepts,



arta 2008 Premium on Windows Vista

The dynamic maps were generated with the same engine that powered Microsoft ft power point software. The map was a virtual globe that one can freely rotate and magnify to any location down to major streets for big cities. An article written by Bill Gates addressed the nature of writing encyclopedias the globe has multiple surfaces displaying political boundaries, physical landmarks, historical maps and statistical information. Robert McHenry while Editor-in-Chief of the Encyclopedia Britannica, criticized Encarta for differences in factual content between national versions of *Encarta*, accusing Microsoft of "pandering to local prejudices" instead of presenting subjects objectively. for different regions. (Alderman 20009)

2.9.7 Cengage Learning Inc.

Cengage Is an educational content, technology, and services company for the higher education and K-12, professional and library markets worldwide. The company provides content, personalized services and course-driven digital solutions that accelerate student engagement and transform the learning experience. Colin (2015), says, Cengage Learning has operations in more than 20 countries around the world. Liqun (2015), says that, a developmental professor in the institute says that, Cengage Learning serves secondary, higher education, and graduate-level students, teachers, libraries, government agencies, and corporations in both traditional and distance learning environments. Gale is Cengage Learning's library reference arm and specializes in e-research and educational publishing for libraries, schools and businesses. The company creates and maintains databases that are published online, in print, as eBooks and in microform.

Gale (2015), further says that, Cengage Learning acquired the National Geographic Society's school publishing unit to launch the National Geographic Learning brand. The global brand combined the former Cengage Learning ELT and National Geographic School Publishing imprints and sub-brands, under one unified identity. In addition to organic growth, Cengage Learning has expanded through acquisitions within the publishing industry. The cengage learning provides all kind of information

free for teachers and students. Services provided include: Course design, course support, learning materials, teacher development, and curriculum innovation, cengage brain by textbooks, auto desk education community, and software to make some mon of buildings that ignites. The cengage can be used by the Biology teachers to gain more knowledge on the subject matter plan and upgrade their lesson note with new information to meet the global challenges. Since the Cengage learning provides services teachers, topics like demonstration of experimentally the flow of materials in plant, transportation in different organisms and the digestive systems etc. teachers can buy books from the Cengage learning corporation. Students can be referred to the Cengage library for information and research work. (Cengage Learning EMEA 2015)

2.9.8 Dassault Systemes

Dassault Systèmes (3DS) provides the academic world with learning opportunities for all ages in the latest 3D and PLM technology; from the early discovery of 3D at kindergarten and middle schools through a more sophisticated PLM knowledge at high-schools and universities. 3DS promotes the advancement of excellence in all aspects of engineering, engineering technology and design while fostering innovative student projects and professors' educational practices. Engineering and design students want to express their talent and find the job of their dreams. Students also need to develop PLM skills in order to be prepared for the 21st century job market and to access the best and largest employment opportunities. Charles (2014), says, as a fact, academia has the same challenges as industry to innovate cleaner and safer products by taking into account the environment. The 21st century professionals of now and tomorrow contribute to the creation of new ideas thanks to 3DS solutions which facilitate product design innovations.

The Dassault Systemes, company during the Bloomberg week (GIMD), says that the 3Ds can be used for models like heart, explaining, nutrition cycle, the carbon cycle as they rotate to show their functions and movements. The students will be able to see clearly how the models of the organs

functions. The 3Ds can provide Animation of certain functions or cycle as in real life. All the content of the curriculum of SS11 can be used to teach Biology using the 3Ds using the Animation, practical aspect of the Biology will be more applicable.

2.9.9 ERASYSAPP

the main objective of the ERANET proposal Systems Biology Applications ERASysAPP (app = application = translational systems biology) is to promote multidimensional and complementary European systems biology (SB) projects, programmes, and research initiatives on a number of selected research topics. Inter alia, ERASysAPP will initiate, execute and monitor a number of joint transnational calls on systems biology research projects with a particular focus on applications or in other words so called translational systems biology research approaches (application-oriented and/ or industry-relevant). ERANET (2013), says, he joint call proposals and their respective topics will be on applied aspects of biological processes in microorganisms, plants, and animals. As common feature, all addressed proposal topics will tackle biological and physiological processes of common interest in the field of life sciences and biotechnology.. Teachers' development is provided by this platform, teachers can use it to upgrade their knowledge and contribute their quarter for upgrading and corrections of their work. The students can as well use it for research and personal development. The inquisitive students can even create a project work while ERASYS APP assist or even sponsor the project, to motivate the students and enhance research and project work among students.

2. 9.10 .Bio Interactive

Bio interactive – HHML: is a web site that provide powerful teaching tools for Biology education for colleges, high schools and even university free of charge for science teachers and students, including interactive media, virtual labs, videos and animation. The Biology teacher can use this

web site to teach any topic from the curriculum as all topics in Biology are provided. This web site is recommended for Biology teachers since the web site is created by professional teachers in all field of Biology. Biology can as well use the platform for their assignments and researchers. The Animation will be suitable for reproduction, respiration, digestive system, carbon cycle and the nitrogen cycle. The teacher can also use the virtual laboratory to teach his/her practical lessons. Teachers can make use of the library and even buy books from the platform. All activities are free of charge. The Bio interactive program which is popularly known as HHMI'S grants program is enhancing science education for students at all levels from the ealier grade though advance training.

Joseph (2015), says, a professor of Biochemistry and structural Biology in the institute narrated that the school is a science philanthropy whose mission is to advance biomedical research and science education for the benefit of humanity. Na, (2015) a Neuroscientist and head of Janelia Research Campus in the same institute also added by saying that "we empower exceptional scientist and students to purse fundamental questions about living systems.



The above picture is showing a teacher from the Bio Interactive platform in a lecture.

2.9.11 Agilent Technologies

Agilent Technologies, or Agilen**t**, is an American company that designs and manufactures electronic and bio-analytical measurement instruments and equipment for measurement and evaluation. Many of Agilent's predecessor product lines were developed by Hewlett Packard, the American test and measurement Equipment Company founded in 1939. In 1999, product lines not directly connected with computers, storage, and imaging were grouped into a separate company (Agilent), the stock of which was offered to the public in an initial public offerings. Amanda (2014), says, the Agilent IPO may have been the largest in the history of Silicon Valley at the time. Agilent maintains a central research and development group, Agilent Laboratories that conducts the company's research in such areas as micro electro mechanical nanotechnology, and Life sciences.

This centralized group is based on the original Hewlett Packard Lab's design and was formed by dividing the original HP Labs group into two when Agilent was carved out of HP in 1999. On September 19, 2013, Agilent Technologies announced their decision to separate into two publicly traded companies; Agilent life sciences, diagnostics, applied Markets Company, and an electronic measurement company. The life sciences company will retain the Agilent name and the electronic measurement company will be called key sight technologies. Analytical scientists and clinical researchers worldwide rely on Agilent to help fulfill their most complex laboratory demands. Our instruments, software, services and consumables address the full range of scientific and laboratory management needs—so our customers can do what they do best: improve the world around us. Whether a laboratory is engaged in environmental testing, academic research, medical diagnostics, pharmaceuticals, petrochemicals or food testing, Agilent provides laboratory solutions to meet their full spectrum needs. We work closely with customers to help address global trends that impact human health and the environment, and to anticipate future scientific needs. Our solutions improve the efficiency of the entire laboratory, from sample prep to data interpretation and management.

The platform offer information on Life sciences like Biology and laboratory equipments, the Biology teacher can use the platform to introduce practical equipments used in Biology and their uses, it provides for teachers the opportunity to develop themselves through other people research work and as well contribute their own quarter to enhance their knowledge. Instruments for measuring rate of respiration in plant and animals, instruments for dissections of plants and animal etc. especially equipment not available in the school laboratory, the platform can offer the demonstration on how the equipments are applied and how they work.

2.9.12. Autodesk

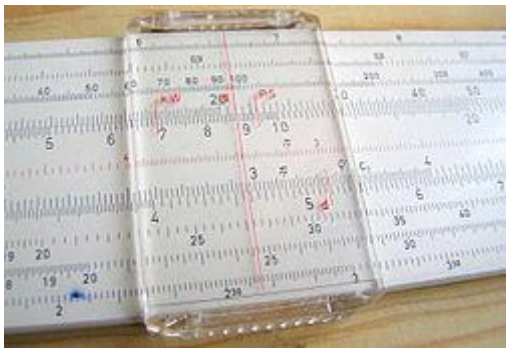
Autodesk is a world leader in 3D design, engineering, and entertainment software for manufacturing, building and construction, and media and entertainment. The auto desk provides 3Ds design, the platform can provide animated 3Ds for Biology. Biology soft ware's can be develop by the platform for the teacher to download and use in the class for the students. Topics like activities of the digestive system, respiration cycle, plants in their natural habitats, teachers can use the platform to create and upgrade their lesson notes and for their self development. The services from this platform is free, Biology teachers are free to utilize the platform to the teacher's and the Biology students' to their advantage. Htt:www//autodesk.com.

2. 9.13. Slide Rule



William Oughtred (1575–1660), inventor of the circular slide rule.

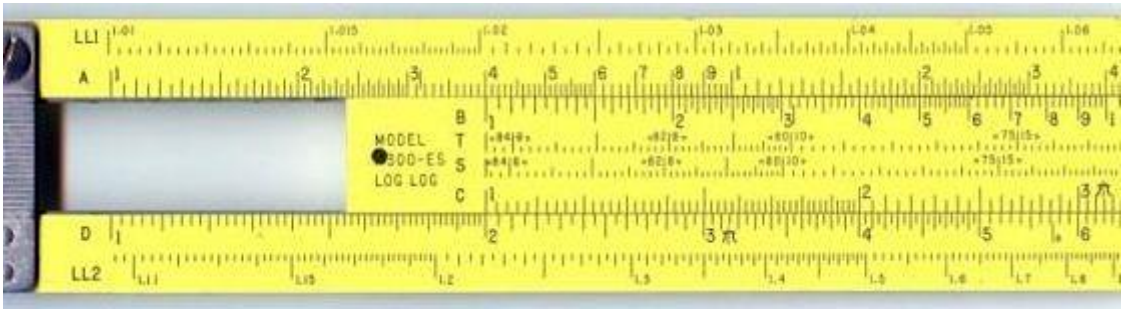
Slide rules come in a diverse range of styles and generally appear in a linear or circular form with a standardized set of markings (scales) essential to performing mathematical computations. Castleden (2007) further says that, Slide rules is manufactured for specialized fields such as aviation or finance typically features additional scales at aid in calculations common to those fields.



Cursor on a slide rule.

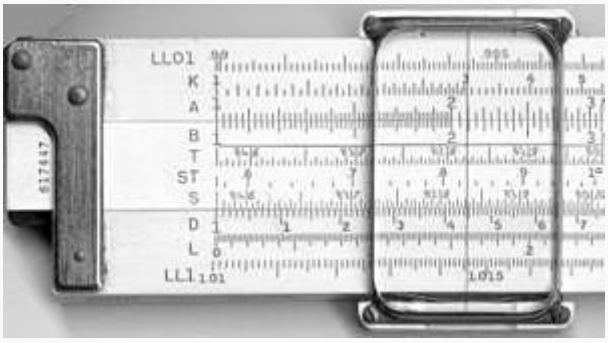
Roger (2002), in his article about the slide rule as an example of Mechanical Analog, says that, in its most basic form, the slide rule uses two logarithmic scales to allow rapid multiplication and division of numbers. These common operations can be time-consuming and error-prone when done on paper. Maor (2009), further says that, slide rules allow other calculations, such as square roots, exponentials, logarithms, and trigonometric function. Slide Rule is an internet tool that offer online courses to both students and teachers to advance themselves. The Slide Rule offer online courses such as Arts and Design, Business and Economics, Computers and Technology, Crafts and Hobby,

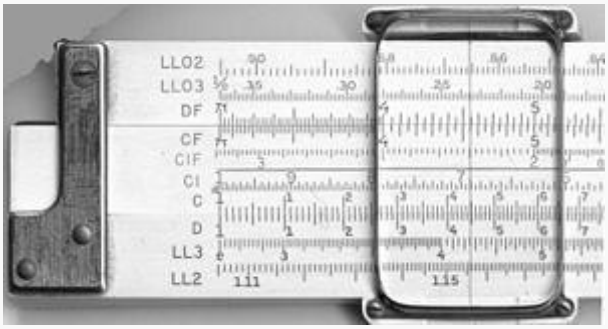
Education, Engineering, Health and Medicine, Humanities, Language and Communication, Law, Math and Science, Self improvement. The tool is provided by Big Data University, Code School. (Sweden & Ferro 2007).



Harry (2009), says that slide rule is positioned to yield several values: From C scale to D scale (multiply by 2), from D scale to C scale (divide by 2), A and B scales (multiply and divide by 4), A and D scales (squares and square roots).

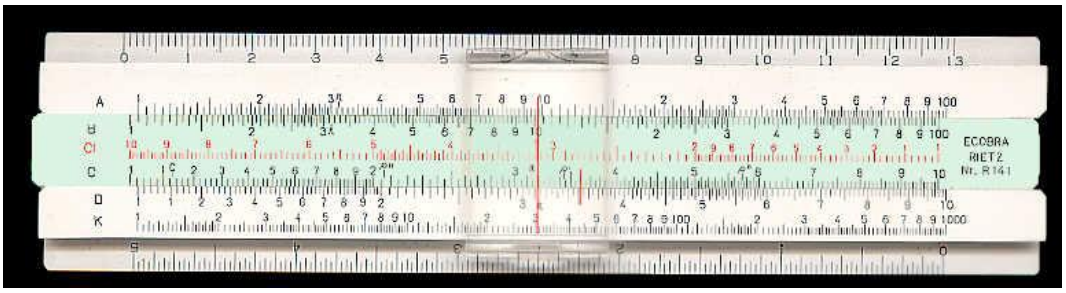
Ln a linear scale, used along with the C and D scales for finding natural (base e) logarithms and e^x





The scales on the front and back of a Keuffel and Esser (K&E) 4081-3 slide rule.

SOURCE: INTERNATIONAL MAP INSTRUCTIONS PRICES



The modern slide rule by RON Monley (2015).

2.10. Internet – Based Learning Tools use in Senior Secondary School in Kaduna State.

Technology and education are pretty intertwined these days and nearly every teacher has a few favorite tech tools that make doing his or her job and connecting with students a little bit easier and more fun for all involved. The Senior Secondary Schools in Kaduna State use some these education platforms as mentioned above. Those used by the Senior Secondary Schools in Kaduna State for teaching of Biology includes:.

2.10.1 Encarta Premium: The Secondary schools in Kaduna State use the Encarta Premium to teach some concepts in Biology. The Encarta premium consists of Encarta cyclopedia, Encarta dictionary, different subjects, and educational games for all school levels. The dictionary is used by the teachers to explain the meaning of words introduced in concept, while the encyclopedia is used by the teachers in Kaduna State for lesson notes and assignments. The games for Biology by the Encarta for quizzes, as well as study guide. The Encarta Premium assist the teachers in developing their lesson notes, and is recommended for teachers and students self improvement. The students can use the tool for their assignments and personal study.

2.10.2. Wikipedia: The Wikipedia is internet tool that also assist teachers to prepare for their biology lesson effectively by providing them with the necessary information required. Student's also use the tool for their assignments and personal study. Topics like respiration in plants and animals, carbon cycle, nitrogen cycle, concepts of types of association. They have similar services

with the Encarta premium. New information is posted by these tools on every hour basis. The secondary schools in Kaduna State are utilizing the tools effectively for their teaching of Biology; the tool also provides pictures, and maps that are used to illustrate while teaching. The maps are used for ecology largely. Wikipedia is a tool that provides information for all levels of education. It is effective for personal study, research, and introduction of new concept by the teacher to the student.

2.10.3. Google Scholar: The tool provides Animation, motion pictures, simulation etc, the biology teachers in Kaduna State uses this tool to teach biology, the tool is suitable for all the biology topics. The teachers also use the tool for their lesson notes and self development. The Google scholar is a tool that provides information, maps, pictures, Animation etc. The teachers in Kaduna State do not directly use the tool in the classroom, the biology information from the Google scholar is downloaded, edited by the teachers and develop into lesson notes in total agreement with the Nigerian Biology curriculum. The Animation is downloaded edited and develop into software for the classroom instruction. Topics taught using the Google scholar includes respiration, digestion, reproduction and the food chain. The students also are advice to visit Google scholar for more information, assignments, and research work.

2.10.4 Skype: Is usually used for interactive learning, and is good for demonstration method of teaching where the students' watch live how experimentation is carried out live by experts in the biology field across the globe. The teacher's in Kaduna State use the Skype for information and learning of new methods in biology practical's and teaching, the Skype is occasionally used for students viewing. The tool is commonly used in the private schools in Kaduna State. It is also a good medium for collaborative learning; student's accessed the tool from their mobile phones for their home work and individual study.

2.10.5 Khan Academy: According to Thompson (2011), the Academy provides lectures live for both the teachers and students, it provide animation, pictures, simulation, questions and answers, either questions raised by the Academy or answers of questions raised by individual students. The Academy provides lessons for teachers in all fields of Biology to develop them and improve the quality of their teaching. Some of the senior secondary schools in Kaduna State download the information as soft ware, which is edited before the transmission to the students. Khan Academy is one of the most reliable tools any Biology teacher can use. Just like the Google Scholar Khan Academy provides online learning opportunity for teachers and students to upgrade themselves and is free of charge. Khan while stressing the importance of the tool emphasis that use of video in teaching is relevant to educational achievement. The Khan Academy provides videos and different types of Animation to support all topics in Biology teaching and learning. The videos and Animation are downloaded and develop as software by the teachers in Kaduna State.

2.11. Empirical Studies

A recent quasi experimental study carried out by Woehle and Quinn (2009) compared the achievements of graduate students in a face – to – face class to that of students in a distance education class. 44 students participated in two classes of similar size with the same instructor. One class used the face – to – face Web – enhanced delivery. The other class was delivered using the ITV and asynchronous methods. The researcher used students' record to obtain predictive information about age, grade point average, the reliability c0rrelation co efficient was r = 0.67 which is significant and valid for the research premises. The two groups were basically the same on predictor variables, and the researchers found no statistically significant differences on the dependent variable. This study is similar to the present study as both studies are talking about internet based learning as a tool. The study used the quasi experimental to compare the traditional classroom and the virtual classroom. The above study used graduate students while the present

study used the senior secondary school students. The study used experimental methods between two groups control and experimental group with five research questions and five hypotheses.

Francisca Aladejana (2008) studied Blended Learning and Improved Biology Teaching in the Nigerian Secondary Schools, the studied focused on the Senior Secondary School two (SS11) Biology students and their teachers. 312 students and 75 teachers randomly selected were used, the study predicated on the theoretical frame work of constructivism. The research design used were descriptive survey and experimental with co – efficient of r = 0.92. 15 item questionnaires were designed to access ICT literacy skills of both teachers and students. The study suggested that the use of blended learning can make a significant differences in the performance of learners compared to when traditional chalk and talk approach to teaching was used. Sample the results for the experiment of the groups which was used to determine if there is any significant performance of learners when exposed to the traditional approach and those exposed to blended learning with ICT, is as follows:

Pre Test Result

G scores	n	X	Stds Dev	df	T_{cal}	T_{cal}
H_1 exp group	156	10.6	3.75	310	$*_{1.04}$	
H_2 control group	156	114	2.69			2021

Post Test Result

Group scores	n	X	Students Dev	df	T_{cal}	T_{cal}
H_1 experimental group	156	18.6	2.70	310	$**_{6.48}$	2021

H_2 control group	156	14.4	2.59			

The study is related to this research because the present study is interested in finding out the value and effectiveness of Internet based learning tools on teaching and learning of Biology in secondary schools, both studies have the same delimitations, and combination of Internet Based learning tools and Biology as blended type of learning. The Present study is particular studying the North West geo political zone while the above studied the whole secondary schools in Nigeria. The above study investigated on the ICT literacy skills of teachers, availability of ICT facilities in secondary schools, the present study is particular about the effectiveness integration of Internet based learning tools on the teaching and learning of Biology in the Kaduna State.

Bhiang & Thomas, (2006) conducted a study on the Effect of Web – Based Learning Environment on Students Motivation in Sciences in high school. The study was conducted within the context of four years design – based research project. A purpose sampling method was employed to promote learners motivation and learning achievement through close work with the science teacher and his students. The participants included one male teacher and 27 students constituting two science classes, classroom observation and students interviews focused on 12 students, six from each class. Bloom's taxonomy was used as the theoretical frame work for the study. The topic fossilization encompassed a three day learning lesson. The teacher distributed the assignments requiring critical thinking abilities on the first day, and the students had to use the web based learning tool to solve the problems within three days. the correlation co efficient was r = 0.60 which was quiet significant for the instruments validity.

Students interacted with the WEBLE to select organisms, an ecological condition and a physical burial, the students then witnessed the results of these three decisions to see whether or not the

fossil would develop. Autonomy was given to the students by the teacher who played the role of the facilitator. Most students as reported appear to remain focus on the assignment. Multiple t – test were used to analyze maximum amount of information possible. According to the result of the study, the result was that the hypotheses as to the ability of the students to use computers were accepted, while the performance ability of the students was also accepted.

The study is related to the present in terms of the Web based learning towards enhancing education and Biology as a field of science, fossilization is also a topic in biology as in other science subjects. The above study used the high school students which is equivalent to secondary school students which the present study is using. The present study is also using two biology classrooms for it quasi experimental research and observation scheduled. This study used Bloom's taxonomy as it theoretical frame while the present study is using constructivism.

Bodzin, Williamson & Price (2002) conducted a research on Learning Biology with a Web Enhanced Curriculum, the study was a formative evaluation study on anew basal Biology curriculum for ninth and tenth grade students, that integrates the World Wide Web with a short topic oriented textbook. The curriculum is based on the National Education Standard and emphasizes an active, constructivist learning program that integrates interactive, Web Base instructional media and inquiry based program of "wet" labs and field work. The evaluation program focuses on the effectiveness of integrating Web Based instruction into the Biology curriculum, both in terms of helping the students to learn and helping teachers to teach. A battery of methods of instruments were used, which include the AAAS criteria for evaluating instructional support, usability analysis, Attitude measures, content knowledge assessment, interview with students and teachers, students response journals and computer experience questionnaire. The pilot study conducted validate the suitability of the instruments used, the correlation co efficient was r = 0.85 Forty two Biology teachers selected through stratified sample from Alaska and Hawaii. 783 students were also used.

The evaluation team conducted classroom field observations. The recommendations resulted in the modifications of websites features and the development of new interactivities.

This study is related to the present study because teachers proficiency on ICT is one accept that will assist the present study in finding out how ICT is blended with Biology and how it has impacted on the performance of the students. Another accepts is that both study are related as science subjects including Biology are the main area of interest. Students and teachers noted they were frequently confused over the purpose of some activities, particularly the longer, multi part interactivities. The present study is studying a large population which includes both teachers and students in Kaduna state, Nigeria and is also employing mainly questionnaires, and is concentrating on Biology teachers and Students, and is based on constructive reasoning.

Drent & Melissen (2007) conducted a study about factors which stimulates or limit the innovative use of ICT by teacher's educators in the Netherlands. The study used questionnaires for 210 teachers and interviews for 4 teachers of those teachers who have responded. Their findings showed that several factors such as a student – oriented pedagogical approach, a positive ICT attitude, computer experience and personal entrepreneurship of the teacher educator have a direct positive influence on the innovative use of ICT by the teacher. The study was descriptive type of research, five Linkert scale was used with a reliability co efficient of r = 0.69 was used for the study. Part of the questions in the questionnaire was how do teachers develop their soft wares for lessons taught, options were (a) I developed my soft ware,(b) through the use of Internet Plat forms, (c) purchase from book stores (d) do not use soft wares. (e) none of the above.

The research is related to the present study also because the present study is also trying to find out the value and effectiveness of internet based learning tools on the teaching and learning of Biology in senior secondary schools, teachers interest and proficiency is one of the factors the study intends to use, the availability of Internet infrastructures which motivates both the teachers and

students to the use of Internet based learning tools to improve teaching and learning. The present study is only interested in Biology teachers and students and the value and effectiveness of Internet based learning tools in the teaching and learning of Biology in senior secondary schools in Kaduna State.

The present study is focusing on the secondary schools in North West geo political zone, while the above study was carried out in Netherlands. The above study used questionnaire and interviews for its data collection while the present study is using questionnaires for teachers and students, interviews and experimental method for the Students. The present study is using both teachers and students using a larger population for the study. The above mentioned study is only limited to teachers and ICT while the present study is on the value and effectiveness of Internet Based Learning Tools for teaching and learning of Biology in Senior Secondary Schools in the North West zone of Nigeria. This study is similar to present as both studies are concerned with ICT integration in education.

Baylor & Ritchie (2002) carried out a qualitative study that looks at the factors facilitating teacher skill, teacher morale and perceived student learning in technology – using classrooms with a reliability co efficient of r = 0.70. They found that professional development has a significant influence on how well Internet is embraced in the classroom. Also added that, teachers training program often focus more on basic literacy skills and less on the integrated use of Internet based learning tools in teaching. Despite the numerous plans to use technology in schools, however teachers have received little training in this area in their teacher program. When technology is introduced into teacher education programs emphasis is often on teaching about technology instead of teaching with technology. The study suggested that teachers should be given the opportunities to practice using technology during their teacher training programs so that they can see ways in which technology can be used to augment their classroom activities. Questionnaires were used, and 25 questions were raised, one of the questions was how efficient are the teachers

in computer education? how often do they use integrate ICT in their teaching? Teachers efficiency in Computer Education, most of the teachers used for the study were inefficient, the hypothesis was rejected, while the frequent integration of ICT in their teaching, the hypotheses was also rejected

The study is related to present study as both studies are interested on the integration of Internet based learning tools in classroom activities; teacher's proficiency in ICT is one factor that could improve both teaching and learning of Biology in Senior Secondary Schools, the teacher is the classroom manager and needs to guide the students and also gain the confidence and respect of his/her students, and the internet based learning tools is a branch of the ICT (the major branch). The present study is to find out the effectiveness of internet based learning tools on the teaching and learning of Biology. The present study is experimental design while the above mentioned study is a qualitative study; the above study limited itself only on the application of internet based learning tools in classroom not associated to any particular subject discipline, while the present research is on Biology and its different fields. The above study used teachers only, while the present study is concerned with both teachers and students' of Biology in senior secondary schools in Kaduna State. The present study concentrated on the students as the recipient and beneficiaries of end product of the learning out comes.

The effect of e – learning in teaching and learning of mathematics in schools argued as being necessary for school effectiveness. According the study conducted by the intel project in GJSS Jabbi town Abuja for the proof of concept (POC). The study took three months, the result revealed that students improve in their academic performance as measured against previous performance, according to their findings it is necessary to improve curriculum and provide digital content and teacher training. Also the Intel project provides students and teachers with the ability to access the internet safely and use interactive content. E – Learning practices promoted equal educational opportunities and gave all students the chance to bridge the digital device. Students' motivation

and performance increased with corresponding decrease in absentees from school. Teachers now prepare their lesson note for the 14 weeks of the term on their laptops and submit their examination question in soft copies. The Intel project is related to the present study, because the two studies are concerned about integration of ICT in teaching and learning. The present is concerned about the use of the Internet – Based Learning Tools for enhancing teaching and learning, the study used only the senior secondary schools in Kaduna State and the study is only concerned with Biology as a subject.

Liverpool, Marut, & Ndam (2009) from their findings of the INTEL project, said that students became more independent through participation in a systematic collaborative work. The similarities with this dissertation are that both studies are particular about employing the use of Internet tools in improving the teaching and learning of Biology and mathematics. e – Learning is an internet based learning tool that can also be incorporated to enhance the quality of teaching and learning. The study used experimental design of research as well as survey. For the survey researcher questionnaire containing 10 questions were raised to find out the students opinion on the use ICT for their collaborative work. Majorities were of the opinion that ICT and learning should be integrated permanently in teaching Biology and Mathematics. One of the parameters also used to assess frequency in classroom attendance show significant improvement. The above research concentrated on one secondary school, the present research is studying the senior secondary .schools in Kaduna State. The present study limited it scope to Biology as a Subject and to experimental research design only.

Esharena and Emperor (2008) researched on barriers to the successful integration of ICT; the study was carried out based on the importance of ICT in the society and possible in the future of Nigerian Education, identifying the possible obstacles to the integration of these technologies in schools would be an important step in improving the quality of teaching and learning. In its findings the study classified those identified barriers into extrinsic and intrinsic barriers to teacher's use of ICT

in science classroom. Another classification also found is the teacher – level barriers versus school – level barriers. The study also presents another perspective, the obstacles as pertaining to 2 kinds of conditions which are material and non material. The material conditions may be insufficient number of computers or copies of software, while the non material include teacher insufficient ICT knowledge and skills, the difficulty of integrating ICT in instruction, and insufficient teacher time. The study suggested that educators, teachers and school principals needs to collaborate and overcome any of the obstacles and break down the above mentioned barriers to the meaningful integration of ICT into teaching and learning sciences. The low rate of ICT adoption and application in Nigerian secondary schools is attributable to several factors. The study is based on a survey of factors associated with low ICT application in Nigerian secondary schools, as perceived by 176 people in two states of Nigeria: 9 schools in Edo State with 84 respondents and 6 schools in Delta State with 92 respondents. Of the 176 teachers, 97 were male and 77 female. The study settings and subjects were selected through purposive sampling methods.

Causes of level ICT application	No.	Percent
Limited/poor information infrastructure	112	64
Lack of/inadequate inadequate ICT facilities in schools	108	61
Frequent electricity interruption	101	57
Non integration into the school curriculum	98	56
Poor ICT policy/project implementation strategy	94	63
Inadequate ICT manpower in the schools	91	52
High cost of ICT facilities/components	83	47
Limited school budget	78	44
Lack of/limited ICT skills among teachers	71	40
Lack of/poor perception of ICTs among teachers and administrators	70	40
Inadequate educational software	62	35
Poor management on the parts of school administrators and government	5	3
Lack of maintenance culture	3	2
Lack of interest in ICT application/use on the part of students	1	1

N = 176

The study is related to the present study because both studies are interested in the effective, teaching and learning of sciences in secondary schools with ICT integration, the impact ICT has on the improvement of teaching and learning of sciences. Though the above study was more particular about the obstacles hindering the proper application of ICT in teaching of sciences, the present study is investigating the effectiveness of internet based learning tools in the teaching and learning of Biology in senior secondary schools in Kaduna State.

Yusuf, Mudasiru Olalere; Afolabi, Adedeji Olufemi: In their study investigated the effects of computer assisted instruction (CAI) on secondary school students' performance in biology. Also, the influence of gender on the performance of students exposed to CAI in individualized or cooperative learning settings package was examined. The research was a quasi experimental involving a 3 x 2 factorial design. The sample for the study comprised 120 first year senior secondary school students (SSS I) sampled from three private secondary schools, in Oyo State, Nigeria. The students' pre-test and post test scores were subjected to Analysis of Covariance (ANCOVA). The findings of the study showed that the performance of students exposed to CAI either individually or cooperatively were better than their counterparts exposed to the conventional classroom instruction. However, no significant difference existed in the performance of male and female students exposed to CAI in either individual or cooperative settings. Based on the research findings recommendations were made on the need to develop relevant CAI packages for teaching biology in Nigerian secondary schools.

2.12 Summary

Chapter two reviews the literature of topics raised in chapter that will assist the researcher in the studies. Some of the literatures reviewed will assist the research in making conclusion and recommendations. The Nigerian policies on the use of ICT in Secondary schools in Nigeria, early use of ICT in Nigeria, the Internet, and history of the internet were reviewed in this chapter. Others also reviewed are the internet learning tools that provides information on Biology those internets – based learning tools used by the secondary schools in Kaduna State and Empirical studies was also carried out.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter highlights procedures and techniques to be used in the conduct of the study, the chapter will discuss topical issues such as research design, population sample and sampling technique, instrumentation, pilot study, validity and reliability of the instrument, procedure for data collection as well as procedure for data analysis. It is intended that this chapter would provide a thorough understanding of the technicalities involved in the study.

3.2 Research Design

The research design used for this study is the experimental research design. Here, the Pretest-Post-test was conducted using the Biology achievement test which was adopted from WEAC past question papers of 2010, 2011, and 2012 respectively. Four schools were used; two schools from the urban areas while two from the rural areas. One of the schools is boys only while the other one is girls only used for the experiment to find answers to gender issues In this design, two groups were used viz:- the experimental group and the control group, represented as E and C respectively. Using X to represent the treatment that was given to the experimental group (E), and Y the test variables the diagrammatic presentation of the study was as follows:

E	$= Y_1$	X	Y_2
C	$= Y_3$	0	Y_4

Figure 3.2

Key: E - Experimental group

C - Control group

X - Treatment

0 - No Treatment

Y - Test Variable.

Here, Y_1 and Y_2 are the initial measurements (pretest). The X indicates that the treatment variable to the experimental group E. The absence of X in the second line in the design shows no treatment was applied to the control group C. Y_3 and Y_4 are the final measurements or post test scores of the experimental group E (Y_1) and the control group C Y_2.

3.3 Population

The targeted population for this study comprised of senior secondary school Biology students (SS2 Biology students) in Kaduna State. The choice of this population is informed by the fact that they are not new to the learning of Biology and are not preoccupied with external examination preparations. The classes were learning Biology using internet. They are totaling 3,589 as at 2014 according to Kaduna state Ministry of education. The students' distribution according to local government is presented in table at Appendix B.

3.4 Sample and Sampling Techniques

The sample size was determined by the actual number of those subjects that were present at the commencement and completion of the study session, In all 100 SS 2 Biology students were involved in the study, the number of the selected sampled students was as a result of the number of

efficient, adequate computers capable to undertake the experiments and as well as the numbers of computers with the internet access, and at the end of the study period (the sample size was reported at the end of the study. Two of the schools were designated as experimental group while the other two as control group. The purposive sampling technique was used in selecting the sample size. The procedure is such that the variables for the study would be considered in the course of the selection process. For this two schools were from urban centers while the other two from the rural, the selection was done in such a way that gender difference, school type and subject combination were considered.

3.5 Instrumentation

The Biology achievement test was used to collect data for both pre – test and post –tests. Questions were both adopted and adapted from WEAC questions of 2010, 2011 and 2012 respectively on the topic respiration. For the experimental group they were assigned computer each, 5 minutes was given to the students to settle down and get themselves acquitted to the computers. The computers used in both schools were networked with central printer, questions were sent out to the computers for the students to answer, and one hour was allotted. The procedure was explained to the students, the topic respiration was written on the board, the students were asked to put on their computers while khan academy was connected to their computers. The students were able to listen to the insruction on their individual computers. The attention was satisfactory, no response to distraction and there was concentration from all the students. Students were told to write down their questions which were entertained at the end of the lesson. Questions in Annex C were sent out as post test questions which were answered by the students on their computers.

3.5.1 Validation of the Instruments

The Biology Achievement Test Instruments was subjected to scrutiny and assessment by an array of Biology scholars; including the Research Supervisors, Senior colleagues in the field of Biology and Senior Research Fellows at the NERDC, Kaduna Branch, and having made the useful corrections and suggestions, which were duly effected by the researcher, the instruments were adjudged to have met content and face validity for the type of study at hand. This attested to by the ease and timely response of the sampled participants in the course of pilot and the study in general.

3.5.2 Pilot Study

The Pilot Study was conducted immediately after the proposed achievement test instruments had been scrutinized and accepted by the faculty experts in educational measurements and evaluation. The Pilot Study was conducted in Nigeria Air Force Secondary School, Air Force Base Kawo Kaduna and Kaduna State Secondary School Air Force Base Kawo Kaduna. The Nigerian Air Force Secondary School was used as the Experimental Group while the Kaduna State Secondary School was used as Control Group. It involved 25 senior secondary students each from Arts and Science Classes with the combination of both male and female Biology Students. The study was conducted from 1^{st} – 3^{rd} February 2015 after being taught Four times (4x) with the same Instrument for both experimental and control group respectively by the researcher.

The result of the pilot study was very encouraging and an indication that the study was viable, interesting and stimulating, touching the heart of the education system. The enthusiasm, curiosity exhibited by the participants and their teachers was positive, pointing to the suitability of the Instruments for the study at hand.

3.5.3 Reliability of the Instrument

The data collected from the pilot study was subjected to test and pre-test in order to determine the reliability of the instrument to be needed in the study. Here, the Pearson product moment

correlation coefficient (PPMC) was used to determine the instruments reliability index. This gave r =0.79 reliability index.

These reliability co-efficient was considered adequate for the internal consistencies of the instruments. This was a confirmation of test of reliability which according to Spiegel M (1992), and Stevens, J (1996*).* According to them an instrument is considered reliable if it lies between 0 and 1, and that the closer the calculated reliability coefficient is to zero, the less reliable is the instrument, and the closer the calculated reliability co-efficient is to 1, the more reliable is the instrument.

This therefore confirms the reliability of the instrument used as fit for the pilot study is quiet adequate. The calculation is at Appendix C

3.6 Procedure for Data Collection

Experimentation is the research design for the study using pre and post method and comparative analysis between the traditional teaching method and those taught using the Internet –Based Learning Tools in order to determine the effectiveness of the tool, others include gender differences, school location, school type and subject combination. The Data was collected directly from the sample schools after being taught six times by the researcher using some of the Internet Learning Tool. After the introduction of the lesson, during the presentation of the lesson the students were asked to name all the organs involved in human respiration and their responsibilities. The students were later informed that the process of respiration will be explained fully to them with Animation from Khan Academy as one of the internet learning tools. The program is played directly, the students were very attentive and majorities were taking notes. At the end of the program the students were asked to ask questions from areas not clear or areas where further explanations were needed. Some questions were posted to their personal computers were posted to answer as part of the lesson evaluation. Most of the schools their computers are networked for transfer of documents from the students to the teacher. In schools

were the computers are not Networked questions were written on the board and the students answer them on their computers and are printed via the central printer.

3.7.1 Timeline for Data Collection

Table 3.1 Timeline for the Administration of the Instruments

Date	School	Duration	Periods	Time	Activity	Audience
6 – 9 February 2015	GSS B/Gwari	3 days	2 periods daily	9.00am – 11.00am and 12noon – 2.00pm	Instructions	Students
11 – 13	Command Secondary School Jaji	3 days	2 periods daily	8.00am – 10am and 12noon – 2.00pm	Instruction	Students
15 – 18	GGSS Soba	3 days	2 periods daily	8.30am – 1030am and 11.00 – 1.00pm	Instructions	Students
20 – 23	Zamani College Kaduna	3 days	2 periods daily	8.00am – 10.30am and 12noon – 1.30pm	Instructions	Students

3.8 Procedure for Data Analysis

The instrument that was administered was collected and processed by scoring and tallying. The Biology achievement test was scored using the figures attached to respective responses as the instrument prescribed. The responses was processed (Coded), and analyzed. First the descriptive statistics, means, mean gain and standard deviation were used to answer research questions. The t – test was used to compare the result and determine the homogeneity of the data that was collected and the groups used for the study.

As the study is purely experimental the T – test statistic was used to analyze the Data collected and the tables were used to test study variables association and attributions to the effectiveness of the Internet – Based Learning Tools in the teaching of Biology in Senior Secondary Schools in Kaduna State, Nigeria. In line with other educational studies, the 0.05 level of significance (a) and degree of freedom were used to determine critical or table values. The critical or table value were used to compare with calculated values in order to arrive at statistical decisions, as informed by different statistics decisions.

CHPATER FOUR

RESULTS AND DISCUSIONS

4.1 Introduction

Four secondary schools from different local government areas of Kaduna state were used, and divided into control and experimental group of 50 each. The number of participants was as a result of the number of efficient and able computers in the school and those that can access the internet. They were made up of male and female from rural and urban settings of the state with equal number from public and private secondary schools. Their orientation was categorized into subject combinations for art and sciences. Academic performance tests for effectiveness of internet – based learning tools for teaching Biology in senior secondary schools was conducted before and after the experimental group were exposed to the use of the internet – based learning tools. The scores for the academic performance were based on 100%. This would mean that the average performance would be 50%. The performance data were analyzed with the Statistical package for the Social Sciences and presented by the respective objectives and hypotheses along with discussion below.

4.2 Responses

One of the specific objectives of the study is to determine the effect of Internet-Based Learning Tools in the teaching of Biology on the Performance of Senior Secondary School Students in Kaduna State. The related research question for assessing the objective is stated as follows:

Research Questions one: How can the Internet – Based Learning Tools affects the performance of Senior Secondary School Student's in Biology in Kaduna State?

The determination of the effectiveness of Internet-Based Learning Tools on the Performance of Senior Secondary School Students was evaluated by comparing the pre-test and post-test scores of the two groups (experimental and control). The computed scores obtained are summarized in Table 4.1.

Table 4.1: Mean performance of the two groups before and after the experiment.

Status	Stages	N	Mean	Std. Deviation	Std. Error
Control	Pre-test	50	45.13	4.882	0.690
	Post-test	50	65.42	5.313	0.751
Experimental	Pre-test	50	57.89	19.559	2.766
	Post-test	50	73.83	15.942	2.255

The mean scores in the table revealed that performances of both groups improved after the experiment. But among the experimental group that was exposed to the use of the Internet-Based Learning Tools, the improvement was relatively higher. The scores before the experiment were 45.13±4.882 and 57.89±19.559 for the control and experimental groups but after the experiment the performances rose to 64.42±5.313 and 73.83±15.942 for the two groups respectively. From these observations, the use of the Internet – Based Learning Tools could be said to be effective for the teaching of Biology among the secondary school students. The actual significance of this observed variability in the efficacy of the two methods is tested in the related hypothesis.

Research Questions two: Are there any gender differences in the performance of students taught Biology using Internet – Based Learning Tools in Kaduna State?

To find out the impact of Internet – Based Tools on Performance of the Senior Secondary School Students taught Biology Internet-Based Learning Tools with respect to gender, the mean t performance for the male and female students were computed and compared along with that obtained by the group in the pretest scores. Table 4.2 present the summary of the performances.

Table 4.2: Variability in performances of male and female students taught Biology with Internet-Based Learning Tools before and after the experiment.

Stages of the experiment	Gender	N	Mean	Std. Deviation.	Std. Error
Pre	Male	38	76.11	9.073	2.619
	Female	12	52.13	18.453	2.993
Post	Male	38	88.97	7.841	2.264
	Female	12	69.05	14.849	2.409

From the observed mean scores in the table, there was a notable variability in the performances of the male and female students before and after the experiment. Both groups could be said to have improved in performances after the experiment. In the table the performances of the male improved from 76.11±9.073 before the exposition to the use of the Internet-Based Learning Too to 88.97±7.841 after the experiment. The Female on their part increased their performance from 52.13±18.453 to 69.05±14.849 after the experiment. This is a clear indication that the experiment generally improved the performances of the male and female students exposed to the use of the Biology Internet-Based Learning Tools or teaching the subject. From the mean score, the male could be said to have a higher performance than their female counterparts in the group. The observed variability in the means is subjected to test of significance in the related hypothesis.

Research Questions three: Are there any differences in the performance pf students from urban and rural centers taught Biology using the Internet – Based Learning Tools in Kaduna State?

In examining the extent to which Internet-Based Learning Tools affect Senior Secondary School Students' Performance in Biology as a result of school location (urban and rural) difference in Kaduna State, Performances of student in the experimental before and after their exposure to the use of the Internet – Based Learning Tools for teaching the subject were computed and compared by the locations. The summary of the performances of the two groups is presented in Table 4.3.

Table 4.3: Variability in performances of urban and rural students exposed to the use of Internet – Based Learning Tools for teaching Biology

Stages of the experiment	Location	N	Mean	Std. Deviation	Std. Error
Pre	Rural	25	39.74	5.202	1.040
	Urban	25	76.04	8.238	1.648
Post	Rural	25	59.10	4.274	0.855
	Urban	25	88.56	6.980	1.396

The table shows that the students from urban locations tended to have better performances before and after the experiment. This is indicated in the table with an increase mean score of 76.04±8.238 before the experiment to 88.56±6.980 after the exposition to the use of the Internet based tools for teaching the subject. Some of the students from rural areas their performance was below 50.0% before the exposure but it rose from 39.74±5.202 to 59.10±4.274 after the experiment. The mean scores imply that the use of the tools could be effective for the teaching of the subject in the two locations. However, the urban students

showed a higher effect of the tools on their performance. For the establishment of the significance of the difference, the related hypothesis was used.

Research Questions four: Are there differences in the performance of students from private and public schools taught Biology using the Internet-Based Learning Tools in Kaduna state?

The result was conducted by computing the mean performance scores of the experimental group before and after the experiment. The computed mean scores were then compared based on the school type in terms of ownership (public and private). A summary of the mean scores are presented in Table 4.4.

Table 4.4: Mean scores of public and private school students exposed to the use of the Internet based tools before and after the experiment

Stages of the experiment	Type of school	N	Mean	Std. Deviation	Std. Error
Pre-test	Public	25	48.24	17.061	3.412
	Private	25	67.54	17.202	3.440
Post-test	Public	25	65.30	11.858	2.372
	Private	25	82.36	15.059	3.012

The mean scores in the table showed that private schools in the group had a relatively higher performance before and after the experiment. Their performance increased from 67.54±17.202 to 82.36±15.059 after the experiment. Students in the public schools ha their performance increased from 48.24±17.061 to 65.30±11.858 after the experiment. This would mean that the use of the Internet based learning tool improved the performances of the two groups in the process of the experiment. Though the groups differed in their performances but the efficacy of the Internet

based learning tools is proved to enhance their performances. The observed variability in the mean scores of the two groups is tested in the related hypothesis.

Research Questions five: Does the use Internet – Based Learning Tools affect the performance of Students of different subjects combination in Biology in Kaduna State?

To determine the extent to which the use of the Internet-Based Learning Tools affected Students' Performance in Biology with regards to subject combinations. The students were classified into two groups for arts and sciences. The computed mean scores were then compared based on the subject combination for arts and science students in the group. A summary of the mean scores are presented in Table 4.5.

Table 4.5: Mean scores of Art and Science students exposed to the use of the Internet based tools before and after the experiment

Stages of the experiment	Subjects	N	Mean	Std. Deviation.	Std. Error
Pre-test	Arts	25	59.06	19.529	3.906
	Sciences	25	56.72	19.921	3.984
Post-test	Arts	25	73.37	14.877	2.975
	Sciences	25	74.28	17.238	3.448

The observation of the mean scores in the table is that both groups performedat relatively equal levels before and after the experiment. For Arts students, performance increased from 59.06±19.529before exposure to the use of the Internet based learning tools to 73.37±14.877 after the experiment. Science students in the experiment improved their score from 56.72±19.921

before the exposure to 74.28±17.238 after the exposure. The two groups were however proportional in the improvement of their performances. The observations could imply that there is no much difference in the performances of the students with respect to their subjects' combinations. The observed variability in the mean scores was however subjected to significant test in the related hypothesis.

4.3 Test of hypotheses

The null hypotheses formulated in line with the objectives and research questions of the study are tested here at a fixed probability level of significance of 0.05. The hypotheses are tested with the two sample t-test procedure as follows:

Hypotheses I: There is no significant difference between performances of students taught Biology with traditional method and Internet based learning Tools among senior secondary school students in Kaduna State.

This hypothesis tested the observed variability in the mean scores of students in the control (taught with conventional method) and experimental group (taught same subject with the Internet based learning tools) after the experiment (Post –test). The test was carried out with the two sample t-test procedure because of the two groups involved. A summary of the result is presented in Table 4.6.

Table 4.6: taught with Internet Two sample t-test on performance in Biology between students of control group and those in the experimental based learning tools.

Status	N	Mean	Std. Deviation	Std. Error	t-value	DF	P-value
Control	50	65.42	5.313	.751	3.539	98	.001
Experimental	50	73.83	15.942	2.255			

(t-critical at 98 DF = 1.98 at 0.05 level of significance)

The test as indicated in the table revealed that the students differ significantly in their performance by the method used in teaching them the subject (P > 0.05). The t-value observed in the test at the 98 degree of freedom (DF) is higher than the critical value of 1.98 and the observed probability level of significance is 0.001. With these observations, there is enough evidence to reject the null hypothesis. The null hypothesis that there is no significant difference between performances of students taught Biology with traditional method and Internet based learning Tools among senior secondary school students in Kaduna State is therefore rejected. In other words, the use of Internet based learning tools is more effective for teaching biology than the conventional method of teaching the subject at the Senior Secondary Schools in Kaduna State.

Hypotheses II: There is no significant difference between performances of boys and girls taught Biology with the Internet – Based Learning Tools among senior secondary school students in Kaduna State.

This hypothesis with the post-test performance students in the experimental group who were exposed to the use of Internet based learning tools for teaching Biology applied in the experiment. The hypothesis was tested with the two sample t-test procedure. The result of the test is summarized in Table 4.7.

Table 4.7: Two sample t-test on performance of male and female students taught biology with the Internet Based Learning tools

Gender	N	Mean	Std. Deviation	Std. Error	t-value	DF	P-value
Male	12	88.97	7.841	2.264	4.434	48	.000
Female	38	69.05	14.849	2.409			

(t-critical at 48 DF = 2.02 at 0.05 level of significance)

The test revealed that male and female students differ significantly in their performances after their exposure to the use of the Internet based learning tools in teaching the subject ($P < 0.05$). The observed t-value in the test is 4.343 obtained at the 48 degree of freedom compared with the 2.02 that stands for the critical value at the same degree of freedom. The observed level of significance was 0.000. By this observation, the null hypothesis that there is no significant difference between performances of boys and girls taught Biology with the Internet – Based Learning Tools among senior secondary school students in Kaduna State

could therefore be rejected.

Hypotheses III: There is no significance difference between performance of students from rural location and those from urban location taught Biology with Internet – Based Learning Tools among senior secondary school in Kaduna State.

The performances of the urban and rural based schools after their exposure to the use of the Internet based learning tools were compared here to determine the effect of the school location on the use of the Internet based learning tools for teaching the subject. The two sample t-test was used to determine the significance of the observed difference between the mean performances of the students. The result of the test is summarized in Table 4.8.

Table 4.8: Two sample t-test on performances of rural and urban students taught biology with internet based learning tools.

Location	N	Mean	Std. Deviation	Std. Error	t-value	DF	P-value
Rural	25	59.10	4.274	.855	17.994	48	.000
Urban	25	88.56	6.980	1.3961			

(t-critical at 48 DF = 2.02 at 0.05 level of significance)

The performance of students from urban schools is significantly higher than those of the rural schools as indicated in the table ($P < 0.05$). From the calculated t-value of 17.994 obtained at the 48 degree of freedom (DF) and the observed probability level of 0.000, there is sufficient evidence to reject the null hypothesis. This means that the null hypothesis that there is no significance difference between performance of students from rural location and those from urban location taught Biology with Internet – Based Learning Tools among Senior Secondary School in Kaduna State is therefore rejected.

Hypotheses IV: There is no significant difference between performances of students in private school and public school taught using Internet – Based Learning Tools among senior secondary school in Kaduna State.

The school ownership in terms of private and public school was used as the independent variable of this hypothesis in order to determine the effect on the use of the Internet based learning tools on the students' performance in the subject with respect to school type. The post test scores of the students taught with the Internet based learning tools was used as the dependent variable. The hypothesis was tested with the two sample t-test procedure. The result of the test is summarized in Table 4.9.

Table 4.9: Two sample t-test on performances of public and private schools students taught biology with internet based learning tools.

School Type	N	Mean	Std. Deviation	Std. Error	t-value	DF	P-value
Public	25	65.30	11.858	2.3716	4.449	48	.000
Private	25	82.36	15.059	3.0118			

(t-critical at 48 DF = 2.02 at 0.05 level of significance)

The result reveals that students in the private schools performed significantly better than those in the public schools were taught with the same Internet based learning tools after the experiment ($P < 0.05$). The observed t-value (4.449) obtained in the test at the 48 degree of freedom (DF) is higher than the critical equivalent value of 2.02. The observed level of significance is 0.000. Based on these observations, the null hypothesis could be rejected. Therefore the null hypothesis that there is no significant difference between performances of students in private school and public school taught using Internet – Based Learning Tools among senior secondary school in Kaduna State is thus rejected.

Hypotheses V: The use of Internet – Based Learning Tools has no significant effect on the performance of Senior Secondary Schools Students as a result of Subject combination difference in Biology in Kaduna State.

The subject combinations were categorized into art and science oriented as used in the test of this hypothesis. The aim is to determine the effect of the subject combination on the impact of the Internet based learning tool on the performances of students in teaching of the subject. The hypothesis was tested with the two sample t-test because of the two independent groups involved. The result of the test is summarized in Table 4.10.

Table 4.10: Two sample t-test on performances of arts and science students taught biology with internet based learning tools.

Subjects	N	Mean	Std. Deviation	Std. Error	t-value	DF	P-value
Arts	25	73.372	14.8769	2.9754	0.200	48	.842
Sciences	25	74.284	17.2379	3.4476			

(t-critical at 48 DF = 2.02 at 0.05 level of significance)

No group was found to be significantly different from the other after their exposition to the Internet based learning tools in the experiment (P > 0.05). This is indicated in the table with observed t-value of 0.200 obtained at the 48 degree of freedom (DF). The observed levels of significance in the test is 0.842. With these observations there is no sufficient evidence to reject the null hypothesis. The null hypothesis that there use of Internet – Based Learning Tools has no significant effect on the performance of Senior Secondary Schools Students as a result of Subject combination difference in Biology in Kaduna State is therefore retained. The result of the test revealed that the students' performances cut across the different subjects' combinations.

1. The use of Internet Based Learning Tools for teaching biology has significant improvement on the performances of Senior Secondary School Student's in Kaduna State.

2. The male students have significantly higher performance than female Senior Secondary Schools Student's when taught Biology with Internet – Based Learning Tools.

3. The location of schools has effect on the performances of students when taught biology with Internet – Based Learning Tools in Senior Secondary School of Kaduna State

4. The performances of private schools students more improved upon than their public schools counterparts when taught biology with Internet Based Learning Tools in Senior Secondary Schools of Kaduna State.

5. Subjects' combinations has no significant effect on the use of Internet – Based Learning Tools in improving the performances of students taught biology among Senior Secondary Schools of Kaduna State

4.5 Discussion

This study evaluated effectiveness of Internet – Based Learning Tools for teaching biology in Senior Secondary Schools of Kaduna State by comparing students' performances with that of the conventional method. Five hypotheses were tested in line with the objectives and research questions of the study. In hypothesis I, the performances of the students who were taught biology with the Internet – Based Learning Tools were compared with those in the control group who were taught the same subject with the conventional lecture method. The test revealed that the students who were taught with the Internet – Based Learning Tools performed significantly better than their counterparts who were taught with the conventional lecture method. The null hypothesis was therefore rejected. The finding here is consistent with the report of Mhlolo (2007), who stated that the use of ICT enhances the ability of teachers to teach more effectively and allow the students to learn in more concrete ways. The finding is in line with the report of Mikre (2011) cited in Tinio (2002), where it was stated that ICTs are making dynamic changes in society and that its usage is influencing all aspects of life. Such influences stated in the report are felt more and more at schools

because ICTs provide both students and teachers with more opportunities in adapting learning and teaching to individual needs.

Hypothesis II tested the significance of the variability obtained in the performances of male and female students taught biology with the use of the Internet – Based Learning Tools. The two sample t-test procedure used for the test revealed that the male students differed significantly in their performances when compared with the female counterparts in the group. The null hypothesis was therefore rejected.

Hypothesis III tested difference in the efficacy of the Internet – Based Learning Tools on the students' performances based on the location of their schools. The locations of the schools were categorized into rural and urban. From the result of the two sample t-test conducted, it was found that the students from urban schools had a significantly higher performance when compared with their rural schools' counterparts. The null hypothesis was therefore rejected. This finding reflects the finding of Bhiangand Thomas, (2006) who conducted a study on the Effect of Web – Based Learning Environment on Students Motivation in Sciences in high school. Their result was that the environment have significant influence on the performances of the students involved in the experiment.

The test of null hypothesis IV was aimed at determining the effect of school ownership (public and private) on the efficacy of the Internet – Based Learning Tools for teaching the subject among the state secondary schools. The two sample t-test procedure used for the test revealed that the improvement made on the performances by the students from private schools was significantly higher than was obtained among the public secondary schools. The null hypothesis was therefore rejected.

Null hypothesis V test the effect of the different subject combinations on the use of the Internet – Based Learning Tools for teaching the subject in the state secondary schools. For the

purpose of the test, the subjects' combinations were classified into art and sciences. From the two sample t-test used in the test, no significant difference was observed between the performances of the students of the subject combinations. The improvement obtained from the use of the Internet – Based Learning Tools was found to have cut across all subject combinations by the students. The null hypothesis was therefore retained.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the investigation into the effectiveness of Internet – Based Learning Tools for teaching biology in Senior Secondary Schools of Kaduna State. The chapter will discuss the, Summary, Summary of Major Findings, Conclusions, Recommendations and Suggestions for further studies.

5.2 Summary

This study investigated the effectiveness of Internet – Based Learning Tools for teaching biology in Senior Secondary Schools of Kaduna State. The study is set against the background that data

available from terminal examinations of senior secondary schools students in Kaduna State have not been encouraging. Among others, teachers of the subject have been faced the enormous task of how to get students to fully understand Biology. Many students tended to perceive Biology as too wide and too difficult to comprehend, while the Biology textbooks are too difficult to read and understand. These have contributed to the fluctuating results of students in Biology at NECO and WEAC terminal levels. The application of internet- based learning tools for teaching the subject in Kaduna State Senior Secondary Schools was therefore investigated here towards effective Biology curriculum implementation and enhanced performance of students in the subject at the terminal examinations though an experiment in which the conventional method of teaching the subject is compared with the use of the internet based learning tools. Performance test was administered to the two groups before and after the use of the internet based learning tools. Data collected were analyzed with the Statistical Package for the social Sciences (IBM version 20). The study was structured into five chapters.

In chapter one, the background study was highlighted along with theoretical framework, statement of the problem, the research objectives, questions and hypotheses formulated to establish the statistical significance of the findings. Other aspects of the chapter are significance of the study, Scope. Chapter two featured a review of the related literatures. In chapter three, the methodology employed by in the sample selection for the experiment, the process of the experimentation, the instrument and method of data analysis were stated.Chapter four consisted of the statistical analysis of the data from the experiment. Five null hypotheses were tested along the research objectives and questions. Of the five null hypotheses, four were rejected while one was retained. From the analysis of the data and test of the study's hypotheses, the following major findings were outlined.

Summary of Major Findings

The major findings from the study are itemized below:

1. The use of Internet based learning tools significantly improve the performances of students exposed to their use among secondary schools in Kaduna State..
2. More improvement tended to be enhanced among male students than the female students with the use of the Internet based learning tools for teaching biology in the selected senior secondary schools of Kaduna State.
3. Urban based school students have more and significant enhancement in their performance when exposed to the use of the Internet based learning tool for teaching biology among the selected senior secondary schools.
4. Students from private schools have higher enhancement in their performances when exposed to the use of the internet based learning tools than public school students among the selected Senior Secondary Schools.
5. Subjects' combinations has no significant effect on the improvement of students performances when exposed to the use of Internet based learning tools for the teaching of Biology among Senior Secondary schools in Kaduna State.

5.3 Conclusions

Based on the findings from the result obtained from the experimental data, the researcher concluded as follows:

1. The use of Internet based learning tools are significant effective for improving teaching and learning of Biology in senior secondary schools of Kaduna state especially for improving students' performances.
2. Though the use of the Internet based learning tools have general improvement on performances of students but male tended to have a significant edge over the female students when exposed to the use of the tools.

3. The location of schools have significant effect on the improvement on students performances when taught Biology with the use of Internet based learning tools
4. Private schools students have significantly higher enhancement than public school students when taught biology with Internet based learning tools among the senior secondary schools involved in the study.

5.4 Recommendations

Based on the conclusion drawn on this study the following recommendations are put forward:

1. Greater emphasis should be placed on training teachers to use computers effectively. At the least courses on basic word processing skills and computer vocabulary should be offered. These simple lessons would ease the fears of many teachers. In addition, Kaduna State Government should expose its Secondary School Teachers to workshops and further training that will equip the Teacher's effectively to incorporate the use of internet – based learning tools into their teaching to help improve performance of learners in the Senior Secondary School Biology. It is stated by the NPE that" no school will live above the knowledge of its teachers"

2. Senior Secondary Schools in Kaduna State should develop a long term plan to budget more money for technology, in recognition of its potential benefits especially the public schools in order to ensure that all the Internet facilities and its accessories are easily replaced before Governments Intervention as contingencies. Schools can source legitimate ways to generate revenue internally to accommodate areas the budget is able to cover.

3. Schools in Kaduna State that located in the villages with power supply problems, internet reception problems, big generators as alternative power supply, or other means of power supply should be provided to the schools. Soft wares should be provided to in excess to provide the needed information from the internet. The School Budget should specifically provide funds

for the purchase of Diesel/fuel and soft Ware's. For fairness teachers in rural schools should be given special consideration; they should be more involved in any seminar, further training relating to the use of Internet – Based Learning Tools in teaching and learning of Biology and should be well motivated in order to enhance their performance. Kaduna State Government should ensure that the Budget in rural schools are given more consideration than those in the city who have access to everything. The Joint Admission and Matriculation Board Examination is now Internet Based therefore the need of Kaduna State Government to ensure the rural schools are also in line.

4. The Kaduna State Government and other Education Stake holders in the State should endeavor to provide more computers in its senior secondary schools in order to give opportunity to all students to use the computers without discrimination to gender. Some topics in Biology especially topics in reproduction, or human anatomy could be embarrassing to the female students they should be taught in such a way that the male and female students accommodate them especially in mix schools. Teachers should emphasize the need the reason why such topics need to be taught and why they are taught in that manner and is not associated with immorality. The explanation if done properly will enhance the understanding of both the male and female students and even reduce the misunderstanding that women are inferior.

5. Time Table for Biology for the Art and Science Student in Kaduna State should be harmonized to ensure adequate representation of all the students for the Biology classes as stipulated. Teachers of all disciplines are to ensure that all Biology students are released for their Biology classes at exact time and not delayed this will ensure that all the students are operating on the same frequencies in learning of Biology. All Students offering Biology either from Art class or Science Class should be given same opportunity as Biology students.

5.4.1 Suggestions for Further Studies

This research work has identified some number of research areas for further studies towards the understanding of issues surrounding the Effectiveness of the Internet – Based Learning Tools in Teaching Biology in Senior Secondary Schools in Kaduna State, Nigeria. These include:

1. Enhancing Biology Curriculum Implementation through the use Internet – Based Learning Tools in Public Secondary Schools.

2. Promoting Internet Development and Connectivity in Nigerian Secondary Schools.

3. Student's as victims of Teacher's ignorance in the Internet world.

4. Influence of Internet – Based Learning on Students' Career Choice/ progression

5.4.2 Contribution to Knowledge

The study assessed the Effectiveness of the Internet – Based Learning Tools in the Teaching of Biology in Senior Secondary Schools in Kaduna State, Nigeria. The study looked at how the effectiveness of the Internet – Based Learning Tools has promoted the performance of the students more than the traditional method, whether the location of schools has affected the provision the internet facilities which hinders the application of the tools, whether tool has effect on gender, subject combination of the students in the State. The outcome of the work had generated vital information which if taken advantage of would be very rewarding. Specifically the study had:

1. In line with the objectives and significance of the study, the research work had been able to bring awareness of the existence of these tools to both the teachers, students and school administrators who had never heard of them. Teachers saw the immediate influence the tool has on the students, the interest shown by the students and the effectiveness of the tool towards enhancing better performance by the students in all aspect of learning.

2. The Senior Secondary School Teachers were also motivated and were able to see the more reason why they need to be computer literate. They were able to understand that the Internet – Based Learning Tools will assist them in planning their lesson and as well provide them with adequate teaching materials for proper curriculum implementation without difficulty.
3. The study has also afforded the stake holders of education in Kaduna state to bear in mind that there are a lot of benefits that the Internet can offer to the up liftment of education in the state, and national development and educational sustainability in the state.
4. Recommendations were made for a more proactive approach facilitate effective use of the Internet – Based Learning Tools, and popular participation of the Biology students' and teachers' toward the overall education progress and/advancement of Biology education in Kaduna State

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APPENDIX A

THE NIGERIAN BIOLOGY CURRICULUM

1. concept of living
2. Basic ecological concepts
3. Plants and animal nutrition
4. Conservation of matter/energy
5. Variations and variability
6. Evolution
7. Genetics.

The aims and objectives of the Biology Curriculum syllabus derived from the National policy on education (2004), and specifically they are aimed at evaluating the students.

- Mastery of the structures and functions of living organisms.
- Appreciation of nature and the need for its conservation
- Acquisition of adequate laboratory and field skills in Biology necessary to carry out and evaluate experiments and project in Biology;
- Ability to observe, classify and interpret Biological data (the scientific skills);
- Acquisition of meaningful and relevant knowledge in Biology as a pre requisite for pursuit of careers in Biological Sciences and related disciplines;
- Acquisition of acceptable scientific attitudes for problem solving and
- Ability to apply Biological knowledge/thoughts to everyday life in matters of personal, social, economic. Environmental and community health.

These concepts/topics are sequenced spirally into instructional units, such that each unit is treated in great depth for each successive year. The curriculum developers also provided

topics that are of direct relevance to the community. These include ecological studies and principles applied ecology, man and microbes including public health and personal hygiene. Ben (2002) says that, a curriculum is always in every society, a reflection of what the people think, feel believe and do.

The curriculum of SS11include the following:

Theme 1: Organization of life –Classification of plants, classifies plants using (a) Botanical (b) Agricultural techniques of classification. Classify plants based on cycles.

Theme 2: The organism at work. Topic –

Digestive System,

diffusion in complex organisms,

transportation in different organisms.

Mechanism of transportation in different animals.

Demonstrate experimentally the flow of materials in plant.

Respiratory System: types of respiratory systems,

the characteristics of a respiratory surface,

the respiratory organs of some animals,

the various mechanisms of respiration in some animals and plants.

Excretory System: different types of excretory

systems in plants and animals, mechanisms of the excretory organs and relate structure to functions.

Theme 3: Nutrient Cycle: The carbon cycle,

why carbon cycle is necessary for life,

the delicate balance between carbon and oxygen.

The parts played by plants and animals in the water cycle,

the water cycle

the role of nitrogen.

Ecological Management:

different types of association existing between different species,

types of association (symbiosis, parasitism, mutualism commensalism),

Tolerance: concepts of minimum and maximum range of tolerance,

Geographic range graph illustrating maximum and minimum range of tolerance

Adaptation:

Nutrition: Pollution of the atmosphere

Conservation of Natural Resources

Pest and Diseases of Crops

Diseases caused by pests and their agents: (i) fungal diseases (e.g. blight, root, rot and mildew) , (ii) viral diseases (e.g. mosaic, molting, stunting.), (iii) bacterial diseases (e.g. bacterial wilt, leaf spot, soft rot).

Control Pests

Theme 4 – continuity of life

Reproductive Systems in Vertebrate

Structure of the male and female reproductive systems

Differences between male and female reproductive organs.

Structural differences in the eggs of vertebrates.

Comparison of the reproduction in fish, reptiles and mammals

Reproductive Systems in Plants:

Types of flowers are Hypogenous. Perigynous.

Different Kinds of placentation.

Pollination in plants

APPENDIX B

Distribution of Senior Secondary 11 Biology students according to Local Government Areas in Kaduna State.

Local Government Area	Schools			Students		
	Private	Public	Total	Male	Female	Total
Anchau	4	10	14	54	26	80
Birnin Gwari	2	8	10	67	33	100
Kaura	2	9	11	65	37	92
Kaduna South	8	28	36	108	54	162
Kaduna North	9	29	38	100	50	150
Giwa	3	17	20	72	35	107
Ikara	5	17	22	64	44	108
Igabi	6	20	26	115	54	169
Jama'a	4	21	25	112	67	179
Kudan	5	12	17	68	35	103
Kaura	3	11	14	67	35	102
Makarfi	4	15	19	119	54	173
Jaba	3	15	18	114	59	163
Sanga	2	10	12	73	42	115
Chikun	4	9	13	77	55	132
Kagarko	9	2	11	105	48	153
Kajuru	2	12	14	88	47	135
Sabon Gari	5	10	15	72	42	114
Kachia	5	12	17	120	65	185
Zaria	11	15	26	130	73	203
Zankuwa	5	13	18	87	52	139
Lere	4	13	17	102	44	146
Soba	3	10	13	77	38	115

Total	101	325	426	2056	1533	3589

APPENDIX C

Biology Achievement Test Questions (BAQ)

Student's Achievement Test Questions used for the Study. The questions were adopted from WEAC past questions.

Name of School ……

Class…..……

Sex: Male ( ) Female ( )

ACHIEVEMENT TEST

INSTRUCTIONS:

Answer all questions

Each question is followed by four letter options lettered A – D or A - E find out the correct option for each question and shade in pencil on your answer sheet on the answer space provided which bears the same letter as the option you have chosen. Give one answer to each question.

1. Taking in of oxygen and giving out carbon dioxide is known as:

   a. Digestion

   b. excretion

c. respiration

d. reproduction

2 . Which of following is not regarded as Air pollutant?

a. Smoke

b. Noise

c. Sulphur Dioxide

d. Carbon Monoxide

e. Nitrogen

3. Enumerate the two main types of respiration you know

4. Which of the under mentioned organs is involved in respiration?

a. Heart

b. Lungs

c. Trachea

d. Stomach

5. Which is correct as the process of respiration after air is inhaled?

a. nasal cavity – pharynx – esophagus – larynx – trachea – bronchi

b. oral cavity – nasal cavity – pharynx – esophagus – larynx – trachea – bronchi

c. pharynx – oral cavity – larynx – trachea – bronchi – nasal cavity

d. bronchi – nasal cavity – pharynx – trachea – esophagus – oral cavity

6. Asthma is a disease of the

a. Brain

b. Digestive tract

c. Respirator tract

d. Spinal Cord

7. Anaerobic respiration results in the production of :

a. more energy than aerobic respiration

b. no energy

c. an equal amount of energy to aerobic respiration

d. less energy than aerobic respiration.

8. The chemical equation present in respiration is:

a. $C_6O_6H_{12} + 6CO_2 + 60_2 + 6H0_2 +$ Energy

b. $C_6H_{12}O_6 + 60_2 + 6C0_2 + 6H_20$ + Energy

c. $H_{12}C_60_6 + 6H0_2 + 60_2 + 6C0_2 +$ Energy

d. $6H_20 + 6C0_2 + 60_2 + C_6H_{12}0_6 +$Energy

9. Which of the following structures is used for respiration in insect?

a. Lungs

b. Thorax

c. Cuticle

d. Spiracles

10. The second stage of respiration involves the release of :

a. Acetic acid

b. pyruvic acid

c. carbon dioxide

d. Glycolysis

11. Glycolysis takes place in the second stage of respiratory process in the:

a. lungs

b. cytosol

c. trachea

d. pharynx

12. Pyruvic acid is chemically represented as $C_3H_4O_3$

a. True

b, False

13. Briefly explained the processes involved in Krebs cycle

14 Bronchioles are small air bags found in the lungs

a. True

b. False

15. The arteries and veins involved in the respiration are called:

a. digestive arteries and veins

b. urinary veins and arteries

c. cardiac arteries and veins

d. Pulmonary veins and arteries

16. Aerobic respiration occurs only in mammals and human beings

a. True

b. False

17. The following diseases are diseases of the respiratory tract expect

a. pneumonia

b. asthma

c. weeping cough

d. malaria.

18. An asthma patient is to avoid the following expect:

a. Dust

b. Boiled water

c. Cold

d. Things the patient is allergic to.

19. In your own words define respiration comprehensively

20. Name three ways to avoid Pneumonia.

APPENDIX D

The Pilot study Report

Test retest Reliability Analysis

Appendix B: Raw scores of the two sets of tests for determining the coefficient of reliability of the test instrument

S/NO	X	Y	X^2	Y^2	XY
1	41	59	1681	3481	2419
2	44	50	1936	2500	2200
3	39	46	1521	2116	1794
4	55	62	3025	3844	3410
5	28	49	784	2401	1372
6	33	50	1089	2500	1650
7	43	50	1849	2500	2150
8	36	44	1296	1936	1584
9	40	48	1600	2304	1920
10	48	53	2304	2809	2544
11	22	46	484	2116	1012
12	39	50	1521	2500	1950
13	40	51	1600	2601	2040
14	50	63	2500	3969	3150
15	63	92	3969	8464	5796

16	59	87	3481	7569	5133
17	51	69	2601	4761	3519
18	49	38	2401	1444	1862
19	65	72	4225	5184	4680
20	55	69	3025	4761	3795
21	61	66	3721	4356	4026
22	43	68	1849	4624	2924
23	47	89	2209	7921	4183
24	51	91	2601	8281	4641
25	54	88	2916	7744	4752
26	50	72	2500	5184	3600
27	54	70	2916	4900	3780
28	60	67	3600	4489	4020
29	46	49	2116	2401	2254
30	50	63	2500	3969	3150
31	50	51	2500	2601	2550
32	46	75	2116	5625	3450
33	44	54	1936	2916	2376
34	48	77	2304	5929	3696
35	50	78	2500	6084	3900
36	52	88	2704	7744	4576
37	53	72	2809	5184	3816
38	50	90	2500	8100	4500
39	55	90	3025	8100	4950
40	38	56	1444	3136	2128
41	40	52	1600	2704	2080

42	36	50	1296	2500	1800
43	44	49	1936	2401	2156
44	50	61	2500	3721	3050
45	22	49	484	2401	1078
46	38	53	1444	2809	2014
47	44	50	1936	2500	2200
48	29	40	841	1600	1160
49	41	62	1681	3844	2542
50	30	42	900	1764	1260
N=50	**∑X** =2276	**∑Y=**3110	**∑X2=**108276	**∑Y2=**205292	**∑XY=**146592

Note: x and y are first and second tests scores for early child hood education pupils

(Statistics for finding reliability)

Pearson Product Moment Correlation computed for the Reliability index for the instrument used in the pilot study of the research.

The formula for Pearson Product Moment Correlation is given below:

Reliability equation=

$\frac{N(\sum xy) - (x)\sum Y}{((N(X^2) - (NY^2)-(Y)^2)}$

N=Number of respondents

X is test scores at first administration

Y is test scores at second administration

∑x is scores at first administration is summed

∑y is scores at second administration is summed

$\sum x^2$ is scores at first administration is squared and summed

$\sum Y^2$ is scores at second administration is squared and summed

$(\sum x)^2$ is scores at first administration is summed and squared

$(\sum Y)^2$ is scores at second administration is summed and squared

Where

N=50	**∑X** =2276	**∑Y=**3110	**∑X2=**108276	**∑Y2=**205292	**∑XY=**146592

Pearson Product Moment Correlation formula is:

$r=\frac{N(\sum xy) - \sum (x)\sum Y}{((N(\sum X^2) - (N*\sum Y^2)-(\sum Y)^2}$

$= \frac{50*146592 - 2276*3110}{50*(108276^2-50*205292-(205292)^2}$

=.793

r=.79

APPENDIX E

Achievements Post – Test

The post-test achievement test used for the study was generated from the topic taught (respiration) which was used for the data collection. Questions were adopted.

1. Breathing in and out is said to be an act of taking in oxygen and expiration of carbon dioxide. What is the process called? Define the process comprehensively.
2. Respiration is divided into two (2). Name the two types of respiration and where they occur.
3. Name and explain the two stages respiration
4. What are the chemical equations of respiration, and briefly explain how the equation is formed.
5. List all the organs involved in respiration and their functions during the process of respiration.
6. The Krebs cycle also known as the citric acid cycle, describe the Krebs cycle
7. At what stage of respiration is the pyruvic acid release? Give the chemical equation of the pyruvic acid.
8. The enzymes needed for the first stage of respiration are found where? Is oxygen needed for the first stage of respiration?
9. Name three disease conditions of the respiratory tract
10. Briefly explain what you understand by the word Asthma?

APPENDIX F

Lesson Notes

Name of School: G.G.S.S Soba

Class; SS11 ^{B}

Date: 17 February 2015

No of Students: 25

Age: 14 -20 years

Subject: Biology

Topic; Respiration

Time Allowed; 1;30 Mins.

Aims/Objectives: At the end of the lesson the students should be able to, define respiration; enumerate all the organs involved in respiration, process of respiration, the Krebs cycle, the chemical equation involved in respiration and arteries and veins involved in respiration.

Instructional Materials: Disc plate, DVD Player, Projector, blackboard Computer, internet and marker.

Previous Knowledge: The Students were taught the anatomy of the human and mammalian body and organ structures, while respiration is an every second activity that all human engage in for survival is an involuntary activity.

Instructional Method: Blended method using the Internet – based learning tools, experimental method as well as lecture method.

Introduction: The students would be asked to breath in and out for at least three times (3). The students would then be asked to name the activity that just took place. In order to re-fresh their memory, the students were also be asked to name the body organs they felt are responsible for respiration while same is written on the board. Together with the students the correct organs were chosen while the wrong ones are wiped out.

Presentation: The topic respiration was written on board. Respiration is define and written on board for the student to read. Respiration is defined as the process by which cells convert food into energy. The food from which energy is released is mainly glucose. The students would be asked to name the two types of respiration. The aerobic respiration and anaerobic respiration.

Step 1: The lesson will concentrate on aerobic type of respiration which occurs in human and mammals. We shall watch how the earlier mentioned organs involved in respiration function in the process of respiration from the internet with the help of animation. We shall link up with Khan Academy, listen to the teacher on the internet and watch carefully the movement of the organs with the presences of air inhaled into the body.

Step11: The lesson on respiration from Khan Academy is linked up and projected. While the Students listen along with the students. The teacher continues to observe the student, questions

were allowed from students after the lectures. The lecture is as well down loaded into a diskette to be played during question and answer section.

Step 111: After the first phase of the lesson the students were allowed to ask any question. The second phase is about the Krebs cycle that is the respiratory processes. The Krebs cycle was briefly explained before the instruction from Khan Academy. The Krebs cycle also known as citric acid cycle, is part of cellular respiration. It is a series of chemical reaction used by all aerobic organisms.

Step 1v; The khan Academy would later be connected for the Students to see the Animation of the Krebs cycle and explain from the Khan Academy Instructor. The chemical equation involved in respiration is also explained.

Summary: The lesson would be summarized by the teacher especially areas that the teacher deemed difficult for the students. Special points are written on the board for the students to always take into consideration when describing or writing about respiration. Example includes definition of respiration, types of respiration, meaning of aerobic respiration, chemical equation of respiration, and the Krebs cycle.

Conclusion: The lesson is concluded by allowing the students to ask questions where they have difficulties. Notes were given to the students to copy at their free time because of time factor.

Evaluation: The Students were given test on the lesson taught to measure the objectives of the lesson.

LESSON NOTES

Name of School: Command Day Secondary School Jaji

Class; SS11 Blue

Date: 12 February

No of Students: 25

Age: 14 -20 years

Subject: Biology

Topic; Respiration

Time Allowed; 1; 30 Mins

Aims/Objectives: At the end of the lesson the students should be able to: to define respiration, describe the organs involved in respiration, describes the Krebs cycle, the process of respiration, chemical equation involved in respiration.

Instructional Materials: Board, Marker, model of the human body showing organs involved in respiration, and the diagram of the Krebs cycle.

Previous Knowledge: The students are already familiar with the organs of the human body from the previous instructions. Breathing in and out is a known process and continuous in all existing humans, the students are familiar with the exercise of breathing in and out.

Instructional Method: Lecture/ experimental method.

Introduction: The students would be asked to breath in and out for at least three times (3). The students would then be asked to name the activity that just took place. In order to re-fresh their memory, the students would also be asked to name the body organs they felt are responsible for respiration while same is written on the board. Together with the students the correct organs are chosen while the wrong ones are wiped out.

Presentation: The topic respiration would be written on board. Respiration is define and written on board for the student to read. Respiration is defined as the process by which cells convert food into energy. The food from which energy is released is mainly glucose. The students were asked to name the two types of respiration. The aerobic respiration and anaerobic respiration, aerobic respiration is the type respiration that occurs in humans and mammals. The lesson today is limited to the aerobic respiration. The students were also asked to name human organs they felt are involved in respiration and same is written on board whether wrong or right. The right ones are left on the board while the wrongs are cleaned off the board.

Step 1: The definition of respiration is given and written on the board, as well as that of the aerobic respiration. Explanation on how energy is released and utilized by the enzymes and body cells to perform their functions during the process of respiration is as well given.

Step 11: The model is used to remind them and identify those organs involved in respiration as earlier mentioned. The process of respiration is explained using the model, from the inhalation of the air to its expiration. Oral cavity – nasal cavity – pharynx – esophagus – larynx – trachea – bronchi which kept splitting into Bronchioles (small air bags in the lungs) – pulmonary arteries then the pulmonary arteries to the heart for expiration. The students were allowed to ask questions.

Step 111: The two stages of respiration are taught, which involved Glycolysis which takes place in the cytosol which is also a clear portion of the cytoplasm. The enzymes needed for the first stage of respiration are located in the cytosol. This process does not need oxygen. The second stage involves the release of the pyruvic acid, which is formed as result of the splitting of the glucose molecule into 3 carbon molecules. ($C_3H_4O_3$ Pyruvic acid). The Chemical equation present in respiration is also explained as $C_6 H_{12} O_{6+} 60_2 .6co_2 +6H_20$ + Energy.

Step vi: The Krebs cycle was explained to the students using the diagram as represented on the cardboard paper. The explanation was repeated for proper understanding by the students. Later diseases associated with respiration were explained. Diseases like asthma, pneumonia, catarrh. Cough

Summary: The lesson ended with the summary of the entire topic taught, major highlights were made on important areas that the students need to pay more attention to. The students were allowed to ask questions on areas deemed difficult. Questions asked were attended to and answers were provided.

Conclusion: The question and answer section continued to the conclusion, notes were given to the students to copy at their free time. Students were told to remove all books and a test was given on what was taught to check their level of understanding of the topic taught. Same was marked by the students.

Evaluation: The aims and objectives of the lesson were measured from the small test given after the lesson. Aims and objectives were 90% achieved.