TEACHERS’ READINESS FOR INTEGRATION OF INFORMATION COMMUNICATION AND TECHNOLOGY IN THE TEACHING OF BIOLOGY IN SECONDARY SCHOOLS OF BAUCHI STATE, NIGERIA

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E55F/27529/2013

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE DEGREE OF MASTER OF EDUCATION (SCIENCE EDUCATION) IN THE SCHOOL OF EDUCATION OF KENYATTA UNIVERSITY

MAY, 2017
DECLARATION

I declare that this thesis is my original work and has not been presented for a degree in any other university/institution for consideration. This research thesis has been completed by referenced source duly acknowledged. Where tables, text, data, graphics and pictures have been borrowed from other sources, including internet, these are specifically accredited and references cited in accordance in line with anti-plagiarism regulations.

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DEDICATION

I dedicate this work to my family for bearing with me during the many times I have been away not being able to give them the attention they deserve. I also appreciate the role my late father played in my educational life. I appreciate the financial, moral and spiritual support from my wives Hassana, Altine and my children. May God eternally bless them abundantly throughout their endeavours.
ACKNOWLEDGEMENT

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ABSTRACT

The aim of this study was to investigate teacher’s readiness for ICT integration in the teaching of biology in Bauchi state Nigeria. Readiness was considered at two levels, namely internal (skills and attitudes) and external (resources and administration’s support). Teacher’s readiness was measured regarding availability of facilities, teachers ICT skills, teacher’s attitudes and administration support. (i) there is very little integration especially in science subjects in Bauchi state. (ii) teachers do not have sufficient ICT resources in their schools, necessary to integrate ICT in teaching of biology. (iii) teachers do not have positive attitude towards ICT integration in teaching and learning. (iv) the administrative support of learning institutions do not provide ICT resources for the necessary support. The objectives of this study involves the following. (i) to investigate the level of biology teachers ICT integration skills in Bauchi state, (ii) to explore the availability of ICT resources necessary for the integration of ICT in the teaching of biology. (iii) to establish the attitude of biology teachers towards the integration of ICT in the process of teaching and learning and (iv) to investigate the administration support towards ICT integration in the teaching of biology. The study is guided by technology acceptance model theory. The study employed a descriptive survey design. The target population was 363 public secondary schools from the three zones of Bauchi state 133 secondary schools from South Zone, 110 from Central zone and 120 from North zone). The method employed was stratified random sampling, the sample size include 68 students, 36 head teachers, and 36 school heads of institutions. A mixed boarding school was sampled for piloting the instruments. The respondents of the study were all the biology teachers, the form three biology students, and all the heads of institutions in the sampled secondary schools. Data was collected using checklists, observation schedule, questionnaires and interview schedule. The questionnaires were administered to biology teachers and biology students while the interview schedules were conducted on the heads of the institution. The data collected was analysed using statistical package for social sciences (SPSS). The findings revealed that for ICT to be effectively adopted in public secondary schools, more emphasis should be put in developing the competence of teachers. Teachers’ perception in terms of using ICT were found to be positive but hampered by other aspects such as unavailability of adequate equipment. The study recommends that teachers’ ICT development should be stepped up with corresponding supply of necessary equipment and training. Further continuous and consistent technical assistance should always be available for the teachers whenever required.
CHAPTER ONE
INTRODUCTION

1.1. Background of the Study

Information Communication and Technology (ICT) has become an important part of most organisations and businesses these days (Zhang & Aikman, 2007). There is substantial evidence that if in the right hands and used appropriately for specific purposes in specific contexts; ICT can be an effective tool in positively impacting the quality of human life. Hodge and Miller (1997) confirm the positive impact of ICT on people’s lives by indicating that: “Information and communication technologies are rapidly changing the way individuals live, firms do business, governments’ administer and nations interact”.

Education has been identified as one of the public sectors most influenced by technological developments Kombo, and Tromp, (2006). New technologies have the potential to support education across the curriculum and provide opportunities for effective communication between teachers and students in ways that have not been possible before (Dawes, 2001). According to white paper on e-Education (2004), ICTs can enhance educational reform by enabling teachers and learners to move away from traditional approaches to transformed teaching and learning.

In a transformed teaching and learning environment, there is a shift from teacher-centered, task – oriented, memory-based education, to an inclusive and integrated practice where learners work collaboratively, develop shared practices, engage in meaningful contexts and develop creative thinking and problem-solving skills (White Paper on e-Education 2004). Saidu, (2000) further point out that technology can play a part in supporting face-to-face teaching and learning in the
classroom. There has been a national concern in Nigeria due to the relatively lower performance of Biology in the national examination and due to the fluctuating levels of enrollment (candidature). Table 1.1 shows the national performance and the enrollment of science subjects over a period of five (5) years 2011 to 2015, in Bauchi state Nigeria.

**Table 1.1: National Examination Percentage Scores and Candidature in Sciences Between 2011 to 2015**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Physics</th>
<th>Biology</th>
<th>Chemistry</th>
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<tr>
<td></td>
<td>Mean score (%)</td>
<td>candidature</td>
<td>Mean score (%)</td>
</tr>
<tr>
<td>2005</td>
<td>40.32</td>
<td>72,499</td>
<td>24.91</td>
</tr>
<tr>
<td>2006</td>
<td>41.31</td>
<td>83,162</td>
<td>25.39</td>
</tr>
<tr>
<td>2007</td>
<td>36.21</td>
<td>93,692</td>
<td>22.74</td>
</tr>
<tr>
<td>2008</td>
<td>31.33</td>
<td>104,188</td>
<td>19.13</td>
</tr>
<tr>
<td>2009</td>
<td>35.13</td>
<td>109,072</td>
<td>24.91</td>
</tr>
</tbody>
</table>


From Table 1.1, it is clear that in all the five years, Biology has the highest candidature as compared to Chemistry and Physics. Regarding mean score, the mean score of Biology is lower than that of Physics. Considering the nature of the subject and high enrollment in Biology, one expects higher mean score in biology than in physic and chemistry. The low enrolment in physics was due to lack of teaching equipment and qualified teachers. Students attitudes contributed to the low enrolment due to fear and believe that the subject is the most difficult, and also attitude of the teachers towards teaching the subject. The high percentage in physics was due to the fact
that, only brilliant students are enrolled for the subject. Due to the low enrolment teachers would consult them individually and the little or few ICT equipment available can be sufficient in matching their number hence more conceptualization. Hayes, (2003) as cited in Nyaga (2011) notes that poor performance in science may be attributed to several factors such as attitude, teaching approaches/ method, content and resources mobilisation and management.

Hardman et al., 2008) observes that many African countries continue to use teaching methods that are over four decades old, teaching is teacher-centered, and typically encourages passive learning styles. According to Meredith,(1996), the traditional approach to teaching, as ancient as formal teaching itself, involves the directed flow of information from the teacher as sage to the student as receptacle. This is further confirmed by Dawson and Rakes,(2003) who defines teacher centred teaching style as:

A style of instruction that is formal controlled and autocratic in which the instructor directs how what, and when students learn. Shehu (2002) carried out research to find out whether the science teacher in Nigeria was integrating computers in their subject’s topic areas. The findings were that majority of them do not integrate computers in their general teaching and learning processes. Sa’idu (2000), as cited by Shehu (2002) point out that few teachers used computers – based technologies for instructional purposes and observed that computers are not being integrated into most instructional curricula. The traditional teaching methods used by most of the teachers continue to face a global resistance due to changing level of technology. This is because the changing level of technology has made learners more inquisitive, critical, and informed. This, in
turn, puts pressure on the education sector to embrace modern technology in its various undertakings.

The government of Nigeria, however, recognises the importance of ICT in teaching and learning. This is evidenced by its effort to address the issue of ICT integration in classroom teaching and learning. In 2007, the Nigeria government, through the Ministry of Information and Communication, adopted the National Information and Communications Technology (ICT) Policy. Other than the government, other indigenous and non-indigenous non-governmental organisations have engaged great effort in the endeavour of promoting ICT integration in teaching and learning. According to Gioko, (2007), use of computer technology can improve the quality of instruction by assisting teachers in the complex task of managing and supporting instructional programs in schools. According to Nyaga (2011), when teacher effectively integrates the computer into classroom teaching and learning, the speed of the management of student’s data, search for information and presentation of learning materials is greatly increased.

In Nigeria, the biology syllabus in secondary schools is greatly compressed to include many topics that require more time allocation to be learned at higher cognitive skill while the time for syllabus coverage has always been shortened due to over increasing school program. Consequently, Biology has been poorly performed in National Examination. According to Hodge and Miller (1997), poor performance in sciences can be solved by the use of computer for instruction. Poole also emphasises that use of simulations enable students to enjoy more effective than students not using a computer.
1.3 Statement of the Problem

Despite all the efforts by the Government and many non-governmental organisations to encourage and facilitate ICT integration in teaching and learning, research shows that in most of the educational institutions, there is very little integration, especially in science subjects (Hardman et al., 2008; Shehu 2002). If there is to be effective ICT integration in teaching and learning, the teacher must be prepared both intrinsically (sufficient ICT integration skills and positive attitude towards ICT integration) and extrinsically (be provided with sufficient ICT resources and be accorded the necessary support by the administration). It is against this background that the researcher found it useful to investigate teachers’ readiness to integrate ICT into the process of teaching and learning, considering that the teacher is a key player in the success of any educational program. The aim of this study was to investigate the performance of biology at secondary school level has been dismal in Nigeria, Bauchi state seen not to be spared. The performance has continued to be poor in comparison with other states in Nigeria if this trend is allowed to continue it will be detrimental to the welfare of those who lived in the state and the whole country. There is a therefore a dire need to do research in this area to find out the reasons behind the poor performance. It is against this background that the researcher found it useful to investigate teachers’ readiness to integrate ICT into the process of teaching and learning, considering that the teacher is a key player in the success of any educational program.

1.4. Purpose of the study
The purpose of this study is to examine the teacher’s readiness for ICT in teaching of biology in secondary schools of Bauchi state Nigeria. The teacher skills levels, attitudes and the availability of ICT resources would equally investigated.

1.5. General Objective

The main purpose of this study was to investigate teachers’ readiness for ICT in the teaching of biology in secondary schools of Bauchi state, Nigeria.

1.6. Specific Objectives

The objectives that guided this study were to:

i. Investigate the extent to which biology teachers integrated ICT in the teaching of biology.

ii. Explore the availability of ICT resources necessary for the integration of ICT in the teaching of Biology.

iii. Establish the attitude of Biology teachers towards the integration of ICT in the process of teaching and learning.

iv. Investigate the administration’s support towards ICT integration in the teaching of Biology.

1.7. Research Questions

This study attempted to answer the following questions:

i. Do the Biology teachers have necessary ICT skills for effective integration into the teaching of Biology?
ii. Are there sufficient ICT resources in the schools to enable Biology teachers effectively integrate ICT in the teaching of Biology?

iii. What are the attitudes of biology teachers towards ICT integration in secondary schools?

iv. Does the schools’ administration provide the necessary support to Biology teachers to enable them to effectively integrate ICT in the teaching of Biology?

1.8. Significance of the Study

The findings of this research will be significant to teacher training institutions in the designing of their curriculum so as to thoroughly prepare the teacher-trainees to be able to be relevant to the learners in this information age. The findings will also be of great significance to bodies that design and revise the curriculum such as the Nigeria Institute of Education (NIE) in that the findings will look into details on whether or not the current curriculum allows the teachers to integrate ICT effectively in teaching and learning.

The findings would also be significant to the practising teachers because the study looked into barriers and enablers of ICT integration. This would help the practising teachers embrace the enablers and overcome the barriers thus helping them to be more effective in their practice. The research will also be of great benefit to learners once ICT integration tendency is improved among the teachers, the learners’ conceptualization would be improved and therefore lead to unimprovement of their academic performance. The findings would also inspire other researchers to carry out more researches in this field. This would further expand the literature related to the field of ICT integration, thus greatly contributing to the body of knowledge on the same.
1.9. Scope, Limitations and delimitation of the study

1.9.1. Limitations of the Study

The extension of this study to other parts of the country would be limited by time and the finances available. The study was confined to public secondary schools in Bauchi State. All the private schools in the state were not considered. The information obtained from this study might therefore not be sufficient to come up with a generalization about the state and the national trend in Bauchi State Nigeria.

1.9.2. Delimitations of the Study

Although ICT is not limited to computer technology since it includes multimedia tools such as television and radios and communication tools such as mobile phones, this study was only be confined to computer related ICT tools such as hardware, software, the internet and computer peripherals such as printers and projectors. Although ICT integration is emphasized in all subjects across the curriculum, the study considered only the integration of ICT in Biology. Although there are many factors determining the extent and effectiveness of ICT integration in the process of teaching and learning, only teachers’ readiness were studied.

1.10 Theoretical and conceptual framework

1.10.1 Theoretical Framework

This research is based on the Technology Acceptance Model (TAM), a theory developed by Davis et al., (1989). This Model is an information systems theory that predicts how users come to accept and use a new technology. It suggests that the acceptability of an information system is determined by two main factors, namely perceived usefulness and perceived ease of use.
Perceived usefulness is the degree to which a person believes that the use of a system will improve his performance while perceived ease of use refers to the degree to which a person believes that the use of a system will be effortless.

In TAM, Davis et al., (1989) considered perceived usefulness and perceived ease of use as the independent variables while acceptability and adoption of a new technology are the outcome/dependent variable. This theory guides this study by helping the researcher to work under the assumption that if the teachers’ attitude towards ICT integration is positive, their perceived usefulness of ICT integration in instruction improves. At the same time, if the teachers have the necessary ICT integration skills, have the required facilities necessary for ICT integration and they receive enough support from the school’s administration, their perceived ease of ICT integration were improved. These two factors will lead to actual ICT integration in teaching and learning, which in turn leads to improved achievement in Biology. This is summarized in figure 1.1
Figure 1.1: Theoretical Model

Source: Adapted from the Technology Acceptance Model by Davis et al., (1989)
1.10.2 Conceptual Framework

**Independent Variables**
- Biology Content
  - Syllabus
  - Textbooks
  - Scheme of Work
  - Lesson plan

**Intervening Variable**
- Biology Instructional Method
  - Theory Based
  - Practical Based

**Dependent Variables**
- Low Achievement
  - Low Enrolment
  - Poor Conceptualization
  - Low Performance

**Teachers’ readiness in ICT Integration in teaching of Biology**
- ICT resources
- ICT integration skills
- Positive attitude towards ICT integration
- Administration’s support in ICT integration

**ICT Integrated Instructional Methods**
- Drill and Practice
- Tutorials
- Simulations

**Improved Achievement**
- Higher Enrollment
- Improved conceptualization

*Figure 1.2; Conceptual Framework*

*Source: Awang, Z. (2012)*
The conceptual framework of this study relates to the relationship between Biology teaching methods and achievement in Biology. According to Awang (2012), if the conventional methods are used alone, the achievement in Biology is low. However, if ICT integrated Biology teaching methods are combined with the conventional teaching methods, the achievement in Biology is improved.

The level of teachers’ readiness is a key determinant of the extent of ICT integration in the teaching of Biology by teachers. The higher the level of ICT integration in the teaching of Biology the better the conceptualization of Biology concepts, which in turn would increase the selection of Biology by students and also improve the performance in Biology.

In this study, there are four factors that are used as indicators of teachers’ readiness, namely; teachers’ ICT integration skills, teachers’ attitudes towards ICT integration in teaching and learning, availability of ICT resources and administration’s support towards ICT integration in teaching and learning. This conceptual framework is summarized in figure 1.2

11.0. Assumptions of the Study

This study assumed that all the information given by the respondents in the questionnaire and during the interview is accurate and truthful. It is also assumed that integration of ICT in the teaching of Biology is useful in enhancing teaching and learning of Biology as well as students’ performance in Biology.
12.0. Definition of Terms

**Barriers:** Challenges, which have to be overcome to attain a goal in this study.

**Biology:** A branch of science that deals with the study of life and knowledge.

**Information Communication and Technology (ICT):** Diverse set of technological tools and resources used for accessing, gathering, manipulating and presenting or communicating information in this study.

**Integration:** To seamlessly combine components, parts or elements into a Complex but harmonious whole in this study.

**Readiness:** A state of preparedness, both internally (having skills and positive attitude) and externally (having resources and administration’s support)

**Science:** A body of ordered knowledge that seeks to understand natural Phenomena and to array these ideas into ordered knowledge.

**Technology:** Application of science knowledge to design products, systems and Processes that affect the quality of life.
CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Introduction

The chapter focused on the works of other scholars in order to review and synthesize their contributions towards ICT integration in the teaching of Biology. It looks into details; teaching approaches in Biology methods of teaching biology and ICT integration in the teaching of Biology. Under ICT integration in the teaching of Biology, it explores; the impact of ICT integration in teaching and learning, barriers and enablers of ICT integration in teaching and learning and the teacher’s readiness for integration of ICT in the teaching of Biology.

2.1.1. Teaching Strategies in Biology

According to Twoli, (2007), a teaching strategy is a way and means of carrying out teaching. It forms a general plan or design into which one can fit detailed instructional procedures. Teaching (instructional) strategies determine the approach a teacher may take to achieve learning objectives. A teaching strategy can be said to be good if it brings out expected results in a given situation. There are many proposed categories of teaching strategies, but for the sake of this study, they were classified into two, namely; expository versus heuristic strategy and deductive versus inductive strategy (approach).
2.1.2 Expository versus Heuristic Strategy

When teaching a strategy is described as either expository or heuristic, it is based on the comparison between teacher’s involvement and learner’s involvement in a teaching/learning experience.

Twoli. (2007) notes, the expository strategy, involves the teacher passing information to the learner by telling while the learner passively listens and takes notes. This method is predominantly teacher centered because the teacher is the centre of almost all the activities in the classroom. It emphasizes the transfer of basic information for learners to memorize and reproduce and leads to shallow learning since it answers questions that ask; what, when and how only.

According to Were (2003), heuristic strategy refers to an approach in teaching and learning where the learners are left to explore or find out information by themselves. It entails encouraging a person to learn, discover, understand, or solve problems on his or her own, as by experimenting, evaluating possible answers or solutions, or by trial and error. This method is learner centered since the learner is the centre of almost all the activities in the classroom. Because the strategy involves the learners in exploring and finding out information by themselves, it leads to deep and more meaningful learning. The two strategies can be represented using a continuum, which forms two extremes of the major forms of classroom instruction with specific instructional modes (methods) that fall between the two as shown in figure 2.1.
A teaching is said to be inductive if the learning process starts from specific examples or experiments, which lead to a generalization or law. In this strategy, the learner tends to be more carefully and accurate in the data collected since he/she does not know the law. This approach is
more preferred in the teaching of science since it leads to the acquisition and practice of the process and the manipulative skills which are core to the scientific method of enquiry.

In the deductive teaching strategy, the learning process starts from a law or generalization and then specific examples are given, or specific experiments are carried out to verify the law or generalization.

2.1.4 Methods of teaching Biology

A teaching method comprises the principles and methods used for instruction. There are many factors that determine the selection of a teaching method. Some of these factors are; the teacher, the content to be taught, the entry behavior of the learners, the size of the class and the teaching/learning resources available. The most commonly used methods in teaching Biology include lecture method, discussions, demonstration, class experiments and project work.

2.2.1. Lecture Method

Twoli.(2007) define lecture method as an instructional method involving one-way communication from the active presenter (teacher) to the mere or less audience (Learners). Research in Education shows that lecture method is used quite a lot (Omstein, 1990). Lecture method is appropriate when used to introduce a topic, sub-topic or to summarise and synthesise important information. This method is highly discouraged in Biology but according to Ministry of Education (1988), if this method has to be used the following points should be noted:

a) Use of simple and precise language, together with illustrations, is crucial.

b) The choice of content being taught should fit the understanding of the learner since an understanding audience is an important aspect of communication.
c) Instructional objectives to be achieved should be considered. If the aim is to convey knowledge, then a careful exquisite lecture may be quite good, but if the aim is to encourage reflective thinking, application of facts, principles and values, then other methods may be appropriate.

2.2.2. Discussion method

This is a cooperative model of teaching whereby the students are arranged in pairs or small groups to help each other learn the assigned task or material. According to Twoli, (2007), the students could be one-to-one (buzz group) or to a range of five students per group (task or syndicate group). Twoli, (2007), notes that discussion method is associated with certain benefits which include:

a) It increases learner participation which in turn increases effective learning.

b) It allows students to share ideas with each other (peer learning) in a more relaxed way which leads to a more effective learning.

c) It gives learners opportunity to pool and share skills such as process, manipulating, organisational and even language skills.

2.2.3. Demonstration Method

A demonstration is performed either by the teacher (teacher demonstration) or by a selected student/group of students (student demonstration). A demonstration can be approached either inductively or deductively. According to Twoli, (2007), demonstrations are preferred in science lessons under the following conditions:

a) When the experiment is dangerous.

b) When the equipment is expensive and complicated for learners.
c) When the resources are limited.

d) When time is limited.

### 2.2.4. Laboratory Experiments (Practical Work)

In the laboratory experiments, the learning is arranged to perform some special tasks by manipulating the material and apparatus under the direction of the teacher Twoli, (2007) Laboratory work is associated with the following advantages:

a) It helps the learners to acquire and practice process and manipulative skills which are useful in everyday life.

b) It arouses and maintains interest in learning.

c) It promotes the scientific process of thinking because laboratory investigation follows the scientific method of inquiry.

d) It reinforces conceptual understanding.

### 2.2.5. Project Work

Project work provides learners with an opportunity to carry out investigations to solve problems. Twoli, (2007), notes that the main purposes of project work are to:

a) Explore the field deeply.

b) Develop initiative and resourcefulness

c) Increase intellectual curiosity

d) Develop innovativeness

e) Develop creative, process and manipulative skills.
According to Ministry of Education (1988), the success of any modern science curriculum rests upon the presentation of concepts and ideas of the course through experiments. It is necessary to integrate project work into the Biology curriculum to enrich laboratory experiments.

2.2.6. Field Trips

A field trip entails learners visiting specific points or places of interest for an educational purpose. Such places include; factories, ResearchCentre’s, dams among others. Field trips enhance meaningful learning because it provides learners with firsthand experience of the application of the scientific knowledge. A field trip is one of the best ways that a Biology teacher can use to emphasised the relevance of classroom content to the learners, which in turn, would boost learners’ motivation in the learning of Biology.

2.3. ICT integration in the teaching of Biology

The concepts of ICT integration blossoms from the knowledge that despite the fact that there is continual poor performance when conventional teaching methods are used. ICT by itself cannot improve performance. Technologies by themselves have little stable or sustained impact on learning in schools Muntax, (2000) and Hayes, (2003). It needs to be used alongside the conventional methods, a process known as ICT integration.

2.4. The impact of ICT on teaching and learning of Biology

Technology is developed to solve problems associated with human need. If there is no problem to solve, the technology is not developed and not adopted (Newhouse et al., 2002). While theoretical arguments can be put forward to justify ICT integration in teaching and learning of Biology the only true rationale should be based on whether or not it has a positive impact on the
process of teaching and learning of Biology. This section will review the literature relating to the impact of ICT integration on different aspects of teaching and learning of Biology. These aspects are the learning environment for Biology, teacher’s pedagogy, and the learners.

2.4.1. The impact of ICT on Learning Environment

Salomon (1994), defines a learning environment as “a system of interrelated factors that jointly affect learning in interaction with (but separately from) relevant individual and cultural differences”. The learning environment provides a structure within which learning is organised, and the roles of the teacher and students occur. In a broader sense, the learning environment can be described as either learner-centered or teacher centred. The major characteristics of each of the two learning environment are summarised in Table 2.1
Table 2.1: Teacher centered environment versus Learner centered environment

<table>
<thead>
<tr>
<th></th>
<th>Teacher-centered environment</th>
<th>Learner-Centered Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Activity</strong></td>
<td>Teacher – centred and didactic</td>
<td>Learner-centered and interactive</td>
</tr>
<tr>
<td><strong>Teacher role</strong></td>
<td>Listener and learner</td>
<td>Collaborator and sometimes learner</td>
</tr>
<tr>
<td><strong>Student role</strong></td>
<td>Listener and learner</td>
<td>Collaborator and sometimes expert</td>
</tr>
<tr>
<td><strong>Learning emphasis</strong></td>
<td>Facts and replication</td>
<td>Relationships and inquiry</td>
</tr>
<tr>
<td><strong>Concept of knowledge</strong></td>
<td>Accumulation</td>
<td>Transformation</td>
</tr>
<tr>
<td><strong>Demonstration of success</strong></td>
<td>Quantity</td>
<td>Quality</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Norm-referenced and multiple guesses</td>
<td>Criterion-referenced and performance portfolios</td>
</tr>
<tr>
<td><strong>Technology use</strong></td>
<td>Seat work</td>
<td>Communication, collaboration, information access, and expression</td>
</tr>
</tbody>
</table>

Source: A Report on 10 Years of ACOT Research (p13) learning from instruction to knowledge construction. (ACOT, 1995, p13).

In a learner-centered learning environment, learning emphasises on relationships and inquiry as opposed to facts and replication emphasised in teacher centred environment. In this case, the role
of the teacher is more of a collaborator than that of a fact teller. The role of a learner in a learner centred learning environment is that of a collaborator and not a passive listener. The learning in learner-centered learning environment focuses on transformation through knowledge rather than mere accumulation of knowledge. Success in a learner-centered learning environment is measured by the quality of the product (the learned learner) as opposed to the quantity of information accumulated, which is the basis of measuring success in a teacher-centered learning environment. Based on the information above, it is evident that learner-centered learning environment supports learning, especially of science subjects, more than a teacher-centered learning environment. This, therefore, implies that there is more meaningful learning in the learner-centered environment than teacher centred environment.

According to White Paper on e-Education (2004), ICTs can enhance educational reform by enabling teachers and learners to move away from traditional teaching and learning approaches (teacher-centered, task-oriented, memory-based education) to transformed teaching and learning approaches (learners work collaboratively, develop shared practices, engage in meaningful contexts and develop creative thinking and problem-solving skills). This transformation will make the process of teaching and learning to enjoy the benefits implied in Table 2.1 above which will lead to more meaningful learning. This would translate to better performance and higher enrollment in Biology subject.
2.4.2. The Impact ICT on Teachers’ Pedagogy

The integration of computers in teaching does not substitute the role of teachers but rather; it will enhance the quality of their work, Wong et al., (2006), points out that technology can play a part in supporting face-to-face teaching and learning in the classroom. When the computer is integrated into the classroom the role of the teacher changes from that of the information provider to that of a facilitator of learning (Clark 2000). This leads to mere meaningful learning because the learner gains most of the knowledge through discovery rather than through teacher’s exposition which according to Twoli, (2007), lead to deep learning.

Biology just like any other science is a dynamic discipline whose content is tentative. This, therefore, implies that effective Biology pedagogy requires continuous access to the most recent information, ICT gives teachers access to information to support them in trying new strategies, thinking, reflecting on proactive, and engaging with new material (Committee on Developments in the science of learning, 2000), This access to information according to Cradler & Bridgforth (2002), leads to increased interest in teaching and experimentation which in turns improves the quality of teacher’s pedagogy.

2.4.3. The impact of ICT on Learners

The contemporary view of learning is that people construct new knowledge and understandings based on what they already know and believe (Committee on Developments in the Science of Learning, 2000); an approach known as constructivism. According to world bank, the use of ICT falls into four (4) major categories; constructing knowledge and problem solving (through the internet/mail, CD-ROMs, databases, videoconferencing); using process skills; aiding explanation
of concepts; and communicating ideas (power point, desktop publishing) (MeFarlane & Sakellariou, 2002).

This, therefore, implies that those learners who learn in an ICT integrated environment and up with better chances of knowledge construction than their counterparts who study in the traditional learning environments. The extent to which learners learn a given discipline largely depends on how motivated the learner is towards the discipline. Through the use of ICT (such as CD-ROM, power point, simulations, etc.), the teaching and learning of Biology become interesting (Ade, 2012). This according to Newhouse et al., (2002) increases students’ motivation. Computer systems also do provide the opportunity to create a wide range of interesting learning experiences (Committee on Developments in the Science of Learning, 2000), which are likely to help maintain student interest and a wider range of students (Cradler & Bridgforth, 2002). This makes a learner invest more academic learning time in the subject thus learning to better achievement.

The interactive and multimedia features within the software can be used to help students grapple with concepts and ideas (Committee on Developments in the Science of Learning, 2000). Students can more readily be provided with similar information and experiences within a variety of contexts (Committee on Developments in the Science of Learning, 2000). This improves the quality of learning which in turn leads to higher achievement in Biology.
2.5. **Barriers and enablers of ICT Integration in Teaching and Learning**

Bromme et al., (2005), define barriers as challenges which have to be overcometo attain a goal. They also define them as the gap between an initial and the end state. Word Net (2007) as cited in Schoepp (2005) defines a barrier as any condition that makes it difficult to make progress or to achieve an objective. Many scholars have tried to explain the possible contributors of the integration of ICT in teaching and learning. Ertmer (1999) classified barriers as falling into two primary categories, namely; extrinsic (first order) and intrinsic (second order). Extrinsic barriers include lack of resources, inadequate training, insufficient technical support, and lack of time; intrinsic barriers include teachers’/instructors’ beliefs, visions concerning technology integration, and views about teaching, learning, and knowledge.

2.5.1 **Teachers’ readiness in the Integration of ICT in Teaching and Learning**

The success of any educational program largely depends on the readiness of the teacher since the teacher is a key player in the process of teaching and learning. Teachers’ readiness can be viewed two levels, namely; intrinsic readiness (skills and attitudes) and extrinsic readiness (resources and administration’s support).

2.5.2 **ICT Integration Skills**

The teachers’ ICT integration skills level is often seen as the major obstacle to progress in ICT integration in teaching and learning (OECD, 1999). This is further confirmed by Solomon (2001), who states that the success of educational innovations depends largely on the skills and knowledge of teachers. Hodge and miller (1997) notes that “the changing landscape of communications and information exchange in the 21st century requires teachers to be at the
cutting edge of knowledge production, modification and application – rather than consumption”.

They further propose that teachers need to be ready for this by being provided with skills on how to use ICT effectively and creatively.

### 2.5.3 Teachers’ attitude towards ICT Integration

Concurrent studies have demonstrated that the effective utilisation of ICT depends largely on the attitudes of teachers who ultimately decide the way in which it is implemented in the classroom (Becker and Riel 2000, Beggs 2000, Ertmer et al., 1999, Mumtaz 2000). This is because according to Huang &Liaw 2005), teachers’ attitudes strongly affect the acceptance and implementation of ICT integration program.

### 2.5.4 Availability and Accessibility of ICT Resources

In a study to explore factors that influence classroom use of ICT in sub-Saharan African, Gioko, (2007) noted that introducing technology into schools is largely dependent upon the availability and accessibility of ICT resources. Mumtax (2000) stated that lack of the necessary hardware and software is one of the major reasons as to why teachers do not use technology in their classes. Also, a report on teachers’ use of technology by the National Center for Education Statistics (September 2000) indicates that there exists a positive correlation between availability of computers and computer use. The efficient and effective use of technology therefore largely depends on the availability of hardware and software and the equity of access to resources by teachers’ students and administrative staff.
2.5.5 Administration’s Support towards ICT Integration

Dawson and Rakes (2003), Mulkeen (2003) and Tondeur et al., (2008) all agree that leadership plays a major role in ICT implementation at schools, especially in its integration into the curriculum. According to Gioko (2007), the school’s administration role in enhancing ICT integration program can be classified into four categories, namely; Strategic direction and development of the subject, Teaching and learning, leading and managing and efficient and effective deployment of staff and resources. This can be summarised in table 2.2

Table 2.2: Summary of Administration’s Role in Enhancing ICT Integration

<table>
<thead>
<tr>
<th>Strategic direction and development</th>
<th>Teaching and learning</th>
<th>Leading and Management</th>
<th>Efficient and effective deployment of staff and resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Creating enabling environment</td>
<td>* Ensuring subject</td>
<td>* Establishing</td>
<td></td>
</tr>
<tr>
<td>* Plans for developing and</td>
<td>coverage</td>
<td>constructive</td>
<td></td>
</tr>
<tr>
<td>resourcing ICT integration program</td>
<td>* Setting standards</td>
<td>working relationship</td>
<td></td>
</tr>
<tr>
<td>* Monitoring the progress of ICT</td>
<td>* Guidance for ICT</td>
<td>* Leading and</td>
<td></td>
</tr>
<tr>
<td>integration program</td>
<td>integration material</td>
<td>motivating teachers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>* Evaluate teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>and learning</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Identification of staff needs and efficient deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Allocation of resources for best use</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>* Ensuring efficient and effective managing and organisation of learning resources</td>
<td></td>
</tr>
</tbody>
</table>
* Use data to identify student’s capabilities

* Promote ICT integration program
  * Development through consultative practices

* Exploring ways to develop and add resources

**Sources: Gioko, (2007)**

### 2.6 Summary

From the literature reviewed, it is evident that if ICT is integrated into the traditional instructional approaches and methods, there would be improved achievement in Biology. This is because ICT complements these approaches through:

a) Improving the availability of recent and relevant teaching and learning materials

b) Shifting instruction from teacher-centeredness to learner-centeredness

c) Improving teachers’ pedagogy

d) Improving learners’ motivation

At the core of ICT integration in teaching and learning are the teachers and therefore teacher readiness in terms of attitude, skills, resources and administration’s support needs to be investigated.
CHAPTER THREE
RESEARCH METHODOLOGY

3.1. Introduction

This chapter describes the research methodology which were used to investigate teacher’s readiness for integration of ICT in the teaching of biology in secondary schools in Bauchi State Nigeria. The chapter discusses the research design, location of the study, sampling procedure and research instruments. The chapter also considered the data collection and analysis procedures.

3.2. Research Design

This study used a descriptive survey design. According to Mugenda and Mugenda, (2003), a survey design is used to collect data from members of a population to determine the current status of that population on one or more variable. On the other hand, descriptive research is a process of collecting data to test a hypothesis or to answer questions concerning the current status of the subjects in the study Gay (1981). A descriptive survey, therefore, integrated the survey design in a descriptive research. According to Orodho (2003), in a descriptive survey information is collected by interviewing or administering a questionnaire to a sample of individuals. According to (Borg and Gall, 1989), descriptive survey research is intended to produce statistical information about aspects of education that interest policy makers and educators.
According to Orodho and Kombo (2002), a descriptive survey can be used when collecting information about people’s attitudes, opinions or social issues. This made the design suitable because the study is intended to investigate teachers’ readiness for integration of ICT in teaching biology. In this investigation, some of the indicators of teachers’ readiness which were used include teachers’ attitudes, opinions and habits.

3.3. Location of the study

The study was carried out in Bauchi State, Nigeria. Bauchi State is among the 36 states of Nigeria which were formed in February 1976. It is located in the northern part of the country with a total population of 4,676,465 people spread into three senatorial zones: South; Central and North (Census, 2006). This location was chosen because it has several schools that have been targeted to benefit from ICT as compared to other states. Such a high number of schools would be able to give a lot of data.

Other factors that influenced the choice of the location of the study area include familiarity with the area and limitation of the time for the study. Gay (1976) observes that factors such as familiarity with an area, limitation of time and money may influence the researcher’s choice of the locale as it has a positive effect on the administration of instrument and the amount of data to collect. Meredith (1996) noted that carrying a research in a setting where you are known as a friend and a colleague makes it easier than if you are regarded as an outsider with unknown motives. This also improves the ethical, legal and public relations in research.
3.4. Target Population

The target population was 363 public secondary schools from the three zones of Bauchi state 133 secondary schools from Southern Zone, 110 from Central zone and 120 from Northern zone. This study targeted school heads, biology teachers and biology students. The biology teachers were purposively selected to find out the persistent drop in the performance of biology in Nigerian National Examination (NNE) between 2011 and 2015.

Table 3.2 Target public secondary schools

<table>
<thead>
<tr>
<th>Zone</th>
<th>No. of Schools</th>
<th>No. of Biology Teachers</th>
<th>No. of Biology students</th>
<th>No. of Principals</th>
</tr>
</thead>
<tbody>
<tr>
<td>South zone</td>
<td>133</td>
<td>130</td>
<td>240</td>
<td>133</td>
</tr>
<tr>
<td>Central</td>
<td>110</td>
<td>113</td>
<td>200</td>
<td>110</td>
</tr>
<tr>
<td>North</td>
<td>120</td>
<td>120</td>
<td>240</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td>363</td>
<td>363</td>
<td>680</td>
<td>363</td>
</tr>
</tbody>
</table>

3.5. Sampling procedures and sample size

3.5.1 Secondary schools

The secondary schools used as a sample were selected through stratified random sampling. According to Kombo and Tromp (2006), stratified random sampling involves dividing your population into homogenous sub-groups and then taking a simple random sample in each subgroup. The secondary schools in Bauchi State were divided into three senatorial zones namely; Southern zone, Central zone and Northern zone. And also divided into four types of
schools which includes mixed day schools, boys boarding schools, girls boarding schools and mixed boarding schools.

According to Mugenda and Mugenda (2003), where time and resources allow a researcher should take as big as a sample as possible. This is because the smaller the sample, the bigger the sampling error. In this study, the target population of public secondary schools in the state is 363 secondary schools. This makes it possible to select 10% of the population as the sample.

3.5.2 School heads

The school heads were purposively selected. Since each school has one school head (principal) all the school heads in all the sampled schools were interviewed.

3.5.3. Biology Teachers

The significance of the findings of this study largely depended on the biology teachers. According to Mugenda and Mugenda (2003), when a very high level of statistical significance is required in a study, a large sample is required. Based on this consideration all the biology teachers, who currently have biology classes in the sampled schools were involved in the study. 

3.5.4. Biology students

In this study, form three biology students were targeted because, selection of students for science and arts start at JSS 3 (Form Three). The researcher purposively selected 2 biology students from each school that was sampled to participate in the study because in most of the schools, subject selection activity takes place before form three, and this therefore implied that the sampled students were those who took biology as one of the first or second science. This reduced the biases of the data collected from students. Ten percent of the population was considered
adequate for the sample size. The samples taken for secondary schools, heads of institutions, biology teachers and biology students are summarised in Table 3.3.

Table: 3.3 Distribution of the sample size from the target population
<table>
<thead>
<tr>
<th>Zone</th>
<th>Category</th>
<th>Sampled Schools</th>
<th>Sampled Schools</th>
<th>Total Biology Teachers</th>
<th>Sampled Biology Teachers</th>
<th>Target Biology Students</th>
<th>Sampled Biology Students</th>
<th>Total principal</th>
<th>Sampled principals</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>MD-40, MB-50, GB-20, BB-23,</td>
<td>3</td>
<td>13</td>
<td>130</td>
<td>13</td>
<td>240</td>
<td>24</td>
<td>133</td>
<td>13</td>
</tr>
<tr>
<td>Central</td>
<td>MD-20, MB-30, GB-40, BB-20,</td>
<td>3</td>
<td>11</td>
<td>113</td>
<td>11</td>
<td>200</td>
<td>20</td>
<td>110</td>
<td>11</td>
</tr>
<tr>
<td>North</td>
<td>MD-31, MB-30, GB-30, BB-29,</td>
<td>3</td>
<td>12</td>
<td>120</td>
<td>12</td>
<td>240</td>
<td>24</td>
<td>120</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>363</td>
<td>36</td>
<td>36</td>
<td>363</td>
<td>36</td>
<td>680</td>
<td>68</td>
<td>363</td>
<td>36</td>
</tr>
</tbody>
</table>

**Key**

MD = Mixed Day
MB = Mixed Boarding
GB = Girls Boarding
BB = Boys Boarding
3.6. Research Instruments

This study employed five instruments to gather both qualitative and quantitative data. These are resources checklist, lesson observation schedule, biology teachers’ questionnaires, biology students’ questionnaires and heads of institution interview schedule.

3.6.1 Resources Checklist (RCL)

A checklist is a special type of an observation schedule whereby the researcher assesses whether or not certain resources are available and fills in the findings in a pre-prepared rubric. In this study, the researcher visited the computer rooms, staff rooms, department offices and any other rooms/office in the school in which ICT facilities are kept and observed. The resources of interest in this study are ICT facilities such as electricity supply, computers (hand wares and software and internet connectivity).

3.6.2 Lesson Observation Schedule (LOS)

An observation schedule involves direct observation and recording of what one has observed. According to Meredith (1996), the data obtained from observation is very reliable because it is the first-hand information. In this study, the researcher sat at the back of the classroom during a biology lesson as a non-participant observer and collected the data as the lesson progressed and filled in this instrument (Appendix II). The information collected includes the following; whether or not the teacher integrated ICT during the lesson and the ICT integration skill level of the teacher.
3.6.3 Biology Teacher Questionnaire (BTQ)

A questionnaire is a written list of questions directed to specified respondents with the aim of gathering information relating to the study topic. This is an instrument that gathers data over a large sample (Kombo and Tromp, 2006). Each item in the questionnaire is developed to develop a specific objective, research questions or hypothesis of the study (Mugenda and Mugenda 2003).

In this study, the questionnaires (Appendix III) were administered by the researcher to all the biology teachers in the sampled schools. To minimise the limitation of low return of questionnaires, the researcher allowed them to fill the questionnaires and take them back. The researcher visited the schools and collected the questionnaires. The questions in the questionnaire included both closed and open-ended questions.

3.6.4 Biology Students’ Questionnaire (BSQ)

This questionnaire (Appendix IV) was administered to each of the form three biology students in the sampled schools. The researcher gave out the questionnaire to the students, waited for them to fill and collected them back on the same day.

3.6.5 Head of Institution Interview Schedule (HIIS)

An interview is an oral administration of a questionnaire or an interview schedule (Mugenda and Mugenda, 2003). An interview schedule is a set of questions that the interviewer asks when interviewing (Mugenda and Mugenda 2003). In this method, an investigation follows a rigid procedure and seeks answers to a set of pre-conceives questions through the personal interview (Orodho, 2003). In this study, the sampled heads of institutions were interviewed, guided by this
instrument (Appendix V) on various aspects of ICT integration in teaching biology such as availability of ICT resources, teacher’s frequency of ICT integration in the teaching of Biology and also the administration support or readiness to support in ICT integration in teaching of biology.

3.7 Pilot study

Pilot study was used for the validation and taking the reliability of the research instruments. In piloting the research instruments, a mixed boarding school was sampled. The school was sampled, because it has all the categories of schools used in the actual research.

3.7.1 Validity of the research instruments

According to Mugenda and Mugenda 2003, validity is the degree to which the results obtained from the analysis of the data represent the phenomenon under study. In other words, it is the measure of how well a research instruments measures what it is supposed to measure (Kombo and Tromp 2006). In this study, the research instruments were examined by researcher to ascertain their validity. Validity of the instruments was obtained by consulting experts on ICT, who looked at the research instruments and made comments on the face validity. The research instrument were piloted after which modifications were made to suit content validity of the instrument.

3.7.2 Reliability of the research instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda and Mugenda, 2003). According to Kombo and Tromp (2006), is a measure of how consistent the results from research instruments are. Orodho (2004)
observed that a reliable instrument is the one that has a small error or standard deviation. In this study, the Spearman-Brown prophesies formula of internal consistency was used, and reliability of 0.7 and above is as follows;

$$r = \frac{1 - 6(\sum d)^2}{N(N^2 - 1)}$$

Where, $r =$ reliability, $N =$ sample size and $d =$ deviation

3.8 Data collection techniques

In this study, the researcher obtained a research permit from the Ministry of Education Bauchi state. The researcher then visited the sampled schools before the actual data collection time to create a rapport with the prospective respondents. This previous appointment reduced the Hawthorne effect during the actual research. Hawthorne effect refers to a situation where subject’s awareness of being an experimental group motivates them to perform better (Mugenda and Mugenda, 2003).

In the actual data collection, the questionnaires were physically given and collected from the respondents by the researcher. The researcher requested the heads of institutions to state when they were available to give the researcher the science department timetable from which the researcher planned a random visit to the schools during the form three biology lessons for observation. The researcher also visited the science departments and the ICT rooms/computer rooms, and any other room used to store ICT facilities to observe and record the ICT resources available. Additionally, interview schedule was conducted with principals of the selected schools and tape recorded by the researcher. Moreover, the researcher went ahead to observe the lesson
and assess the level of integration of ICT in teaching of biology by the teachers. This process was conducted for the period of three months. On the second visit to the schools the researcher issued the questionnaires to the respective teachers and the form three biology students. The biology teachers were given time to respond to the items in the questionnaires. The researcher collected the questionnaires after one week.

On the administration of student’s questionnaires the researcher sought the assistance of the biology teachers. Then the third form three students were put in one group to enable easy administration of the questionnaires. The subject teachers assisted the researcher to distribute the questionnaires to the students. After they are filled, the researcher collected them immediately. This enabled the researcher to obtain all the questioners back. The interview with the head of teachers was arranged at their own convenient time during the first visit. The interview was advantageous because the researcher was able to rephrase the questions and also got a chance to probe further. The five instruments used in the study were biology teachers’ questionnaire, biology students’ questionnaire, head of institutions interview schedule, lesson observation schedules and finally resource check lists.

3.9 Data analysis and presentation

This was a descriptive survey study, the researcher analyzed the data using descriptive tools of data analysis such as frequency tables, mean and percentages. All the questionnaires and information from interview schedules obtained from the field were assembled. Using the research objectives and questions as guidelines, all the data on the teacher questionnaires, students questionnaires and head teacher interview schedules were coded for analysis. A code book was made from which the tables were derived from. The teacher’s questionnaires provided
data to answer questions on qualifications, attitude of the biology students, cultural influence and other general and specific factors influencing performance. The head teacher interview schedule provided data to back up and supplement the teacher questionnaires. Student’s questionnaires provided data to answer the question on attitude towards biology, their preferred as part of biology, cultural and any other factors that may influence performance in biology. The researcher counterchecked the questionnaire to ascertain that they were completed adequately. The responses were then coded and then analysed using a computer program called the statistical package for social sciences (SPSS). The data collected during the study was both quantitative and qualitative data. Quantitative data also presented using pie chart and bar chart. Qualitative data was analyzed using content analysis.
3.10 Logistics and ethical consideration

The researcher gave credit to all the authors quoted in the study. Conclusion of this study were derived from the data collected from the field and not the researcher’s guesses, intolerance or judgement. The quality and integrity of this research work were improved by truths and avoidance of error to the best ability of the researcher. The information gathered was not shared with other parties for purposes other than those of the research.
CHAPTER FOUR
REPORTING AND DISCUSSION OF THE FINDINGS

4.1. Introduction

In this chapter the study presented the analysis of the collected data from the research items which were; ICT Resources Checklist, Lesson Observation Schedule, Biology Teacher Questionnaire, Biology Student Questionnaire and Head of Institution Interview Schedule. The researcher used the statistical package for social sciences (SPSS version 21) for quantitative data while qualitative data was analyzed and presented using content analysis. Quantitative data was also summarised and analysed using descriptive statistics such as mean, mode, media and standard deviations.

The findings of the study were analysed and discussed in order of the objectives as subtopics in this chapter.

4.2. Return on research instruments

The study findings in table 4.1 show the rate of return on the research instruments used by the researcher to collect data.
Table 4.1: Return on research instruments

<table>
<thead>
<tr>
<th>Research Instrument</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biology students Questionnaires</td>
<td>68</td>
<td>100%</td>
</tr>
<tr>
<td>Biology teachers questionnaires</td>
<td>36</td>
<td>100%</td>
</tr>
<tr>
<td>Head teacher interview schedule</td>
<td>36</td>
<td>100%</td>
</tr>
<tr>
<td>ICT resource checklist</td>
<td>36</td>
<td>100%</td>
</tr>
<tr>
<td>Lesson observation checklist</td>
<td>36</td>
<td>100%</td>
</tr>
</tbody>
</table>

The findings in the table 4.1 show that the study was able to achieve 100% response on all research instruments. This conforms to Hagger et al., (2003) who argued that a response rate of 50%, 60% or 75% provide adequate data to draw a conclusion about a study.

4.3. Demographic Information

To achieve the precise information intended by the study, the researcher had to specifically choose the right respondents who had the actual information on teachers’ readiness for integration of information communication and technology in the teaching of biology in secondary schools of Bauchi state, Nigeria. The demographic information of the study covered; Gender, type of school, Highest professional qualification and lastly the number of years in teaching professional. The demographic information is very relevant for the study since it determines the criteria for exclusion and inclusion of respondents to the study.

4.3.1. Gender of respondents

The outcomes in the figure 4.1 show the gender representation of the respondents to the study.
Figure 4.1: Gender Respondents

From the study findings in the figure 4.1. The results show that majority of the respondents were males at 51% while 49% were female respondents. It was observed that there was no large variation in the composition of respondent’s gender. However the slight variation observed reflects the reality that exists in the educational institutions in Nigeria. For a long time there have been concerted efforts to attain gender parity in the institutions targeting pupils, students, teachers and other actors in the education sector.

4.3.2. Types of school

The figure 4.2 shows the findings on the distribution of the types of schools that were involved in the study.
Types of schools

**Figure 4.2: Percentage of schools in the study.**

The types of schools was purposively sampled and the study findings in the figure 4.2 show that a great number 41.60% (14) of the schools were mixed boarding schools, they were seconded by 25% (8) of the schools who were mixed day schools and 16.70% (7) and 16.70% (7) which were boys boarding and girls boarding respectively.

**4.3.3. Professional Qualification of teachers.**

The findings in the table 4.3 shows the highest professional qualification levels that the teachers who were involved in the study
Table 4.3: Professional qualification of teachers

<table>
<thead>
<tr>
<th>Professional Qualification</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploma in Education</td>
<td>10</td>
<td>27.8%</td>
</tr>
<tr>
<td>Bachelor’s degree in Education</td>
<td>11</td>
<td>30.5%</td>
</tr>
<tr>
<td>Master’s degree in Education</td>
<td>7</td>
<td>19.4%</td>
</tr>
<tr>
<td>NCE and grade II certificate</td>
<td>8</td>
<td>22.2%</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>100%</td>
</tr>
</tbody>
</table>

The study outcomes in table 4.3 established that majority 30.5 %( 11) of the respondents indicated that highest professional qualification was a bachelor’s degree. They were followed by 27.8 %( 10) who showed that their highest professional levels was a diploma.19.4 % (7) of the respondents had attained a masters level professional qualifications whereas NCE and Grade II is 22.2 %( 8).

4.3.4. Number of years in teaching profession

The findings in the table 4.4 show the findings on number of years in teaching professions that teachers have been practicing
Table 4.4: Number of Years in the Teaching Profession

<table>
<thead>
<tr>
<th>Number of Years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5 years</td>
<td>13</td>
<td>36.1%</td>
</tr>
<tr>
<td>6-10 years</td>
<td>7</td>
<td>19.4%</td>
</tr>
<tr>
<td>11-15 years</td>
<td>9</td>
<td>25%</td>
</tr>
<tr>
<td>16-20 years</td>
<td>4</td>
<td>11.1%</td>
</tr>
<tr>
<td>More than 20 years</td>
<td>3</td>
<td>8.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

The results in table 4.4 show that majority 36.1%(13) of the respondents have served as teachers for 1-5 years. They were seconded by 25%(9) who indicated that they have been teaching for 11-15 years. 19.4%(7) of the respondents showed that they have been in the profession for 6-10 years and 11.1%(4) of the respondents affirmed that they have been teaching for 16-20 years and lastly 8.3%(3) of the respondents indicated that they have been teaching for more than 20 years.

A similar study conducted in Thailand by Stamper (2002) commented that classroom teachers have only incidental knowledge of ICT use. Teachers recruited to fill teacher shortages in Thailand during the 1970s were not required to have a teaching degree or to take pre-service courses in appropriate uses of new technologies. Teachers of this cohort currently hold lead instructor positions, have seniority on school teaching staffs, and have little incentive to adopt
new teaching methods. Acquiring ICT skills now will not affect their rank, assignments, or pay scale. Practicing teachers need to find pedagogically sound ways to apply technology in the classroom. This is difficult to do when one is not familiar with it and has no motivation to adopt its use (Stamper, 2002).

4.4. The Level of Biology Teachers’ ICT Integration Skills in Bauchi State

This is the first objective of the study which intended to establish the level of biology teachers Information technology integration skills in Bauchi state. To achieve the goal of this objective the researcher used both the questionnaires and interview guide for the head of school. The findings are as discussed in the sub-topics.

4.4.1. Rate of teachers ICT integration in schools

The findings in the figure 4.3 show the results of the analysis on the ICT integrations in schools

![Bar chart showing the rate of teacher ICT integrations in schools]

**Figure 4.3: Rate of teacher ICT integrations in schools**
The analysis outcomes as shown in the figure 4.4 show that majority 41.20 % (14) of the respondents indicated that teachers ICT integration in schools is fair and were seconded by 29.40% (12) who indicated that it is poor. 17.60 % (6) of the respondents indicated that it was good and lastly 11.80% (4) affirmed that it was excellent.

4.4.2. Use of ICT in Preparation of Teaching/Learning Materials

The findings in the table 4.6 show the results of respondents feedback when they were asked to indicate ICT in preparing of teaching and learning materials their feedback is as presented in table 4.6.

**Table 4.6: Use of ICT in preparation of teaching/learning materials**

<table>
<thead>
<tr>
<th>Responses</th>
<th>Computer</th>
<th>Printer</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Never</td>
<td>4</td>
<td>11.1</td>
<td>8</td>
</tr>
<tr>
<td>Rarely</td>
<td>9</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>Frequently</td>
<td>23</td>
<td>63.9</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>100%</td>
<td>36</td>
</tr>
</tbody>
</table>

The findings in the table 4.6 show that majority 63.9% of the biology teachers frequently used computers when preparing for a biology lesson and were seconded by 25 % who rarely use computer in preparing for their biology lessons. 11.1 % of the respondents indicated that they do not use computer in preparing for their lessons. The study also established that 52.8% of the respondents frequently used printers during their learning materials preparations and were
seconded by 25% of the respondents who confirmed that they rarely used printers in their lessons preparations. Minority of the respondents 22.2% indicated that they never used printers during their preparing of learning materials.

Study outcomes observed that 13.9% of the respondents frequently used the internet during their preparation of learning materials and were followed by 36.1% of the respondents who showed that rarely used internet in preparation of their learning materials. Lastly on the other hand 50% of the respondents indicated that they never used internet in preparing their learning materials. Solomon, (1994) carried out a study about technology integration in the schools. They used a qualitative study to examine the classroom practice of 30 "tech-savvy" teachers who used computer technology in their instruction. They found that the teachers were highly educated and skilled with technology, were innovative and adept at overcoming obstacles, but that they did not integrate technology on a consistent basis as both a teaching and learning tool. They stated two reasons regarding these findings: students did not have enough time at computers, and teachers needed extra planning time for technology lessons. Other concerns were outdated hardware, lack of appropriate software, technical difficulties, and student skill levels.

4.4.3. Use of ICT in Classroom Content Delivery

The information in table 4.7 show the respondent’s feedback on whether they use information communication technology in classroom content delivery
Table 4.7: Use of ICT in Classroom Content Delivery

<table>
<thead>
<tr>
<th>Responses</th>
<th>Computer</th>
<th>Projector</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Never</td>
<td>5</td>
<td>13.9%</td>
<td>11</td>
</tr>
<tr>
<td>Rarely</td>
<td>14</td>
<td>38.9%</td>
<td>17</td>
</tr>
<tr>
<td>Frequently</td>
<td>17</td>
<td>47.2%</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36</strong></td>
<td><strong>100%</strong></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>

The research findings established that most teachers 42.2 % (17) frequently use information communication technology in classroom content delivery, and were seconded by 38.9 %( 14) of the respondents who indicated that they rarely use ICT in teaching biology content in class. On the other hand, 13.9 %( 5) of the respondents confirmed that they never used computer in biology content delivery. The findings indicate that 47.2 %( 17) of the respondents rarely used projectors during their biology class content delivery and were seconded by 30.6 %( 11) who indicated that they never used projectors in biology class content delivery. Contradictory, 22.2 % (8) of the respondents indicated that they frequently used projectors in content delivery.

Lastly, 80.6 %( 29) of the respondents indicated that they have never used the internet in biology classroom content delivery and were seconded by 13.9 % (5) of the respondents who indicated
that they rarely used internet in their biology classes during content delivery while only 5.6 % (2) of the respondent frequently used internet.

4.4.4. Rate of Teacher use of ICT

The information in table 4.8 show student’s feedback when they were asked to indicate how often their teachers use information communication technology while teaching them.

Table 4.8: Rate of teacher use of ICT

<table>
<thead>
<tr>
<th>Responses</th>
<th>Computer</th>
<th>Projector</th>
<th>Internet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Never</td>
<td>5</td>
<td>7.4</td>
<td>20</td>
</tr>
<tr>
<td>Rarely</td>
<td>20</td>
<td>29.4%</td>
<td>17</td>
</tr>
<tr>
<td>Frequently</td>
<td>43</td>
<td>63.1%</td>
<td>31</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>100%</td>
<td>68</td>
</tr>
</tbody>
</table>

The study outcomes show that majority 63.1 % (43) of the respondents indicated that their teachers frequently used computers and they were followed by 29.4 % (20) of the respondents who showed that their teachers rarely used computers while instructing them in biology lesson while 7.4 % (5) of the respondents used computer. The study also found out that 46% (31) of the respondents confirmed that their teachers frequently used projectors when teaching biology and were seconded 29.4 % (20) who indicated that they never use projectors in class. On the other hand, 25 % (17) of the respondents showed that their teacher rarely used the projectors while instructing them in their biology class.
Lastly, 83.8 % (57) of the respondents indicated that their teacher never used internet while instructing them in class and were seconded by 22% (15) who indicated that their teachers rarely used the internet while teaching them in class, while only 5.9 % (4) of the respondents indicated that their teachers frequently used the internet in teaching them biology.

4.4.5. Teacher reference to internet as a source of information

The researcher intended to establish whether teachers refer their students to the internet as a source of information and the findings are as shown in table 4.9

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>47</td>
<td>69.1 %</td>
</tr>
<tr>
<td>No</td>
<td>21</td>
<td>30.9 %</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>100%</td>
</tr>
</tbody>
</table>

The findings in table 4.9 show that majority 69.1 % (47) of the students indicated that their teachers used the internet as their reference materials when sourcing information whereas on the other hand 30.9 % (21) of the respondents indicated that their teacher do not asked them to refer to the internet as a source of information.

4.4.6. Teacher Assign Homework to students to be searched from the Internet

The researcher intended to establish whether teachers assign homework to their students to be searched in the internet as a source of information and the findings are as shown in table 4.10
Table 4.10: 4.3.6. Teacher Assign Homework to students to be searched from the Internet

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>57</td>
<td>83.8%</td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>16.2%</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>100%</td>
</tr>
</tbody>
</table>

The study findings in the table 4.10 established that majority 83.8 % of the respondents indicated that their teachers require them to refer to the internet on the assigned homework they have been given to complete their home assignment where as 16.2 % of the respondents showed that their teachers do not require them to use the internet in completing the assigned homework.

4.4.7. Ability for teachers to use computer applications

The study finding in the table 4.11 shows the outcomes of teacher’s rate of familiarity with stated computer applications/packages. The researcher used a Likert scale of key 1-4(1-Excellent, 2-Good, 3- fair and lastly 4-poor) in which respondents were required to use a tick as an indication of their rating on ability to use computer applications.
Table 4.11: Ability for teachers to use computer applications

<table>
<thead>
<tr>
<th>Computer Application</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
</tr>
<tr>
<td>a) Word processor (e.g. MS word)</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>44.4%</td>
</tr>
<tr>
<td>b) Spreadsheets (e.g. MS excel)</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>36.1%</td>
</tr>
<tr>
<td>c) Databases (e.g. MS access)</td>
<td>3</td>
<td>8.4%</td>
<td>21</td>
<td>58.3%</td>
</tr>
<tr>
<td>d) Presentation tools (e.g. PowerPoint)</td>
<td>8</td>
<td>17.6%</td>
<td>15</td>
<td>44.1%</td>
</tr>
<tr>
<td>e) Graphic design (e.g. Adobe)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>f) Internet search tools (e.g. Google)</td>
<td>3</td>
<td>8.3%</td>
<td>15</td>
<td>41.7%</td>
</tr>
</tbody>
</table>

The study outcomes in table 4.11 show that majority 44.4 % (16) of the respondents indicated that they are good in word processor (e.g. MS word) this was followed by 30.6 % (11) of the respondents who showed that their MS word skills are fair but 25 % (9) showed that their skills were poor.
The respondents 52.8 %( 19) indicated that their MS spreadsheet skills were fair and they were seconded by 36.1 %( 13) who confirmed they had good MS word spreadsheet skill but others 11.1 %( 4) of the respondents indicated that their skills were poor. The study also found out that 58.3 %( 21) of the respondents indicated that they had good skills in database and were seconded by 33.3 %( 12) of the respondents who confirmed that they had fair skills while 8.4 %( 3) showed that they had excellent skills in database.

Lastly 44.1 %( 15) of the respondents indicated that they were good at presentation tools and were seconded by 17.6 %( 8) of the respondents who confirmed that they were excellent in MS PowerPoint.20.6 %( 7) of the respondents indicated that they had fair skills in MS PowerPoint whereas 17.6 %( 6) showed that they had poor skills in PowerPoint presentation.

Findings indicate that majority 79.4 %( 27) of the respondents indicated that they had fair skills in graphic design (e.g. Adobe) while 20.6 %( 7) of the respondents indicated that they had poor skills in Graphic design. Lastly, 50 %( 18) of the respondents indicated that they have fair skills in internet search tools and were seconded by 41.7 %( 15) who showed that they had good internet skills and 8.3 %( 3) concluded that they have excellent internet skills. This study found that ICT illiteracy is a major impediment in its use for teaching and learning. This implies a great need for teacher education that will eliminate the lack of knowledge. It will also equip them with ICT skills and set a new and exciting learning environment for today’s learners. This indicated that teachers should become more daring in ICT skills and knowledge acquisition to salvage the situation by getting out of the seemingly in escapable loop so far created between teachers and learners.
4.5. **Availability of ICT resources necessary for the integration of ICT in the teaching of Biology**

This is the second objective of the study which intended to establish the availability of ICT resources necessary for the integrations of ICT in the teaching of Biology. The findings were achieved from the data obtained in the lessons observation checklists, ICT observation checklist and teachers questionnaire. The results are presented in form of sub topics.

### 4.5.1. Availability of Electricity in schools

The findings in figure 4.4 below shows the observation on the availability of electricity in the schools involved in the study.

![Pie chart showing availability of electricity in schools](image)

**Figure 4.4: Availability of Electricity in schools**

The findings in figure 4.4 show that majority 91% of the schools had electricity connections whereas only 9% of the schools did not have electricity.
4.5.2. ICT Hardware available in schools

The findings in figure 4.5 show the researcher's findings on the availability of ICT hardware in the schools involved in the study.

**ICT Hardware availability in schools**

![Bar chart showing availability of ICT hardware in schools]

**Figure 4.5: Availability of ICT hardware in schools**

The findings in figure 4.5 show that majority 67% (24) of the schools had ICT hardware to enable the integrations into students teaching and learning. Whereas on the other hand only 33% (12) of the schools did not have ICT hardware to enable integration into the teaching and learning of biology.

4.5.3. Functional computers available in schools

The findings in figure 4.6 show the researcher observation on the availability of functional computers.
Functional computers available in schools

Figure 4.6: Availability of Functional computers in schools

The study observation findings show that majority 56% (20) of the schools had functional computers whereas 44% (16) of the schools do not have functional computers.
4.5.4. Projectors available in schools

The findings in figure 4.7 show the availability of projectors in schools that were involved in the study.

**Projectors in schools**

![Bar graph showing the availability of projectors in schools. 69% (25) of the schools had projectors whereas only 31% (11) of the schools had no projectors.]

**Figure 4.7: Availability of Projectors**

The study outcomes form the ICT resource observation checklist show that majority (69%) (25) of the schools had projectors whereas only (31%) (11) of the schools had no projectors.
4.5.5. Printers available in schools

The findings in figure 4.8 show the schools involved in the study had printers or not.

**Printers available in schools**

![Pie chart showing 62% with printers and 38% without printers.]

**Figure 4.8: Availability of Printers in schools**

The finding in figure 4.8 shows that majority 62% of the schools had printers whereas only 38% of the schools had no printers.

4.5.6. Presence of ICT software Internet connectivity in schools

The findings in table 4.12 show the analysis of the observation checklist on the presence of ICT software’s internet connectivity in schools.
Table 4.12: Presence of ICT software Internet connectivity in schools

<table>
<thead>
<tr>
<th>Internet Connectivity</th>
<th>Yes</th>
<th></th>
<th>No</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percentage</td>
<td>Frequency</td>
<td>Percentage</td>
</tr>
<tr>
<td>Simulators</td>
<td>25</td>
<td>69.4</td>
<td>11</td>
<td>30.6%</td>
</tr>
<tr>
<td>MS office materials</td>
<td>21</td>
<td>58.3%</td>
<td>15</td>
<td>41.7%</td>
</tr>
<tr>
<td>Education games</td>
<td>20</td>
<td>55.6%</td>
<td>16</td>
<td>44.4%</td>
</tr>
</tbody>
</table>

The findings in table 4.12 show that 69.4% of the schools had simulators but only 30.6% of the schools did not have that. Also the study established that 58.3% of the schools had MS office materials while only 41.7% did not have MS office materials. Lastly, 55.6% of the schools have education games whereas only 44.4% of the schools did not have education games that students played on the computers.

4.5.7. Teacher use of ICT during lessons

The findings in the figure 4.9 show the head teacher’s feedback on teachers use of information and communication technology during their lessons.
Figure 4.9: Teacher use of ICT during lessons

The findings in the figure 4.9 shows that majority 56 % (20) of the head teachers indicated that teachers in their schools do not use information and communication technology in their lessons and only 44% (16) who integrate ICT in their teaching and preparation of lessons.

4.5.8. School administration support

The findings in the table 4.13 show the respondents feedback on condition of school administration’s support, provision and ensuring the availability of Information and communication technology in their schools.
Table 4.13: School administration ICT support

<table>
<thead>
<tr>
<th>Types of Support</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
</tr>
<tr>
<td>a) Purchasing and repairing of ICT facilities.</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Motivating teachers towards integrating ICT in teaching and learning.</td>
<td>2</td>
<td>5.6</td>
<td>20</td>
<td>55.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Sponsoring most teachers for ICT integration in-service courses.</td>
<td>0</td>
<td>0</td>
<td>27</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For any research to succeed in an institution mostly schools, the administration plays a very significant role in foreseeing that. The study findings in the table 4.13 indicate that majority 38.9% of biology teacher confirmed that the school administration support in Purchasing and repairing of ICT facilities to ensuring integrations of information and communication technology were fair and were seconded by 25% who showed that the support were good. On the other hand, 36.1 % of the respondents showed that the support were poor.

The study established that majority 55.6 % of the respondents indicated that the administration did good in Motivating teachers towards integrating ICT in teaching and learning and were seconded by 38.8%(14) who showed that they did fair and lastly 5.6%(2) showed that the administration did excellent .Lastly, majority 75%(27) showed that the administration support
were good in Sponsoring most teachers for ICT integration in-service courses and were seconded by 25%(9) of the respondents who showed that the support were fair.

4.5.9. ICT resources available in the schools

The findings in the table 4.14 below show the outcomes on ICT resources availability and use by teachers in the schools

Table 4.14: ICT resources available in the schools

<table>
<thead>
<tr>
<th>ICT Resources</th>
<th>Is it available</th>
<th>If so, have you used it?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>f</td>
<td>%</td>
</tr>
<tr>
<td>a) Computer /laptop</td>
<td>23</td>
<td>63.9</td>
</tr>
<tr>
<td>b) Internet</td>
<td>8</td>
<td>22.2</td>
</tr>
<tr>
<td>c) Printer</td>
<td>16</td>
<td>44.4</td>
</tr>
<tr>
<td>d) Biology software</td>
<td>5</td>
<td>13.9</td>
</tr>
<tr>
<td>e) Projectors</td>
<td>20</td>
<td>55.6</td>
</tr>
</tbody>
</table>

Source: Result of the respondents questionnaire

The findings in the table 4.14 show that majority 63.9% (23) of the respondents indicated that computers/laptops were available whereas on the other hand 36.1% (13) indicated that computer/laptop are not available in their schools. Those who indicated that the
computers/laptops are available in their schools 87 % (20) of them affirmed that they have used them whereas 13 % (3) indicated that they have not used the equipment’s.

About 76.4 % (26) of the respondents indicated that they don’t have internet in their schools whereas on the other hand 22.2 % (8) affirmed that they have internet in their schools. Out of those who confirmed that they have an internet connection in their school 62.5 % (5) confirmed that they have never used the internet while on the other hand 37.5 % (3) showed that they have been using the internet in their teaching.

About 52.9 % (18) of the respondents indicate that printers are not available in their schools whereas on the other hand 44.4 % (16) of the respondents indicated that they do have a printer in their schools. Amongst those who indicated they have a printer in their schools 56.2 % (9) of them confirmed that they do not know how to use the printer while only 43.8 % (7) confirmed that they knew how to use the printers.

Followed by 85.3% (29) of the respondents showed that they do not have biology software in their school whereas on the other hand 13.9 % (5) confirmed that they have biology software in their school. Amongst those ascertained to that 80 % (4) do not know how to use the software and only 20 % (1) agreed on knowing how to use the software.

Lastly 55.6 % (20) of the respondents to the study indicated they have projectors in their school whereas 44.4% (16) of the respondents indicated that they do not have projectors. Amongst those who indicated that they have projectors in their schools 75 % (15) of them confirmed that they knew how to use them while only 25 % (5) doesn’t how to use the projectors.
Giordano, (2007) carried out a study examining the factors relating to the teachers’ attitudes toward information and communication technologies. A questionnaire was designed to collect evidence from high school English teachers about their perceptions of computer attributes, cultural perceptions, computer competence, computer access, and personal characteristics (including computer training background). The sample consisted of 63 male and 251 female teachers.

The results showed that a relatively high percentage of the respondents (57%) had computers at home while only 33.4% of the respondents had access to computers at school. This percentage gives a clear indication of the insufficiency of computers at Syrian schools, particularly for teacher use. Thus, Giordano, (2007) findings substantiated this globally felt barrier that computer access has often been one of the most important obstacles to technology adoption and integration worldwide Dawes, (2001).

The findings of this study showed that ICT were available and to a large extent accessible to teachers and learners in secondary schools of Bauchi state. However the study also found that the ICT available were not sufficient for the teaching/learning needs of both teachers and learners. The teachers and the student’s perceptions on the sufficiency of ICT were very similar, clearly showing that ICT were not enough in schools.
4.6. The attitude of Biology teachers towards the integration of ICT in the process of teaching and learning

This is the third objective of the study which aimed at establishing the attitude of biology teachers towards the integrations of information and communication technology in the process of teaching and learning. The findings on this objective have been discussed in subtopics.

4.6.1. Prioritizing ICT integration

The findings in the table 4.15 show the results on head teacher agreement on prioritization of information and communication technology in their teaching and learning process.

Table 4.15: Prioritization of ICT integrations

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>25</td>
<td>69.4%</td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>30.6%</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>100%</td>
</tr>
</tbody>
</table>

The study outcomes as shown in the table 4.15 indicate that 69.4% of the schools head teacher agreed to prioritization of integrations of ICT integrations in learning where as 30.6% were not standing for that. Despite the findings that the teachers were not using ICT in the class rooms, all the stake holders, i.e. teachers, students, and school head of institutions had a positive attitude towards the use of ICT in biology class rooms. Murdock and Desberg (1994) realized that students can use ICT to break out of the walls of class rooms, but this research found that in the Nigerian situations the teacher is very instrumental in helping the students do so. This is because
the African culture, teachers have authority and a lot of influence on what the student can take up in the class room. Molnar (1997) agrees that the successful use of ICT in the class room is dependent on positive teacher attitude towards ICT.

4.7 Administration’s support towards ICT integration in the teaching of Biology

This is the last objective of the study which aimed at establishing the administration supports towards Information and communication technology integrations in the teaching of biology. The findings were achieved and discussed in the sub-topics which include ICT impact in learning, prioritization of purchased of ICT resources and considering ICT integration as a requirement.

4.7.1 ICT impacts in learning

The findings in table 4.16 shows the teachers response on various statements on the impacts of information technology integrations in learning, the researcher used a likert scale key 1-5(1- Strongly agreed,2-Agree,3-Neutral,4- Disagree and lastly 5-Strongly disagreed) the results of the analysis were as presented.

<table>
<thead>
<tr>
<th>Statements</th>
<th>SA</th>
<th>A</th>
<th>N</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Use of ICT in teaching can help improve learners’ performance.</td>
<td>19 52.8</td>
<td>9 25</td>
<td>8 22.2</td>
<td>0 0</td>
</tr>
</tbody>
</table>
b) ICT can make difficult concepts be understandable by the learners.

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>36.1</td>
<td>23</td>
<td>63.9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

c) ICT has the ability to improve my quality of classroom teaching.

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>72.2</td>
<td>7</td>
<td>19.4</td>
<td>3</td>
<td>8.3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

d) It is easy to integrate ICT in the classroom teaching.

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>15</td>
<td>41.7</td>
<td>4</td>
<td>11.1</td>
<td>17</td>
<td>47.2</td>
</tr>
</tbody>
</table>

e) Teachers should frequently attend ICT integrated into service courses

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>58.3</td>
<td>15</td>
<td>41.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

f) ICT integration training should be included in the teacher training institutions.

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>80.8</td>
<td>7</td>
<td>19.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The study found out that majority 52.8 % (19) of the respondents strongly agreed that use of ICT in teaching can help improve learners’ performance. They were seconded by 25% (9) of the respondents who agreed, however 22.2 % (8) were neutral to the statement.

Also the study found out that majority 63.9 % (23) of the respondents indicated that they agreed that ICT can make difficult concepts be understandable by the learners, and were seconded by 36.1 % (13) who strongly agreed to that. Also respondents indicated that ICT has the ability to improve their quality of classroom teaching this was strongly agreed upon by 72.2 % (26) and were seconded by 19.4 % (7) whereas 8.3 % (3) were neutral to that.
The study found out that majority 47.2 % (17) of the respondents disagreed to the statement “It is easy to integrate ICT in the classroom teaching.” However, 41.7 % (15) of the respondents agreed to that and only 11.1 % (4) were neutral to that.

The analysis also showed that majority 58.3 % (21) of the respondents indicated that strongly agreed that Teachers should frequently attend ICT integrated in-service courses and were seconded by 41.7 % (15) who agreed. Lastly, 80.8(29) of the respondents indicated that they strongly agreed to ICT integration training to be included in the teacher training institutions and were seconded by 19.2 % (7) who agreed.

4.7.2 Prioritization of purchase of ICT resources

The findings in the table 4.17 shows the head teacher feedback when they were asked to indicate whether ICT resource should be put into purchase priority of their schools

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>25</td>
<td>69.4%</td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>30.6%</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>100%</td>
</tr>
</tbody>
</table>

The study findings in the table 4.17 indicated that majority 69.4 % of the respondents agreed to prioritization of purchase of ICT resources in their schools where as 30.6 % did not agreed to that.
4.7.3 Considering ICT integrations as a requirement

The findings in the table show the head teacher’s feedback on considering information and communication technology as a requirement in their schools.

Table 4.18: Considering ICT integrations as a requirement

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>22</td>
<td>61.1%</td>
</tr>
<tr>
<td>No</td>
<td>14</td>
<td>38.9%</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>100%</td>
</tr>
</tbody>
</table>

The findings in the table 4.18 show majority 61.1% of the head teachers agreed to consider ICT integrations as a requirement in their schools teaching and learning but only 38.9% did not applaud to that. Despite the availability of ICT in schools, 61.1% of head teachers as shown on table 4.18 of this study acknowledge that the ICT were not enough. The acknowledgement that the ICT were not enough implies that head teachers were aware that they were expected to provide more ICT resources. Head teachers got ICT resources for their schools through partnership with NGOs and development partners. This implies that the cost is of impediment towards ICT acquisition and agrees with the findings that the cost of ICT hardware and software were cited as one of the challenges that head teachers were experiencing.
CHAPTER FIVE
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1. Introduction

This chapter covers summary of the findings, discussion of results and conclusions drawn from the study as well as recommendations based on the study findings and suggestions for further studies.

5.2. Summary of the findings

At the classroom level, teachers can more easily keep student’s marks and their personal and academic records permanently up-to-date, as well as produce all required data for school administration and for parents, using preformatted documents. Most importantly, teachers can maintain their subject content (lesson plans, exercises, evaluation) in digital format, making it easy to update, to share with other teachers and to enhance with time.

In fact, the many ways tools such as a computer, a handheld device or a portable keyboard (and a network) can help a teacher in administrative tasks is one of the more convincing arguments to make to inexperienced teachers so they will accept training eagerly. This should be carefully considered during teacher-training planning because before pedagogical use in the classroom, many teachers may prefer to become familiarized first with the technology outside the classroom. This can often be facilitated greatly by starting out with software applications or simple devices such as portable keyboards or handhelds that can be of immediate use. It is relatively easy to learn how to use these machines to store text in a portable keyboard, to construct spreadsheets, or to make use of word processing to record students’ marks and records.
Although, some research studies have shown that ICT has a huge impact on the ways in which principals work (Hardman, abd-Kadir, and Smith, (2008), the ICT research literature has largely ignored the role of principals as technology leaders (Gorder, 2008). Meredith, (1996). This gap in the research literature is rather strange because many research studies related to school improvement, school effectiveness, and change showed that school principals play an important role in creating successful changes in schools (Hardman, abd-Kadir, and Smith, (2008)). According to (Hardman, abd-Kadir, and Smith, F.,(2008), school leaders are key factors in ICT implementation in schools. They have to shoulder the heavy responsibility for creating changes in schools through the use of ICT and facilitating the process of making complicated decisions to integrate it in schools (Schiller, 2003).

Although the role of the principal in supporting technology integration is very important, there are a few researches conducted on the role of the principal in ICT implementation. Also, little is known about the use of ICT by principals and the factors that are related to their level of computer use.

5.3.  Conclusions

The proliferation of technologies has complicated the teaching-learning process and finding the best ways of integrating technology into classroom practices is one of the challenges the 21st century teachers face. Effectively integrating ICT into learning systems is much more complicated than providing computers and securing a connection to the Internet. In fact, the integration of ICT is associated with a shift from instructivist to constructivist philosophies of
teaching and learning (Ertmer, 1999). So, technology integration takes time; time to learn about the innovation, time to be adequately prepared to use it.

In this respect, principals play an important role and apply different strategies such as change agent, lifelong learner, principal supporter, and resource provider to implement ICT in schools (Hayes, 2003). Thus, they should be able to identify and articulate a vision, provide an appropriate model, provide individualized support, provide intellectual stimulation, foster acceptance of group goals, and achieve high performance expectations (Solomon, 1992). They should have knowledge, skills and positive attitudes toward the implementation of ICT in schools. In this way, they can create changes in their schools by focusing on action and by converting their teachers to be leaders who will eventually become agents of change. Therefore, teachers can play a role as a leader when they are committed to a cause and are self-managing (Davis, Bagozzi, and Warshaw, 1989).

5.4 Implications of the study

This study found that ICT were available and accessible to teachers and learners but were not largely being employed in the teaching and learning of biology. The implication is that there is need to seek and clearly focus on the other changes related to the use of ICT it teaching and deal with them swiftly before the teaching goes to waste in this area of teaching and learning of biology.

This study found that teachers and students have a positive attitude towards the use of ICT for teaching and learning. This implies that both parties know the general trend towards the use of ICT, in all spheres of life including teaching and learning would like to be part of this trend despite the challenges. The study also found that ICT illiteracy is a major impediment in its use
for teaching and learning. This implies that a great need for teacher education that would eliminate the lack of knowledge. It will also equip them with ICT skills and set a new and exciting learning environment for today's learners.

5.5 Recommendations

Based on the findings and conclusions the study made the following recommendations that;

i. Governments should improve the training of principals, teachers and computer personnel on the use of computers and other ICT equipment through seminars, workshops and in-service training.

ii. Emphasis should be aimed at developing a long term program effective for continuous commitment to training and use of instructional technologies.

iii. The national and state governments should show more interest in imbibing information communication and technology (ICT) and supply the necessary ICT equipment to all secondary schools through improved funding for the purchase of ICT equipment.

iv. Delivery of instruction should be site-based over an extended period of time, so that teachers can develop and use materials and methods with their students. There should be a provision for delivery and support methods through reliable distance delivery and support to local schools. Both hardware and software support at the local level is critical to site-based delivery of in-service training.

v. Principals should be encouraged to use ICT equipment for the effective management of their schools. This could be done through improved usage of computers and other ICT materials supply to their schools for the storage and retrieval of data on staff and students as well as for data analysis.
vi. To effectively infuse into the schools’ culture, and to be considered relevant by teachers and school administrators, a comprehensive ICT policy should be part of an effort towards improving the equity and quality of an educational system. Also, educational initiatives ought to be coordinated through all administrative and operational levels in order to effectively send coherent messages to teachers, parents and administrators.

vii. Teachers and administrators must have clear and positive incentives for participating in ICT in-service.

5.6 **Recommendations for further studies**

i. The socio-economic factors that influence the uptake of e-learning in public secondary schools.

ii. ICT adoption in educational institutions has brought gains and losses. A critical analysis of both the gains and losses arising from ICT adoption in institutions

---

**REFERENCES**


Zainudin, A. (2012). Research methodology and data analysis, Malaysia: Published by deesega.


APPENDIX 1: ICT RESOURCES CHECKLIST

INTRODUCTION

This instrument will be filled by the researcher. The researcher will visit the computer rooms, staff rooms, departmental offices and any other room/office in the school in which ICT facilities are kept and do a physical check and count filling out this instrument.
SECTION A: BACKGROUND INFORMATION

1. Name of the school

2. Type of the school
   a) Boys boarding [ ]
   b) Girls boarding [ ]
   c) Mixed boarding [ ]
   d) Mixed day [ ]

SECTION B: CHECKLIST

3. Electricity
   Yes [ ]  No [ ]

4. ICT hardware
   a) Functional computers
      Yes [ ]  No [ ]
      If yes, how many?
   b) Projector
      Yes [ ]  No [ ]
      If yes, how many?
   c) Printers
      Yes [ ]  No [ ]
      If yes, how many?
   d) Others (Specify)
5. Presence of ICT software

   a) Simulations    Yes [    ]    No [    ]

   b) MS Office materials  Yes [    ]    No [    ]

   c) Educational games    Yes [    ]    No [    ]

   Others ..............................................................................................................

6. Internet connectivity    Yes [    ]    No [    ]

   If yes, what are its specifications?

..............................................................................................................

..............................................................................................................

..............................................................................................................

..............................................................................................................

APPENDIX II: LESSON OBSERVATION SCHEDULE (LOS)

INTRODUCTION
The data in this instrument will be collected by the researcher himself. The researcher will sit at the back of the classroom during a biology lesson as a non-participant observer and will collect the data as the lesson progresses.

SECTION A: BACKGROUND INFORMATION

1. Name of the school

2. Type of the school
   a) Boys boarding
   b) Girls boarding
   c) Mixed boarding
   d) Mixed day

3. Gender of the teacher
   Male [ ]  Female [ ]

4. Approximate number of learners present during the lesson

SECTION B: BIOLOGY LESSON OBSERVATION

5. Does the teacher integrate ICT integration during the lesson
   Yes [ ]  No [ ]

If yes,

   a) Who is in charge of the software and hardware manipulation?

   Biology teacher [ ]  another person [ ] specify

   b) If it is the Biology teacher, what is his/her skill level?

   Excellent [ ]  Good [ ]  Average [ ]  Below average [ ]
c) What hardware and software/programs were being utilized?

i. Hardwares

......................................................................................................................................................
......................................................................................................................................................
......................................................................................................................................................
......................................................................................................................................................

ii. Software/Programs

......................................................................................................................................................
......................................................................................................................................................
......................................................................................................................................................
......................................................................................................................................................

APPENDIX III: BIOLOGY TEACHER QUESTIONNAIRE (PTQ)

SECTION A: INTRODUCTION
This questionnaire is meant for academic research purposes. The information you provide in this questionnaire will be handled as confidential and will only be used for the above-stated purpose.

You are requested to provide the requested information with truthfulness to the best of your knowledge.

Thanks in advance.

**SECTION B:**

1. Gender  
   - Male [ ]  
   - Female [ ]

2. Highest professional qualification  
   - Diploma [ ]  
   - Bachelors Degree [ ]  
   - Masters Degree [ ]  
   - Other [ ] Specify ....................

3. Number of years in the teaching profession  
   - 1 to 5 [ ]  
   - 6 to 10 [ ]  
   - 11 to 15 [ ]  
   - 16 to 20 [ ]  
   - more than 20 [ ]

4. Your second teaching subject .................................................................

5. Name of the school ........................................................................

6. Type of the school  
   a) Boys boarding [ ]
   b) Girls boarding [ ]
   c) Mixed boarding [ ]
   d) Mixed day [ ]

**SECTION C:**

7. How frequently do you use the following for the preparation of the teaching-learning materials?
### Question 8

How frequently do you use the following in the classroom content delivery?

<table>
<thead>
<tr>
<th></th>
<th>Frequently</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Computer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Internet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Printer</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Question 9

How would you rate your ability to use the following computer applications:

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>g) Word processor (e.g. MS word)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Spreadsheets (e.g. MS excel)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Databases (e.g. MS access)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
j) Presentation tools (e.g. PowerPoint)

k) Graphic design (e.g. Adobe)

l) Internet search tools (e.g. Google).

10. How would you rate your school’s administration effort in the following tasks:

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>d)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Purchasing and repairing of ICT facilities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motivating teachers towards integrating ICT in teaching and learning.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sponsoring most teachers for ICT integration in-service courses.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
11. Please indicate which of the ICT resources listed below are available for use at school as a teacher and whether you have used them.

<table>
<thead>
<tr>
<th>ICT Resource</th>
<th>Is it available</th>
<th>If so, have you used it?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>YES  NO</td>
<td>YES NO</td>
</tr>
<tr>
<td>f) Computer /laptop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Internet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Printer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Biology software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>j) Projectors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12. How strongly do you agree or disagree with the following

SA= Strongly Agree   A= Agree     N= Not sure    D= Disagree   SD= Strongly Disagree

g) Use of ICT in teaching can help improve learners’ performance.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>h)</td>
<td>ICT can make difficult concepts be understandable by the learners.</td>
</tr>
<tr>
<td>i)</td>
<td>ICT has the ability to improve my quality of classroom teaching.</td>
</tr>
<tr>
<td>j)</td>
<td>It is easy to integrate ICT in the classroom teaching.</td>
</tr>
<tr>
<td>k)</td>
<td>Teachers should frequently attend ICT integrated into service courses</td>
</tr>
<tr>
<td>l)</td>
<td>ICT integration training should be included in the teacher training institutions.</td>
</tr>
</tbody>
</table>
APPENDIX IV: BIOLOGY STUDENT QUESTIONNAIRE (BSQ)

SECTION A: INTRODUCTION

This questionnaire is for academic research purposes. The information you provide will be treated as confidential and will only be used for the above stated purpose. You are kindly requested to provide the requested information freely and with utmost truthfulness to the best of your knowledge.

Thanks in advance.

SECTION B: BACKGROUND INFORMATION

1. Gender
   Male [  ]
   Female [  ]

2. Current level (Form)
   One [  ]
   Two [  ]
   Three [  ]
   Four [  ]

3. Name of the school .................................................................

4. Type of the school
   a) Boys boarding [  ]
   b) Girls boarding [  ]
   c) Mixed boarding [  ]
d) Mixed day [  ]

5. How often does your Biology teacher use the following when teaching?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Computer</td>
<td>[  ]</td>
<td>[  ]</td>
<td>[  ]</td>
</tr>
<tr>
<td>b) Projector</td>
<td>[  ]</td>
<td>[  ]</td>
<td>[  ]</td>
</tr>
<tr>
<td>c) Internet</td>
<td>[  ]</td>
<td>[  ]</td>
<td>[  ]</td>
</tr>
</tbody>
</table>

6. Other than the books, does your Biology teacher give reference to internet as a source of information?

Yes [  ]

No [  ]

7. Does your Biology teacher give you the assignment to search from the internet?

Yes [  ]

No [  ]
APPENDIX V: HEAD OF INSTITUTION INTERVIEW SCHEDULE (HII)

SECTION A: INTRODUCTION

This instrument will be filled by the researcher himself. The researcher will visit the offices of the heads of institutions and conduct an interactive with the head of the institution, filling in the interview schedule as the interview progresses.

SECTION B: BACKGROUND INFORMATION

1. Gender  Male [ ]  Female [ ]
2. What are your teaching subjects? .................................................................
3. Name of the school ...........................................................................................
4. Type of the school
   a) Boys boarding  [ ]
   b) Girls boarding  [ ]
   c) Mixed boarding [ ]
   d) Mixed day  [ ]
5. How many students does the school have? .....................................................
6. How many streams in the school? .................................................................
SECTION C: INTERACTIVE QUESTIONS

7. In your school, how would you rate your teacher’s integration of ICT in teaching and learning?
   Excellent [ ]  Good [ ]  Fair [ ]  Poor [ ]

8. What are the possible barriers or enablers of ICT integration in teaching among your teachers? ........................................................................................................................................................
   ........................................................................................................................................................
   ........................................................................................................................................................

9. In the past two years, the government has channeled a lot of finances to ICT integration in schools. In your opinion, should ICT integration be given such a high priority?
   Yes [ ]  No [ ]
   Explain ..............................................................................................................................................
   ..............................................................................................................................................
   ..............................................................................................................................................

10. What priority do you give the purchase and maintenance of ICT resources in your school?
    High [ ]  Medium [ ]  Low [ ]
    Give reasons .......................................................................................................................................
    ....................................................................................................................................................
    ....................................................................................................................................................
    ....................................................................................................................................................
11. In your assessment of teacher’s classroom teaching practices, do you consider ICT integration as a requirement?

Yes [ ]  No [ ]

Give reasons ........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
APPENDIX VI: MAP OF NIGERIA
APPENDIX VII: MAP OF BAUCHI STATE
APPENDIX VIII: RESEARCH AUTHORIZATION LETTER
APPENDIX IX: RESEARCH INTRODUCTORY LETTER

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

OUR REF: E55/CE/23561/11

Date: 1st March, 2016

The Commission,
Ministry of Education
FMD 064, Railway Road
BAUCHI STATE, NIGERIA

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR. MOHAMMED BARDE REG.NO. E55F/27529/13

I write to introduce Mr. Barde who is a Postgraduate Student of this University. He is registered for M.Ed. Degree programme in the Department of Educational Communication & Technology in the School of Education.

Mr. Barde intends to conduct research for M.Ed. thesis entitled “Teachers’ Readiness for Integration of Information Communication and Technology in the Teaching of Biology in Secondary Schools of Bauchi State, Nigeria”

Any assistance given will be highly appreciated.

Yours faithfully,

MRS. EUGY N. MBAABU
FOR: DEAN, GRADUATE SCHOOL

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530
The Principal,

__________________________________________

__________________________________________

LETTER OF INTRODUCTION

(Muhammed Barde)

I am directed to introduce the bearer named above who is a student of Kenyatta University Nairobi, Kenya. He is undergoing a project titled "Teachers’ Readiness for Integration of Information Communication and Technology in the Teaching of Biology in Secondary Schools of Bauchi State, Nigeria”.

2. Kindly give him all the necessary assistance he may require to make the research successful.

3. Thank you.

(BINTA A. SAMBO)

FOR: HONOURABLE COMMISSIONER