The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

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Supervisor:

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December, 2019

DECLARATION

I, **Olabode Olajide**, declare that:

(i) The research reported in this thesis, except where otherwise indicated, is my original work.

(ii) This thesis has not been submitted for any degree or examination at any other university.

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ABSTRACT

The purpose of this study is to investigate the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria. The significance of this study revolves round the prominence given to science education being a mechanism for realising national advancement in Nigeria. This was emphasised in the Nigeria National Policy on Education (2013) as the Federal Government of Nigeria adopted science education as an instrument for effecting national development. This study addressed the following research questions: What is the status of secondary school libraries in Ekiti State, Nigeria? To what extent does the quality of library resources influence science curriculum implementation? To what extent do science teachers advocate using information resources beyond textbooks?

This study was grounded in the theory of constructivism, the teaching theory upon which inquiry is based. The pragmatic paradigm was used to underpin the study. The methodological approach adopted for this study was mixed methods. The study's population comprised school librarians, school principals, science teachers and science students in public senior secondary schools as well as major stakeholders in education associated with the provision, management and utilisation of library resources for science curricula implementation in Ekiti State, Nigeria. The instruments of data collection were questionnaires, interviews, observation and document analysis.

Questionnaires were designed for school librarians, science teachers and science students, while interviews were conducted with school principals and education stakeholders such as area education officers, the permanent secretary, director of teaching service commission and director of State Library Board. Response rates of 97.9% and 100% were obtained from the data collected through quantitative and qualitative methods respectively. Quantitative data collected through the three set of questionnaires were analysed using Statistical Package for Social Sciences (SPSS) to generate descriptive statistics (chi-square, cross tabulations, percentages/frequency tables and charts) to compare similarities and contrasts as well as identify tendencies to actualise the objectives of the study, while qualitative data (interviews) were transcribed and analysed thematically. Library accession registers were statistically analysed to determine the level of acquisition, quantity and quality of library resources. The study complied with the ethical protocols of the University of the Western Cape.

The findings revealed that none of the library staff had a relevant qualification to occupy the post of school librarian in Ekiti State. The findings further revealed that the majority of the library personnel had worked for more than 10 years. Moreover, the majority of library resources that support science curriculum implementation were mainly textbooks. The findings showed that other formats of library resources, apart from textbooks, were either inadequate or not available. Very few (7.9%) teachers adopted inquiry approaches as the majority used a teacher-centred approach. The study offers some far reaching recommendations that could position school libraries for achieving the government's vision.

Keywords: School libraries, Science Curriculum Implementation, Constructivism, Inquiry-based Learning, Science Teachers, Science Subjects, Secondary Schools, Ekiti State, Nigeria

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DEDICATION

This thesis is dedicated to the Almighty God who strengthened, protected and inspired me; to the memories of my parents, Chief Gabriel and Mrs Bosede Olajide-Fasheki; and to my darling wife Engr (Mrs) Favour Bode-Olajide who has always been my partner in progress.

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LIST OF ABBREVIATIONS AND ACRONYMS USED IN THE THESIS

AASL	American Association of School Librarians
AECT	Association for Educational Communications and Technology
AEO.	Area Education Officer
AIT	African Independence Television
ALA	American Library Association
ALIA	Australian Library and Information Association
ASLA	Australian School Library Association
BA Ed	Bachelor of Art in education
B. Ed	Bachelor of Education
BSc Ed	Bachelor of science in education
CD-ROM	Compact Disc-Read Only Memory
CSEE	Certificate of Secondary Education Examination
CSAP	Colorado Student Assessment Programme
DVD-ROM	Digital Versatile Disc- Read Only Memory
EU	European Union
IBL	Inquiry-based Learning
ICTs	Information and Communication Technologies
IFLA	International Federation of Library Associations
IL	Information literacy
JAMB	Joint Admission and Matriculation Board
LRCN	Librarians' registration Council of Nigeria
M. Ed	Master in Education

N. D.	No Date
NRC	National Research Council
NECO	National Examination Council
NERDC	Nigerian Educational Research and Development Council
NLA	Nigerian Library Association
NNPE	Nigeria National Policy on Education
NSES	National Science Education Standards
NTA	Nigerian Television Authority
NV20:2020	Nigeria Vision 20: 2020
OSA	Old Students Association
PGDE	Post Graduate Diploma in Education
PhD	Doctor of Philosophy
PR&S	Planning, Research and Statistics
PS	Permanent Secretary
PTA	Parents teachers Association
SEPIP	State Education Programme Investment Project
SLB	State Library Board
SPSS	Statistical Package for Social Sciences
SSS	Senior secondary schools
STEM	Science, Technology, Engineering and Mathematics
SUBEB	State Universal Basic Education Board
TESCOM	Teaching Service Commission
TRCN	Teachers' Registration Council of Nigeria
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
UBE	Universal Basic Education
USA	United States of America
UWC	University of the Western Cape
WAEC	West Africa Examination Council
WASSCE	West African Senior School Certificate Examinations

CHAPTER ONE

BACKGROUND TO THE STUDY

1.1. INTRODUCTION

The 21st century is increasingly being driven by science and technology. The United Nations Educational, Scientific and Cultural Organisation (UNESCO) recognises this and made its mission to spread not only education, but make a prominent interest in science education wherever it is offered. Through different ways, UNESCO has pushed for curriculum updating where necessary, offered hands-on workshops, provided kits, textbooks and guide books which are made available free of charge for teachers and students, and assists member states to ensure that a sound basis in science education is not just a privilege but a right. In a bid to achieve this laudable project, UNESCO recognises the importance of libraries and, with joint efforts with Nature Education and Roche, developed the World Library of Science, a free online resource for science learning discovery (UNESCO, 2005; UNESCO Science Education, n. d.; UNESCO World Library of Science, n. d.). This is to inspire curiosity in science, facilitate collaboration and foster scientific enquiry. Encouragingly, in the mist of this development, Africa has been selected as its priority area.

Secondary school education in Nigeria is the link between primary and tertiary education. It is the foundational basis of science. The government has placed emphasis on science and targeted skills development in science to achieve its Nigeria Vision 20:2020 (NV20:2020), which is a national effort aimed at developing and growing Nigeria and bringing her in to the league of the 20 largest leading economies by the year 2020 (Economic Transformation Blueprint, 2009).

Significant international organisations such as the International Federation of Library Associations (IFLA) and the UNESCO, have acknowledged the importance of libraries in schools, especially in developing countries such as Nigeria. In 1999, the IFLA/UNESCO published a School Library Manifesto, which stated that: the school library is essential to every long-term strategy for literacy, education, information provision and economic, social and cultural development. It has been demonstrated that, when school librarians and teachers collaborate, students achieve higher levels of literacy, reading, learning, problem-solving and information and communication technology (ICT) skills.

A school library, according Ayanlola (2014), provides information and ideas that are necessary to the success of our conduct in the 21 century society. Libraries are expected to deliberately change the perception of themselves from spaces of collections of information to spaces of creation of information, since today's societies are characterized by their heavy dependence on information. The school library has an obligation to offer learning services, books and resources that enable entire members of the school community to become critical thinkers and effective users of information in all formats and media, with links to the wider library and information networks. The school library could be described as

> the school's physical and digital learning space where inquiry, research, reading, thinking, imagination, and creativity are crucial to students' information-to-knowledge journey and to their personal, cultural and social growth. This physical/digital space is known by numerous terms such as: documentation and information centre; school media centre, library learning commons and library resource centre, however, school library is the term generally applied and used for the facilities and functions (IFLA and Institutions, 2015, p16).

Scholastic Library Publishing (2016, p. 2) emphasised that for school libraries to have maximum impact they should perform the following functions:

- provide collaborative programmes for reading instruction
- select and provide resources to meet the learning needs of all students
- assure seamless integration of technology, teaching, and learning
- provide resources to support state and national standards
- offer resources that enhance classroom-level collections
- encourage students to independently seek, access, and use information (p. 2).

School library resources include but are not limited to electronic, print, multimedia, internet/web and curated digital collections for teaching and learning. According to Isiye (2015), technologies facilitate round the clock access to the school library both in and outside the school environment. In school, the library, which serves as a centre for teaching and learning, makes provision for an active instructional programme in a way to achieve thinking-based, knowledge-based, resource-based, reading and literacy, and learning management capabilities. These capabilities and dispositions are what required of students to prepare for, plan and successfully undertake a curriculum-based inquiry unit (Todd, 2011). School libraries serve both students and teachers by providing them with access to relevant curricular information resources. School libraries also offer teachers professional development within the school environment and beyond. Krashen (2005) argues that digital resources and a print-rich environment leads to free voluntary reading which improves students' potential for grammatical and spelling competence, comprehensive knowledge, numeracy and language ability. The next section discusses the steps taken by the government towards repositioning school libraries to meet up with the 21st century where science is being adopted as an instrument to achieve its vison.

1.2. THE NIGERIAN CONTEXT

In Nigeria, the government realised the significance of school libraries in the Nigeria National Policy on Education (NNPE) (2013, p. 38) which includes a statement on school libraries under 'Educational Services' as follows: "since school libraries constitute one of the most important educational services, proprietors of schools shall provide functional libraries in all their educational institutions in accordance with the established standard, and the weekly library period shall be part of the school curriculum, ton aid learning activities" The national policy documents remain hitherto the most authoritative government policy statement on the provision of libraries in Nigerian schools. Functional school libraries provide a way towards the recognition of curriculum goals and objectives of school subjects, including science subjects. The school library is expected to be set up to expedite the implementation of educational policy goals by providing suitable media resources through careful selection, acquisition and processing of the information resources and making both printed and non-printed media resources available for school community use, particularly students (Afolabi & Elaturoti, 2016).

The major priority of the Nigerian Government has been to reposition science, vocational and technical education in the scheme of national education for optimal performance (Nigeria National Policy on Education, 2013). This is further affirmed in the NV20:2020, which is a national effort targeted at growing, developing and bringing Nigeria to be amongst the world's 20 leading economies by 2020. Acquiring quality education, particularly science education and skills, is one of the cardinal points of the NV20:2020 (Economic Transformation Blueprint, 2009). However, the degeneration in the standard of education has seriously hindered the competitiveness of Nigerian graduates in the national and global labour markets, making it challenging for them to find jobs globally, most especially in science and the information and communication technology (ICT) sub-sector (Economic Transformation Blueprint, 2009). One of the aims of the NV20:2020 is to make the school curriculum more relevant to the needs of the labour markets. To this end, emphasis is being placed on science and ICT diffusion and targeted skills development. Therefore, the government's vision is to make relevant a curriculum that guarantees quality science education required to achieve the NV20:2020 (Economic Transformation Blueprint, 2009).

Secondary school education in the Nigerian system falls within the second tier in the educational system. At this stage in the educational process, a strong scientific foundation should be laid to prepare students for a chosen career in tertiary institutions. The significance of mathematics, physics, chemistry and biology has made it imperative for these subjects to be included in the senior secondary school curriculum. To build a solid technological and scientific foundation, science education needs to be given more priority and attention in the educational system in Nigeria (Gambari & Yusuf, 2016). As stipulated by the Nigerian National Policy of Education (2004, p. 52), the goals of science education are:

- To cultivate inquiry, knowing and rational mind for the conduct of a good life and democracy
- To produce scientists for national development
- To provide knowledge and understanding of the complexity of the physical world, the forms and the conduct of life
- To study technology and the causes of technological development (p. 52).

Looking at the stipulated goals of science education in secondary schools in Nigeria, these goals will be difficult to actualize without a school library equipped with relevant information resources and managed by a professional librarian. It is hard to imagine any meaningful teaching, learning and curricular implementation can take place without a functional school library and professional librarian.

It has been demonstrated by numerous international studies that there is a link between student performance and the presence of professionally trained staff and accessible school libraries. Extensive research reveals that a school that puts its trust in its school library to support student growth, precisely in the areas of literacy, information literacy (IL), and science and technological skills, have been seen to increase motivation, personal and interpersonal capabilities, higher assessment scores, and ultimately, greater graduation rates (New York Comprehensive Center, 2011). Reading enjoyment is an important factor in improving student performance not only in literacy skills, but also in science and mathematics (Denton & West, 2002; Geske & Ozola, 2008; Goodwin, 2000; IFLA and Institutions, 2006; Linnakyla, Malin & Taube, 2004). The system of education in Nigeria has experienced many challenges in terms of inconsistency as a result of restructuring of the system from time to time (Itsekor, 2011). Moja (2000) observed that for the past ten years in Nigeria, the political turbulence has generated a negative impact on the education system. The political instability plagued not just the education system but also the library system. These difficulties were more pronounced at the foundation levels of education where there is a shortfall of school librarians despite government policy on having librarians for all schools (Nigeria National Policy on Education, 2013). Students and teachers need library information resources and the expertise of professionally trained school librarians to succeed. Studies in Nigeria by Atanda and Jaiyeoba (2011); Ayanlola (2014); Egun and Badmus (2007) and Eze (2010) on the impact of the school library on students' achievement showed that school libraries significantly affect students' performance in senior secondary schools.

Libraries and education are partners in progress that should not be separated if any meaningful education is expected in the holistic development of a child. As such, a library is regarded as one of the agencies through which sources of information of accumulated knowledge and experiences are selected, acquired, organized, preserved and disseminated to the right people at the right time (Abdulsalami, Okezie & Agbo, 2013, p. 59). Therefore, the provision of library resources and services is crucial and indispensable to a secondary education system (Moruf & Muhammed, 2015). The school library is the engine room of functional education without which academic excellence would be difficult to achieve. According to Kolade (2001), the school library is the nerve centre of the school for it is required to play a significant role in the school curriculum by providing unlimited access to knowledge.

1.3. STUDY SITE

The study site for the research is Ekiti State, Nigeria. Nigeria is, geographically, located in Western Africa on the Gulf of Guinea with a total area of 923,768 km² making the country the world's 32nd -largest after Tanzania (Network for future geographers, n. d.). Nigeria comprises 36 states and Abuja, the capital, is in the Federal Capital Territory (Network for future geographers, n. d.). The study was conducted in Ekiti State, which was created on 1st October, 1996. Ekiti State is entirely situated within the tropics (see the map in Figure 1.1) in the southwest geopolitical zone of Nigeria and comprises 16 Local Government Areas. Ekiti is politically divided into three senatorial districts – north, central and south (Ekiti Yellow Pages, 2005, pp. 84-85). By the 2006 Census, the population of Ekiti State was 2,384,212. The location of Ekiti State is shown on the map of Nigeria in Figure 1.1.

Ekiti State has 187 public senior secondary schools scattered all over the 16 local government areas (Department of Evaluation and Standard, 2017). The study is specifically based in the following three selected local governments: Ado, Ikere and Ido/Osi which represents each of the three senatorial districts respectively in the state (see Figure 1.2). Ekiti State was chosen because, since its creation on 1st October 1996, no comprehensive studies on the role school libraries play in supporting an inquiry based approach for teaching and learning science subjects in public senior secondary schools have been undertaken.

The Nigerian educational system is predominantly British oriented, and the 6-3-3-4 educational system was adopted, which makes provision for six years of primary education, three years of junior and three years of senior secondary school education and four years for tertiary education. The federal government's emphasis on education is shifting from the liberal arts towards science and technology. The main objective of the change in emphasis is to empower the nation to meet its workforce required for development and modernization towards achieving its vision. This was the fundamental fact that informed the adoption of science and targeted skills development to achieve its NV20: 2020 (Economic Transformation Blueprint, 2009).

Various educators and scholars have acknowledged the importance of establishing libraries in Nigerian schools for effective science curriculum implementation. The Nigeria National Policy on Education (2013) recognised the important role of the school library in achieving effective curriculum implementation in schools, and therefore recommended the establishment of a library in all primary and secondary schools with adequate resources and services. In a bid to obtain qualified librarians (teacher librarians) in schools, librarianship was one of the three subjects studied for a course in the Nigerian Certificate of Education (NCE) up till 1991. The National Council on Education, however, scrapped the programmes on the grounds that librarianship is not part of subjects being taught in schools (Elaturoti, 1993). The only way to obtain a library certificate, diploma or degree after 1991 has been through Library Schools of either polytechnics or universities (Itsekor, Jegbefume & Oyewole, 2019).

In Ekiti State, the only senatorial district that has a public library (Ekiti State Library Board) is Ekiti central senatorial district. The state capital, Ado-Ekiti, is in this senatorial district. The condition of the public library is deplorable as it has not been seriously funded since its creation in 1996 (Zaid, 2011). The accommodation is inadequate, no internet connectivity for users, no centres or section designated for teachers. In a way to access teaching and learning resources, teachers and principals depend on their personal efforts by buying their own resources,

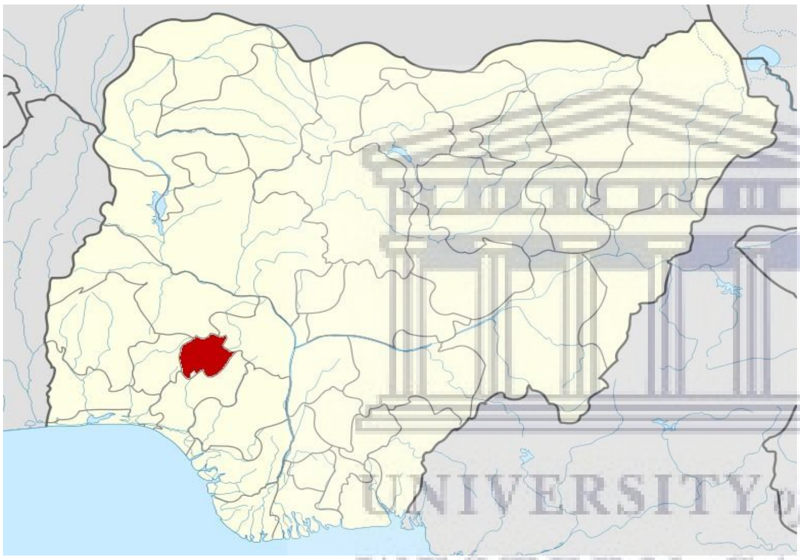


Figure 1.1: Nigerian map indicating Ekiti State

Source: https://en.wikipedia.org/wiki/Ekiti_State#/media/File:Nigeria_-_Ekiti.svg

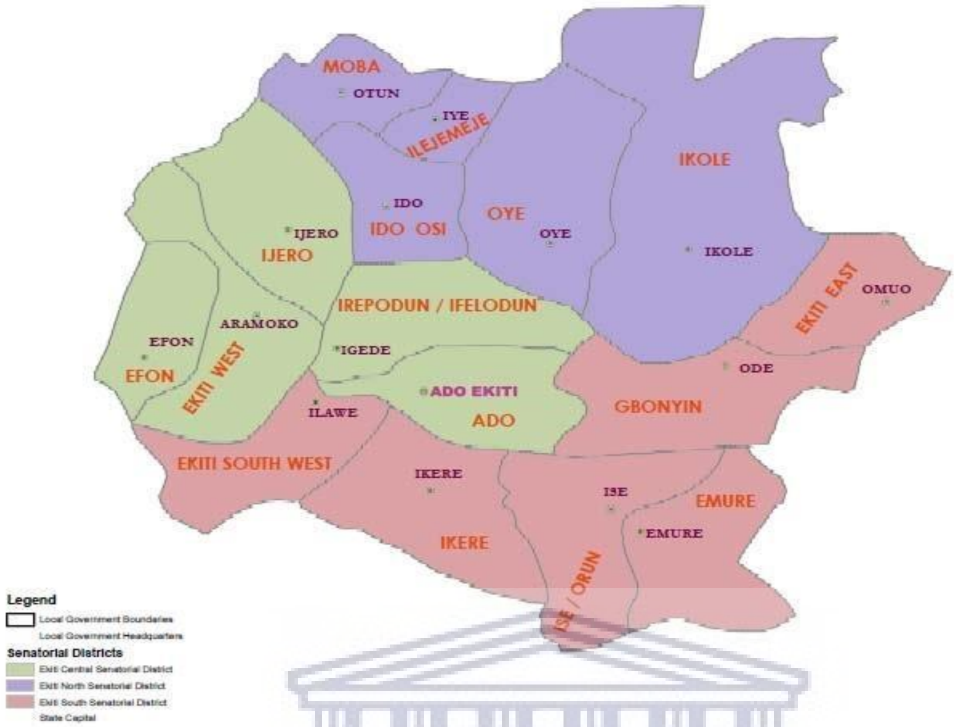


Figure 1.2: Map of Ekiti State illustrating the three senatorial districts

Source: http://ekitistate.gov.ng/about-ekiti/overview/

1.4 STATEMENT OF THE PROBLEM

The role of the school library in science curriculum implementation is recognised by the Nigeria National Policy on Education (2013, p. 38) which states that, the school library is one of the most important educational services, hence proprietors of schools should make available well equipped libraries in all their schools in agreement with the laid down standards. Secondary school education serves as a crucial link between basic education and the world of work on the one hand, and further education and training on the other hand. Secondary school education serves as the bedrock and foundation to equip students to effectively live in the modern age of science and technology (Nigeria Universal Basic Education Commission (NUBEC), 2010). If the government's vision is to make relevant curricula that guarantee quality science education required to achieve NV20:2020, then there is a need to investigate the role of school libraries in science education in senior secondary schools. Very little is known about the role school libraries play in science curriculum implementation in Nigeria particularly Ekiti State. Therefore, it is against this background that the study intends to investigate the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria. This study seeks to address the gap in research.

1.4.1 AIM AND OBJECTIVES OF THE STUDY

The main aim of this study is to determine the impact of school libraries on teaching and learning science subjects in public senior secondary schools in Ekiti State, Nigeria. The specific objectives are:

i. To know the status of school libraries in public senior secondary schools in Ekiti State, Nigeria.
ii. To determine the extent to which the quality of library resources influence the implementation of the science curriculum.
iii. To find out if science teachers advocate using information resources beyond textbooks.

1.4.2 RESEARCH QUESTIONS

The following research questions are pertinent for this study:

i. What is the status of public school libraries in Ekiti State, Nigeria?
    a. What are the qualifications and experiences of school librarians?
    b. What are the available library resources for science curricular implementation?
    c. How adequate are the available science library resources in terms of quantity and quality?
ii. To what extent does the quality of library resources influence science curriculum implementation?
iii. Do science teachers advocate using information resources beyond textbooks?

1.5 JUSTIFICATION AND SIGNIFICANCE OF THE STUDY

According to Creswell (2014, p. 163), a study is said to be significant if it contributes to the knowledge or scholarly research and literature in the field; if it improves practice within the communities; and if it informs important policy issues and contributes to improvement of policy. The significance of this study revolves round the importance attached to science education being an instrument adopted for effecting national development in Nigeria. Although studies on the influence of school library resources on academic achievement in science have been conducted internationally, no comprehensive studies have been conducted on the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria. The results of this study contributed to a better understanding of the status and gap between a theoretical understanding of school libraries and its influence on science curriculum implementation in senior secondary schools as reviewed in the literature and actual school libraries' practices. The study conveys the challenges to various key stakeholders such as head teachers, science teachers, the State Library Board, Ministry of Education, Science and Technology and any organization that may benefit from using the study as a resource. Besides, the study revealed the extent to which school libraries play a role in the effectiveness of the science curriculum. The outcome of this research should encourage the government and other relevant stakeholders to consider more seriously the role school libraries should play in science curriculum implementation.

1.6 SCOPE AND DELIMITATION OF THE STUDY

The study investigated the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State. The study was limited to 27 public senior secondary schools across three local governments, namely Ado, Ikere and Ido/Osi. The schools in these local governments were chosen for the study because they all offered science subjects (mathematics, physics, chemistry and biology). The study covered only the major stakeholders in education associated with provision, management and utilization of school library resources for science curricula implementation. These comprised school librarians, science teachers, science students, school principals, Area Education Officers (AEOs) in the three selected local governments, the director of the State Library Board, the director of the Teaching Service Commission and Permanent Secretary, and the Ministry of Education, Science and Technology.

1.7 DEFINITION OF KEY TERMS

Definitions of some key terms used in the context of this study are defined as follows:

Constructivism is "a learning theory that attempts to explain how learners learn by constructing understanding for themselves. Constructivism is basically a theory which is based on observation and scientific study, about how people learn. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences" (Bada, 2015, pp. 66-67).

Curriculum refers to "the lessons and academic content taught in a school or in a specific course or programme. It is also refers to the knowledge and skills students are expected to learn, which includes the learning standards or learning objectives they are expected to meet; the units and lessons that teachers teach; the assignments and projects given to students; the books, materials, videos, presentations, and readings used in a course; and the tests, assessments and other methods used to evaluate student learning" (Glossary of Education Reform, 2015, curriculum, para 1).

Inquiry based learning (IBL) "is learning in which students actively engage with diverse and often conflicting sources of information and ideas, to build new understandings, and to develop personal viewpoints and perspectives. Inquiry-based learning is a research-based strategy that actively involves students in the exploration of the content, issues, and questions surrounding a curricular area or concept" (Lane, 2007, p. 2).

Metacognition refers to higher order thinking that involves active control over the cognitive processes engaged in learning. It is learning to learn and self-directed learning (Mangal & Mangal, 2019).

School librarian, teacher-librarian or school library media specialist, is a person who holds a recognised teaching qualification and qualification in librarianship and responsible for the school's physical and digital learning space where reading, inquiry, research, thinking, imagination, and creativity are central to teaching and learning (IFLA and institutions, 2015). However, in Nigerian secondary schools, the term school librarian is erroneously used to refer to anyone who is responsible for the running of a school library with or without a librarianship qualification.

School library is "a school's physical and digital learning space where reading, inquiry, research, thinking, imagination, and creativity are central to students' information-to-knowledge journey and to their personal, social, and cultural growth. This physical and digital place is known by several terms, for example school media centre, centre for documentation and information, library resource centre, or library learning commons, but school library is the term most commonly used and applied to the facility and functions" (IFLA and institutions, 2015, p. 16).

School library resources are the resources that include but are not limited to electronic, print, multimedia, internet/web and curated digital collections for teaching and learning (IFLA and institutions, 2015).

School library services are the services provided with the use of a strong networked information technology infrastructure to provides access to collections, community resources, and curated digital collections, as well as the tools for undertaking research-based inquiry and the construction, presentation, and sharing of knowledge (IFLA and institutions, 2015).

1.8 STRUCTURE AND ORGANISATION OF THE THESIS

Chapter one provided the background information and motivation for the study. Sub-sections included: statement of the problem; objectives of the study; research questions; justification and significance of the study; scope and limitation of the study; and study site. Chapter two offers a detailed review of existing literature relating to the objectives of the study. It first presents a general overview of the impact of school libraries on students' academic performance narrowed down to focus on the impact of school libraries on students' performance in Nigeria; and teaching and learning methods in Nigeria. Chapter three examines the theoretical framework - constructivism and inquiry-based learning that underpins the study as well as other comparable learning theories/models. Chapter four focuses on the research methodology and methods employed in achieving the objectives of the study by giving a detailed description of the paradigm (worldview); research design; approaches; population of the study; sample size and sampling techniques; methods of data collection; reliability and validity of the instrument and analysis of data. In Chapter five, both quantitative and qualitative data obtained from the respondents through questionnaires, interviews, document scrutiny, and observation are analysed and presented. Chapter six presents a discussion and interpretations of the findings of the study resulting from the quantitative and qualitative analysis based on the research questions. The final chapter, Chapter seven presents the summary, conclusions, originality and the study's contributions to new knowledge, recommendations and suggestions for further studies based on the outcome of this study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is a written document that presents a complete understanding of the current state of knowledge about a particular topic of study (Machi & McEvoy, 2009). The literature review "is a critical assessment of all research on a topic and defines in advance ways that the review might be replicated" (Onwuegbuzie & Weinbaum, 2017, p. 359), and it involves analysis, summarisation, synthesis and evaluation of the documents. In Creswell's view (2014), the purpose of the literature review is to offer a framework or platform for establishing the significance of a study and the choice of theoretical framework for the study (Creswell, 2014).

A literature review offers insights into theoretical frameworks in the field, as well as methods and approaches in previous studies which could serve as a yardstick for comparing the results of a study with other findings. The four major goals of a literature review, as highlighted by Neuman (2006, p. 26), are follows:

- the demonstration of familiarity with a body of knowledge and to establish your credibility
- showing the path of prior research and how your study is connected to it
- integration and summation of what is known in an area
- learning and stimulation from others for new ideas (p. 26)

The literature review reveals important unanswered questions from previous studies, interpretations of findings and appropriate methods. This current study reviewed both conceptual understandings and empirical findings. The literature reviewed in this study was thematically developed based on the research objectives and questions, conceptual framework, and key variables – independent and dependent and broader issues of the research problem. The categorization of research in school libraries and science curriculum implementation into sections cannot be easily done without there being overlaps. Nonetheless, the research literature is discussed under the following major themes:

- Role of school libraries in education
- Role of the school librarian
- Role and perception of principal towards school library development

- State of school libraries in Africa, especially Nigeria
- Obstacles to school library development in Nigeria
- Information literacy and science
- Teaching and learning methods (mainly in science) in Nigeria
- Library resource utilisation and curriculum implementation
- Impact of school libraries on students' academic achievement

2.2 ROLE OF SCHOOL LIBRARIES IN EDUCATION

The concept of the school library is shifting from audio-visual, towards multimedia, telecommunications, library learning commons and makerspaces (Burke, 2015; Harper, 2016; Harvey, 2001; Howell & O'Donnell, 2017). Students need IL and inquiry, collaboration and curriculum integration, and performance diversification to achieve exceptional needs. A school library is the heart of the school where curriculum development and other academic activities of the school are supposed to revolve around (Govender, 2006; Kalejaye, Fabunmi, & Adeoye, 2011). The school library has a vital role within a school system in developing and sustaining teaching and learning. From primary school to tertiary institution, the mission of every school is to provide their students with the best education possible. In order to achieve this, schools have to provide curriculum, instruction, resources, and an effective learning environment, among others. "School libraries, within this framework, have as their mission to ensure that staff and students are effective users of information and ideas" (American Association of School Librarians, 2009, pp. 9-23). This mission involves intellectual and physical access such as providing as many collections (resources) in many different formats as possible, and being open for students during accessible hours (American Association of School Librarians, 2009).

The role of a school library as related to IL, teaching and learning and culture are highlighted by IFLA and institutions (2015, p. 61) to include:

- supporting and enhancing the goals and objectives of education as defined in the school's mission and curriculum
- instilling the habit of using the libraries for independent lifelong reading and learning in children

- provision of opportunities for experiences in creating and using different sources of information for knowledge and understanding
- supporting all students with evaluation skills needed for using all formats of information, taking into consideration the medium of communication in the community
- creating access to local and global resources and opportunities that expose learners (students) to different ideas, experiences and opinion
- providing opportunities for students, teachers, administrators (principals), as well as parents to accomplish the mission of the school
- advocating the idea that access to various sources of information is necessary for effective citizenship and participation in a democracy
- the provision of library resources and services to the entire school community and beyond (p. 61).

The school library is a "learning laboratory where technology, information and inquiry come together in dynamic ways that reverberate with 21st century learners" (Todd & Gordon 2010, p. 1). All over the world school libraries exist as learning environments that provide both physical and digital spaces, access to resources, activities and services that inspire and support students and teachers as well as community learning (IFLA and Institutions, 2015). Students are expected to use the school library resources and services anytime. Therefore, the school library provides teachers and students access to various sources of information that support curriculum implementation and exposes learners to diverse ideas, opinions and experiences that could inculcate the habit of reading for information and recreation. It also provides reliable information services to the youth, especially on health, careers, family related issues, violence and crime, finance and other cultural and socio political economic matters (South Africa. Department of Basic Education, 2012, p. 9).

Further, Akande and Bamise (2017, p. 18) conducted a study on the role of the library in students' academic motivation in secondary schools in Osun State. Using a questionnaire, they revealed many services rendered by the school library: provision of lending services, newspapers/magazines, arrangement for individual study, provision of computers and internet access, provision of application software on library computers (e.g. Word, Excel), among others. The major factors motivating students academically were relevant library resources and suitable place to study in school libraries The findings recommended more funding for school libraries to be able to acquire various emerging ICTs for student use as a way of motivating them academically. Similarly, Udoh-Ilomechine (2008, p. 1) investigated “the significance of school libraries in the educational development of students”, and revealed that school libraries assist students to develop for themselves the habit of studying independently and learning how to ask questions (inquiry). The findings recommended the employment of a qualified librarian to provide effective services to users; acquisition of current and relevant information resources to arouse students’ interest, proper orientation and, exhibitions and displays to create users awareness of the library service and equally provide adequate study space. Some of the important roles played by the libraries have been highlighted. The role of the school librarian is discussed in the next section.

2.3 THE ROLE OF THE SCHOOL LIBRARIAN

A school library should be staffed with a full time professional librarian and assisted by library assistants. The library should have current resources, include supports for digital literacy skills development and regular collaboration between librarians and teachers in schools (Kachel, 2013). As stressed by Gretes (2013), the major role of the school library is to provide students access to good reading resources that would improve their studies. Moreover, there are different roles being played by different school libraries across the world and school librarians are not hesitating to share their ideas with others. In Indonesia, for instance, Rachmawati and Ekowiyant (2016, p. 1) described the roles of librarians in effectively teaching IL. They state that, for teaching to be successful, school librarians should play some important roles such as: serving as role models for reading, being knowledgeable about book publishing and literary works, collaborating with teachers, being reading advocates and leaders in resource-based learning.

In Japan, Niwai’s (2016) study on the role of school librarians highlighted the main content specifically taught by librarians, which most subject teachers actually expected librarians to teach as the traditional information skills such as: locating information; using books; taking notes and referencing. Niwai (2016) suggested that school librarians should reconsider their expertise in IL (education) and share more responsibility (collaborate) with teachers (as teachers have content knowledge of the curriculum) to improve student learning.

In a comparative study conducted by Tam, Choi, Tkalcevi, Zheng and Dukic (2016) to explore library services in primary and secondary schools in Croatia and Hong Kong, libraries in the two countries offer programmes that assist students’ reading and enhance their information literacy and research skills. In addition, library programmes in both countries go beyond the school walls and school curriculum. The services of librarians in the two countries differ in a few cases. For example, while the school librarians in Croatia offer services that involve them in wider community engagement, the school librarians in Hong Kong apply technology for collection development and library instruction.

One of the expected roles of a school librarian is to offer intellectual, physical and digital access to library resources in all formats – print, non-print and electronic such as; electronic databases, operating systems, storage devices, computer network resources, e-books and computer hardware platforms (American Association of School Librarians, 2016) for use (reading, study, research, consultation) by students and teachers as well as the entire school community (Williams & Coles, 2007). With collaboration and meaningful goals, librarians have assisted teachers in identifying invaluable library resources that support lesson development and curriculum implementation. The collaboration has helped in integrating research based assignments into teaching practice, which has utimately resulted in high academic performance as revelaed in several studies across the United States as well as European countries such as the United Kingdom (UK) and Netherlands (New York Comprehensive Center, 2011; Nielen & Bus, 2015; William, Wavell & Morrison, 2013).

As suggested by Lankes (2011, p. 15), new librarianship should be about the creation of knowledge rather than storing and retrieving information only. This is the reason some libraries keep their staff and reduce the acquisitions when forced to cut their budgets (Lankes, 2011). Knowledge creation (Loertscher & Woolls, 2012) pushes librarians into the role of mentor, coach and teacher in ways that underscore outcomes rather than inputs. Church (2008) suggested that school librarians of the 21st century should be actively involved in school instructional programmes such as; curriculum development, IL instruction and collaborative teaching. A school librarian helps students in acquiring ICT skills (which sometimes are not taught in the classroom) essential for students in the 21st century (Kachel, 2013).

Today's school librarians should perform as collaborative instructional partners by evaluating, planning and teaching with fellow educators. School librarians should also teach IL skills, that is, teaching of students about accessibility, evaluation, and utilisation of information in the context of their curriculum content. When a school librarian fulfils these roles - active involvement in their school's instruction, students achievements increase academically (AASL & AECT cited in Church 2008; Lance, Hamilton-Pennell & Rodney, 2005;). Since school librarians are also supposed to perform as teachers, they are expected to possess good teaching skills and a teaching qualification (Montiel-Overall, 2005). In addition, a school librarian should possess a first degree in librarianship or first degree in other disciplines with at least a postgraduate diploma in librarianship (Carroll, Kerr, Musa & Afzai, 2012; LRCN, n. d.) to be able to participate effectively in collaboration. Kuhlthau, Maniotes and Caspari (2007, p. 49), for instance, described the role of the school librarian as a teacher as:

> the teacher of IL who: selects the IL standards that will be addressed; teaches concepts of information access, evaluation and use; maintains long-term relationships with students from year to year; and fosters an inquiry-based learning (constructivist learning) environment (p. 49).

Part of the role expected of school librarians is guided inquiry. Equally, school librarians are expected to formulate the policy for improving IL, which includes a well organised collection of current and relevant resources within the school; internet connectivity; incorporation of community members from the public library to expand resources and generate authentic experiences, and links to experts on different subjects (Kuhlthau, 2010, p. 22: Kuhlthau, Maniotes & Caspari, 2007).

In developing 21st century citizens who can to locate, evaluate and utilise information effectively, school libraries need to be managed by fulltime qualified librarians. Studies from around the world confirm that a qualified school librarian improves learning outcomes of students regardless of their socioeconomic status. However, school librarians can only perform optimally if they are assisted by support staff – library officers, library assistants, and library attendants. Equally, to achieve quality teaching across an entire school requires effective school librarians. School librarians provide the resources and services that could impact on every teacher and student (Australian Capital Territory. Government Education, n. d.). Barrett (2010, p. 139) endorses the previously mentioned beliefs:

> Librarians should be trained to become school librarians, well versed in pedagogy and curricula. Only by developing an expertise in the educational arena will they be able to collaborate successfully with teachers, be valued as leaders in their schools and fulfil their potential to contribute to the academic success of their students. Teachers

> need training in IL skills and the techniques of effective inquiry-based learning where students are challenged to engage with the various sources available to them, and to question, select, analyse and synthesise until they are able to discern paths to new understandings and knowledge construction (p. 139).

A school library enhances research, sharing of ideas for teaching and learning. Specifically, a student-centred school library helps students engage in their inquiry-based learning by being an inclusive and community space that enables a variety of learning and easy access to all kinds of resources, including ICTs. Besides, providing new technologies and services, school libraries are expected to offer users a welcoming, safe space to gather their information needs without the pressure to spend money. Therefore, school librarians should always make the school library a creative hotspot, just as it is presently practised in Australia where the *GiggleIT Project*'s free resources are being used to showcase students' writing for an international audience, introduce stories and poems written by children in other countries, and collaborating with teachers within existing curriculum frameworks to enhance global understanding at school. Students share their world with peers in other lands through their writing, photography, and art when school librarians use *GiggleIT Project* lesson plans to foster creativity and authentic learning while encouraging positive expressions of children's own personal knowledge and interests (Manck & Garrison, 2016). The *GiggleIT Project* for global student writing through school libraries is sponsored by International Association of School Librarianship - Children's and Young Adult Literature Special Interest Group.

In Ohio, Todd and Kuhlthau (2004) carried out a study to examine ways in which school librarians and library programmes helped students learn. Statistically, more than 99% (13,050 sample students) of students confirm that the services provided by school libraries have actually assisted them (students) in becoming better learners. Todd and Kuhlthau concluded that school librarians in Ohio are agents of; knowledge construction, resources, independent reading, individualized learning, information literacy development, academic achievement, personal development and technological literacy. A secondary school is a place expected to provide students with more instruction to develop into independent learners and information literate individuals, and the assistance provided by school librarians at this level is strong in instilling in students the interest of independent and long life leaning (Todd & Kuhlthau, 2004).

Through well-developed knowledge of pedagogy and curriculum, librarians advocate the 21st century learning goals and information expertise that "support and implement the vision of the school communities through advocating and building effective library and information services and programmes that contribute to the development of lifelong learners" (Australian School Library Association and Australian Library and Information Association, 2004). The school librarian, as educator, provides the needed intellectual agency for developing student's thorough understanding and knowledge through multi-modal experimentation and investigation with information. School librarians assist students to scrutinize information via several ways in a school where appropriate instructions to effectively use the best technology tools that support their performance are provided (Hay & Todd, 2010). Professionally certified full time librarians have prime influence when they: promote reading advocacy; teach IL skills; collaborate with teachers; maintain access to various relevant information resources either local or web-based (Scholastic Library Publishing, 2016, p. 3).

In Hong Kong, Lo and Chiu (2015, p. 696) conducted a study on "the perception of the school administration and teachers about the role of school librarians". In the study, three practicing school librarians were interviwed to explore: the fast-evolving current trends in ICTs and the emphasis laid on inquiry-based learning which positive influence school curriculum implementation and the required library support. They found that the trending roles of librarian include: championing library improvement projects; IL specialists, and offering collaboration and classroom teaching support. The study recommended that school librarians should develop promotional skills as that of marketing managers, self-confidence and self-motivation and not surrender to take up extra work. Further, school librarians should be innovative to relentlessly think outside the box; collaborate with other teachers in other disciplines, possess a self confidnce that what they do as professionals would influence on students' academic perfornmance.

From the literature reviewed, it is apparent that involvement of the school librarian in curriculum implementation guarantees high academic achievement. Therefore, to accomplish the aims of secondary school education, the role of school librarian should be intertwined with curriculum planning and school principal to support and improve curriculum implementation and student academic performance. Discussed in the next section is the role and perception of the school principal towards library development.

2.4 ROLE AND PERCEPTION OF THE PRINCIPAL TOWARDS LIBRARY DEVELOPMENT

There is no gainsaying the fact that the school principal’s support is paramount to the establishment and maintenance of functional school libraries. The principal who is the instructional leader of the school must offer guidance in the developing library programme. Research has revealed that the leadership of the principal in the library programme is essential to its success.

In the USA, Hartzell’s (2002, p. 92) focused on “school principals’ perceptions of school libraries and teacher-librarians”. He found that the major problem of school administrators (principals) is their limited and inaccurate knowledge of the importance of school libraries and school librarians in curriculum implementation. His findings recommended that school librarians should consistently consult with principals in multiple innovative ways to change their perceptions towards school libraries, since reforming perceptions takes more time, effort and commitment. Many principals do not value school librarians nor appreciate the potential of libraries in student academic performance, since they do not understand what librarians really do. This is due to the fact that many principals themselves seldom used libraries as children and were not exposed to the library's role in the curriculum implementation and academic performance in their professional training. In the professional literature read by some principals and teachers, libraries and librarians have not been given a high profile which do not help them (principals and teachers) in changing their perceptions of what the library could actually offer them (Hartzell, 2002).

Shannon (2009) studied the principals’ perspectives of school librarians and revealed that principals supported the competencies of school librarians, and more than 82% of principals were very satisfied with their librarians. Oberg’s (2006) study about gaining respect and support of school administrators by school librarians, revealed that principal’s consideration for the advancement of learners usually revolves around teaching and learning in class. However, this attitude does not take into congnizance that for any effective and quality teaching and learning to take place, library resources, that could assist teachers to present their lessons, must be provided. It is only the trained person who can rightly recommend teachers the relevant information resources for effective presentation of their lessons.

Campbell as cited by Church (2008) affirms the importance of the principal's relationship to the school library programme for its success. Campbell, therefore, proposed that the principal must:

- clearly understand the role and purpose of the school library programme in the context of the entire school
- support the programme through personal commitment and sufficient funding
- set high expectations for the programme
- communicate to teachers and students the importance of the programme

In a study by Church (2010) to explore the school principal's perceptions of the librarian's role as a teacher and educational partner, the study revealed that principals supported the instructional role of school librarians who were expected to be the major initiators of collaboration with classroom teachers at both the individual and school levels. Being an instructional leader, principals' support and understanding play a significant role in the effectiveness of library programmes. Principals are the major library stakeholders, and their priorities and agendas focus on student learning outcomes. Therefore, it behoves school librarians to advocate their library programmes and align them to the principals' priorities and agendas (Church, 2010).

In a related study by Lupton (2016) on the principals' perceptions of the school librarian;s role in Australia. The study revealed different ways in which the school librarian significantly contributes to the school development, such as; their role as teachers, providing the principal with advice and ideas with a broad viewpoint on the school library operations; and offering leadership in the use of ICT at the school. Similarly, Haycock (2007) aptly captured the school librarian's role as neither a support nor a service but a partner role, because "teaching partners share a stake in both the process and outcome of collaboration as it reflects school expectations and a beneficial practice for student learning" (Haycock, 2007, p. 29). State of libraries in African secondary schools, especially Nigeria is discussed in the next section.

2.5 STATE OF SCHOOL LIBRARIES IN AFRICA, ESPECIALLY NIGERIA

The state of school libraries in African countries is not much different from one another as their conditions are, on the whole, appalling. For instance, "very few (less than 8%) public schools in South African have functional (well equipped) libraries" (Equal Education, 2010, p. 21). In Limpopo Province, South Africa, Mojapelo's (2016) study on the challenges facing establishing and sustaining functional school libraries revealed many disheartening encounters which hamper effective provision and maintenance of school library and information services. The study recommended that the National Department of Basic Education should as a matter of urgency formulate, endorse and implement a school library policy that would guarantee rural development and create a condusive environment for teachers and learners in rural black communities so as to have access to library resources in their areas.

Similarly, Mutungi, Minishi-Majanja & Mnkeni-Saurombe's (2014) study on public school libraries in Nairobi County, Kenya contended that most of the schools lacked categorical policies for libraries as there were no government policies on school libraries. The findings, however, recommended that the government of Kenya should come up with library national policies that would integrate libraries in the secondary school education system. Akinniyi's (2003) Nigerian study identified that a fixed percent of the budget for library maintenance and development in schools has not yet been set aside by the Government of Nigeria. Schools are also not consistently given their yearly subvention from which a certain amount can be set aside for school library development. This suggests that there is no nationally consistent model between state and local governments in Nigeria for allocating funds for the development of school libraries.

In a study carried out by Shonhe (2019) on the challenges of school libraries in developing countries such as Ghana, Sri Lanka, Nigeria, Malawi, and South Africa. Nearly all the studies reviewed decried irrelevant library collections and poor staffing, as the problem of school libraries. According to Malanga (2017), inadequate library personnel leads to students' lack of IL and equally results in inadequate marketing of library services and awareness of the library's role.

In Nigeria, the situation of school libraries is abysmal. Scholars have conducted several studies on the conditions of libraries in Nigerian schools. Many of the scholars (Adetoro, 2005; Adebamowo, 2011; Ajegbomogun & Salaam, 2011; Eghosa, 2011; Uzuegbu & Ibiyemi, 2013) who described the condition of school libraries as pitiful, also lamented the state of facilities in school libraries as inadequate, and that the resources are unsystematically organized.

Deploring the neglect of school libraries and their development, Adetoro (2005) conducted a comparative study on development of school library and utilisation in selected public and private schools in Ogun State, Nigeria. The study revealed that schools used unconducive accommodation, and lacked qualified librarians, which could be attributed to non utilisation of the school libraries. All the sectors and three tiers of government responsible for the development of school libraries were lukewarm and lackadaisical towards school library development. In a study on the school library's impact on student's learning. Ahmed (2005) revealed ignorance of what a school library stands for and lack of government's knowledge of the services a school library could offer society as the most serious factors responsible for the underdevelopment of libraries in Nigerian schools.

Eghosa (2011) conducted a research to find out if the school library has become a myth in the attainment of success at the school certificate examination, adopting a questionnaire as method of data collection. The study revealed that "the performances of secondary school students in their examination are not significantly influenced by the use of library services". The study further showed that, in recent times, school libraries have been relegated to the background in teaching and learning in the public secondary schools and they lacked funding. The recommendations were that the Nigerian Library Association should go beyond conferences and publications, and meet with the authority concerned - State Governors and Commissioners for Education - on how to set aside a realistic budget for restoring library education in the country.

Ajegbomogun and Salaam's (2011, pp. 2-3) study on "the state of school libraries in Nigeria" put forward the problems of libraries in Nigerian schools as: recruitment of unqualified personnel; inadequate infrastructure, declining financial support and low levels of ICTs. Also, library accommodation does not meet up with the standard specifications in terms of space per student, while the furniture (most especially tables, chairs, fans, shelves, and so on) is grossly inadequate and the absence of these facilities has continued to hinder information improvement in Nigeria. School libraries are sometimes used as classrooms or where staff hold their meetings without considering whether such will be conducive for learning. The majority of school libraries are managed by unqualified school librarians or sometimes teachers who do not have basic library training skills and these do not portend well for the development of school libraries (Ajegbomogun & Salaam, 2011). Similarly, Adebamowo (2011) investigated the use of school library resources in Ogun State, Nigeria revealed that less than 17% of schools surveyed had a separate library.

Uzuegbu and Ibiyemi (2013) studied the library of Item Community High School. for more than a year, the school library has been closed down. This has resulted in denial of access to the libaray by a total of 166 potential library users, comprising teachers and students of the school. The library was in an alarming state that needed the intervention of both professionals and government (Uzuegbu & Ibiyemi, 2013). In separate studies conducted by Dike (2012) and Lawal-Solarin (2016) on libraries in Nigerian schools, they revealed that school libraries in Nigerian were faced with challenges of inadequate and unqualified library staff.

Aramide, Ladipo and Akinade (2013, p. 775) investigated "the contributions of human and material resources to service implementation in school libraries in Nigeria". The study revealed that reading within the library was the only service being commonly delivered. The best predictors of service implementation in the school library are: ICT resources, human resources and accommodation. The study, therefore, recommended that concerned authorities should ensure the provision of adequate ICT facilities, qualified personnel and suitable accommodation for efficient and effective service implementation in school libraries.

From the literature reviewed in this section, it is evident that school libraries in Nigeria have not been well funded, which has resulted in their poor state. One may not be wrong to ask the role school libraries play in curriculum implementation and academic performance that would warrant the government's attention and other concerned authorities to see reasons for developing school libraries in the country. The next section discusses in great detail the obstacles to school library development in Nigeria.

2.5.1 OBSTACLES TO SCHOOL LIBRARY DEVELOPMENT IN NIGERIA

Scholars have revealed lukewarm attitudes towards libraries as one of the serious problems confronting school libraries in Nigeria. Inadequate funding, inadequate library accommodation, lack of financial support on the part of government to undertake regular maintenance and the issue of book piracy from India and China have been the problems confronting school libraries in Sub- Saharan African countries, particularly Nigeria (World Bank, 2008). Narrating the poor conditions of school libraries, Arua and Chinaka (2011) and Olajide and Ariwodola (2009) highlighted the lack of qualified library staff, irrelevant and inadequate resources, inadequate accommodation, poor orientation, the non-inclusion of school librarianship in curriculum of teacher training, and the lack of a library hour as the major common problems confronting school libraries in Nigeria.

Government policy on education is laudable but its implementation has been a problem. For example, part of the government recommendations is that all schools should have standard libraries stocked with books (fiction, non-fiction), newspapers/magazines, reference, journals, multimedia, television, projector, head phones, view screen, video player/recorder, toys, picture books puzzles and games, and supervised by a teacher-librarian and library attendant (Nigeria National Policy on Education, 2013; Nigeria Universal Basic Education Commission, 2010). A school library should be indispensable in this information age era in which every nation uses information to achieve educational and millennium goals. However, in Rivers State, Nigeria, Owate and Iroha (2013) investigated the availability and utilization of secondary school library resources, and revealed that library resources and services were either not available or not in a good condition in most schools. In some cases, where accommodation was provided for libraries, the resources in the libraries were not only very few but haphazardly arranged for least effective service implementation. As a result, none of the schools met the benchmark for establishing a functional library at the secondary level.

In summary, the major problems facing school library development in Nigeria have been highlighted. In the current study, to address these challenges, respondents (education stakeholders) were asked about the plans on the grounds to guarantee that all the school libraries in the state are adequately equipped in term of resources and qualified personnel to serve science teachers and science students for greater curriculum implementation and academic performance. IL and science is discussed in the next section.

2.6 INFORMATION LITERACY AND SCIENCE

There are numerous definitions of IL presumed by notable authors and associations. The AASL, a forerunner in the IL field, and the Association for Educational Communications and Technology (AECT) as stated in Lau (2006, p. 7), define IL as “the ability to find and use information, which is the foundation of independent and lifelong learning”. IL as the basic skills set of the 21st century develops the ability of students to ask questions, locate, access and utilise information resources effectively, efficiently, and ethically (Eisenberg, 2008). In a keynote address delivered at UNESCO by Christine Bruce, one of the foremost authorities on IL, asserts that:

> information literacy is conceivably the foundation for learning in our contemporary environment of continuous technological change. As ICTs develop rapidly, and the information environment becomes increasingly complex, educators are recognizing

> the needs for learners to engage with the information environment as part of their formal learning processes. Information literacy is generally seen as pivotal to the pursuit of lifelong learning and central to achieving both personal empowerment and economic development" (Bruce, 2004, p. 1).

As stated in the professional guidelines for school librarians by IFLA and institutions (2015), students need to be helped to develop a thorough knowledge and understanding of information beyond face value, which is also stressed in contemporary inquiry-based science required in the 21st century. In addition, IL education as pointed out by Lupton (2004) "supports cross-curriculum skills such as problem-solving, resource-based, evidence-based and problem-based learning". Onen (2015, p. 48) highlighted the most important IL skills as:

> asking the right questions; defining the task; making decisions; brainstorming; problem-solving, identifying sources; locating sources; selecting sources; finding information within sources; reading for meaning; skimming and scanning; evaluating material; note-making, sorting and arranging; developing ideas; presenting findings; writing clearly; rhetoric; citing sources; and evaluation and review (p. 48).

In a related development, science literacy, according to the Organization for Economic Cooperation and Development (OECD) as stated by Holbrook and Rannikmae (2009, p. 280), "requires students to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity". The strategies used by school librarians and scientists (science teachers inclusive) require formulation of questions, finding of information, developing of hypotheses, collection and analysing of data, and drawing of conclusions.

In the USA, the National Science Education Standards (NSES) stressed hands-on learning and inquiry-based investigations anticipate that all science teachers will encourage science advancement through inquiry-based experiences for students. The NSES are a set of guidelines for the science education in both primary and secondary schools, as established by the National Research Council (NRC) in 1996 (National Council Research, 1996; National Science Foundation (NSF), 2012). These standards offer teachers a set of goals for their students, and for principals to provide professional development. As a way to develop such important skills in American students, the national campaign in science, technology, engineering and mathematics (STEM) stresses the need to promote critical thinking to develop science literacy (National Science Foundation, 2012). In the Nigerian context, the government also realised the importance of these skills in achieving its NV20:2020. Thus it emphasised the adoption of science in achieving its vision (Economic Transformation Blueprint, 2009). Discussed in the next section is the teaching and learning methods adopted for science in Nigeria.

2.7. TEACHING AND LEARNING METHODS (MAINLY IN SCIENCE) IN NIGERIA

Bringing about a fundamental change in students' way of solving problems, acquiring intellectual skills and inculcating desirable attitudes and values is the major purpose of teaching at any level of education (Tebabal & Kahssay, 2011). Teaching methodology is an integral part of a school system and a veritable tool for students to question, select, analyse and synthesise information resources until they are able to discern paths to new understandings and knowledge construction for the purpose of achieving the educational goals or objectives (Zuofa & Olori, 2015, p. 1133). This suggests that teaching methods form a track to a pre-determined goal or objective. A teaching method is the way the facilitator (teacher) helps or guides learners (students) to establish a relationship between themselves and the learning activities.

The educational system in Nigeria requires all teachers in schools to be professionally and academically qualified. The NNPE stipulates the Nigerian Certificate in Education (NCE) as the minimum qualification for entering the teaching profession in Nigeria. It is against this background that government under Act 31 of 1993 (now TRCN CAP T3 of 2004), set up the Teacher's Registration Council of Nigeria (TRCN) to control and regulate the practice of the profession. According to the TRCN, the acceptable degrees for the teaching profession in secondary schools are BSc. Ed, B. Ed, BA. Ed, M. Ed and PhD in Education. Also, "educators are expected to possess a Postgraduate Diploma in Education (PGDE) in addition to the degrees not mentioned above" (NNPE, 2004, pp. 39-40). In a bid to ensure a quality education system, the TRCN registrar has given December 31, 2019 as the deadline to remove unqualified teachers from the system (Babalola, 2019).

Osakinle, Onijigin and Falana's (2010) study in Nigeria on teaching methods in schools made a significant connection between methods of teaching and the learners' environment. They recommended, among others, stocking the library with relevant resources for better teaching and learning. Apanpa and Ogunbiyi's (2012) explored learning and teaching styles in language, science and technology education in Nigeria. They used the index of learning style questionnaire to show that learning styles are varied, while teaching styles are rigid and one-directional. The study recommended an adjustment in teaching styles so as to match teaching with learning styles.

In a study on teaching and learning in science education through ICT, Aina (2013, p. 43) reviewed various applications of ICT in teaching and learning of chemistry, biology and physics education. The study highlighted problems affecting the full application of ICTs in these science subjects as inadequate funds, shortage of certificated computer teachers, corruption and insecurity. Aina recommended that government should establish a well-equipped ICT centre in all secondary schools to equip teachers in effectively discharging their duty of teaching. Surprisingly, the study did not identify a school library (which ought to use ICTs) as one of the facilities required to equip the teachers in effectively discharging their duty of teaching.

Modebelu and Igwebuike's (2013) study, on children's different learning styles and how teaching strategies need to accommodate these styles for achieving effective education in Nigeria, revealed that teachers do not usually understand the various learning styles of students that could be among teaching strategy. The findings recommended collaborative, intuitive, visual, and independent learning styles to encourage learner-centred education.

Ikitde and Edet's (2013) study on learning styles and teaching in biology, using a biology achievement test and questionnaire to collect data, revealed that biology students taught with guided inquiry have high academic achievement. Taking their learning styles into consideration, adopting inquiry-based approaches to teaching and learning science improves intellectual engagement and nurtures deep understanding through the development of its practical application and research based disposition towards teaching and learning. However, the complex nature of inquiry-based teaching techniques may have influenced its minimal use or acceptance (Arubayi, 2015).

Alade and Ogbo (2014) conducted a comparative study on chemistry students' learning styles in selected public and private schools in Lagos. The visual-learning style was predominantly preferred among students in both school types. The recommendation was that chemistry teachers should use various teaching styles to accommodate their students' various learning styles. The findings encouraged alignment between teaching and learning styles which will greatly improve the teaching, learning as well as students' performance in chemistry.

In Abuja, Nigeria, Moyinoluwa (2014) conducted a study on assessment and evaluation of teaching methods used in basic education schools revealing that many schools poorly implemented assessment approaches like concept-mapping, individual projects, group works/assignments and guided discovery. The study recommended a change of teaching method from the conventional lecture/discussion methods (traditional methods) to guided discovery. The prevalence of the lecture method in Nigeria may be as a result of training acquired by teachers during their study at colleges of education. Al-rawi (2013. p. 100), however, described traditional teaching methods as not effective as they used to be due to the current advancement and evolving landscape in information technology.

Achuonye (2015) conducted research focussing on teaching strategies and its implications for curriculum implementation in science subjects and found that the lecture method of teaching is still predominant at all levels in most schools, and that ignorance is a major challenge to effective application of innovative strategies such as self-directed learning and higher cognitive skills, required for the 21st century education. Achuonye recommended consistent refresher training for teachers in schools in order to enlighten and motivate them to integrate innovative teaching strategies into their taeching methods. It is on the basis of the weaknesses of the lecture pedagogy in science that Aina and Langenhoven (2015, p. 6) advocate peer instruction as the better alternative to the lecture method. Peer instruction (Aina & Langenhoven, 2015) is a research-based pedagogy created for teaching large introductory science class. This method was developed to assist in making lectures more interactive and equally gets students intellectually involved in what is being taught class.

Kalu-Uche, Alamina and Ovute (2015, p. 50) observed some "pedagogical practices employed by science teachers in Rivers State, Nigeria and compared science teachers' reports of their classroom practices with their observed classroom practices". Data collection instruments used were a classroom practice observation checklist and direct observations. The science teachers used various transmission and constructivist motivated approaches in classroom instruction and there were significant differences in science teachers' reports of their classroom practices and their observed practices. The study recommended science teachers for workshops and seminars that will eventually improve their application of a student-centred teaching method.

Adediran, Orukotan and Adeyanju (2015, p. 146) studied “instructional strategies for effective teaching and learning in Nigerian secondary schools”, and revealed that teachers’ approaches to teaching do not promote effective teaching and learning. They recommended the inclusion of teachers in curriculum planning and implementation, to encourage them to bring in student-centred methods/strategies that will make their teaching more engaging and interesting as it is likely to produce more self-reliant students than the traditional teaching approach.

Oyelekan, Igbokwe and Olorundare (2017, p. 49) examined “science teachers’ use of innovative strategies for teaching senior school science in Ilorin, Nigeria”, with a sample of 256 science teachers. The data collection instrument used was a questionnaire. The findings revealed that of the 36 selected innovative strategies, the majority of the science teachers frequently used only the laboratory and models as innovative strategies for teaching, while other innovative teaching strategies were hardly used. There was no significant difference in the level of science teachers’ utilisation of the innovative teaching strategies, based on qualifications and experiences. The study recommended that science teachers should avail themselves of the opportunities embedded in these innovative teaching strategies to improve their students’ performance. This topic (science teaching and learning methods in Nigeria) is pertinent to the study as it provides a general overview of various teaching and learning approaches (inclusive of inquiry based approaches) employed by science teachers in Nigeria which is the main thrust of the study.

From the reviewed literature, one could correctly deduce that teacher training methods in Nigeria are more academic and removed from the actual challenges facing academic performance in schools. There seems to be a continuation of same teaching styles (lecture method) (Alumode & Onuma, 2016) from Nigerian colleges of education (where teachers are being trained) to schools, where the reality occurs. Alumode and Onuma (2016), researching the benchmark and accountability in Nigerian Colleges of Education, found that many colleges of education operate mostly with dilapidated infrastructure, overcrowded lecture halls and insufficient equipment and materials, for example, library resources and computers. Similarly, school have poor buildings, absence of science laboratories and standard school libraries. Sometimes qualified teachers are overwhelmed especially when they are to function in various roles at schools and wish to try innovative approaches to teaching. Library resource utilisation and curriculum implementation is discussed next.

2.8. LIBRARY RESOURCE UTILISATION AND CURRICULUM IMPLEMENTATION

An effective educational system depends substantially on the accessibility and utilization of library resources and services (Jamil, Tariq & Jamil, 2013). In this regard, a school library is providing information resources and services for teaching, learning and research. A school library is supporting and encouraging adopting new methods of teaching and learning, for instance, collaborative studies, group projects, group study, inquiry-based learning and team work (Edward & Fisher, 2002). Many studies were carried out on the utilisation of a school library. For example, in a study carried out by Clabo (2002) in Tennessee, it was revealed that students used library resources and services for reference purposes, recreational readings, reading of newspapers and doing their assignments, while teachers used available resources in the school libraries for specific information needs of mastering the curriculum contents of their teaching subjects.

Streatfield and Markless (2000) revealed a positive attitude of teachers towards libraries as the most important factor resulting to effective utilisation of libraries in primary and secondary schools. If teachers are using the school library effectively they will be able to motivate students to utilise it regularly. Streatfield and Markless (2000) also identified the lack of training in resource-based teaching and learning, which made the majority of teachers ill- prepared for using the library for curriculum implementation and class preparation. Hence, if no library-related assignment is given to learners, they will hardly use the library. Streatfield and Markless (2000) made it known that students from primary schools that had librarians, or who had received a good grounding in library practice, were more aware of resources when they entered secondary schools. The fact that secondary students encounter problems with using library resources suggests the need for increased emphasis on continuity of information handling skills between primary and secondary school (Williams, Wavell & Morrison 2013). Similarly, Agyekum and Filson (2012) studied on the utilisation of library resources by students in Ghanaian schools revealed that the majority of the students utilise library resources and services to complement their class notes, do their assignments and helped them in the preparation for examinations.

In Nigeria, Moruf and Muhammed (2015) and Olajide and Ariwodola (2009) conducted separate studies on the utilisation of school libraries, and both revealed inadequate funds and materials (that is, materials not in line with curriculum), exclusion of library hours from the school timetable, lack of professional staff to manage the library as the major problems hindering teachers and students from effectively utilising school library resources and services in the country. Both their findings recommended programmes like seminars and on the job in-house training that promotes library use education for librarians; considerable provision of funding for libraries, employment of qualified library personnel, formulation of school library standards with provisions of adequate funds by all concerned stakeholders and encouraging the orientation of teachers about the benefits of better information seeking behaviour with library resources.

Omah and Urhiewhu (2016) conducted a study on a strategy for the effective utilisation of school library resources in Karim Lamido Local Government Area of Taraba State, and revealed that textbooks, charts, pictures, chalk boards, graphs, transparencies, display boards, encyclopaedias, dictionaries, globes and atlases were utilised to a high extent in secondary schools in the local government, while televisions and computers were utilized to a low extent. The low level of utilisation could be attributed to either inadequate or unavailable resources. The study recommended seminars and programmes to enlighten students on the relevance of the utilisation of school library resources and services as this would help in enhancing the library resources utilization level; and school authorities should look inward to internally generate funds for equipping the school libraries by engaging the communities they serve through the Parent Teachers Association (PTA). Therefore, to achieve successful implementation of curriculum content in any school, a functioning library needs to be in place. Utilisation of library resources and curriculum implementation should not be separated if meaningful high academic performance is expected in any school. The next paragraphs will explore in depth the relationship between the two concepts, library resources and curriculum implementation, and the possible outcomes.

Curriculum is defined by Tanner and Tanner (2007, p. 121) as: "that reconstruction of knowledge and experience that enables the learner to grow in exercising intelligent control of subsequent knowledge and experience". Any curriculum that expects to achieve its aims and objectives of translating national educational objectives into within-school actualisations should take into consideration the availability of physical resources which include laboratories, libraries, classrooms and other physical infrastructural material resources like textbooks, maps, and charts, among others (Adeogun & Osifila, 2008). Instructional materials such as print, multimedia, electronic, internet/web and curated digital collections form one of the components of school library resources and are crucial to any proper implementation of the curriculum. In addition, school library resources, as highlighted by IFLA and institutions (2015, p. 33), include “digital resources such as e-books (reference, fiction, non-fiction), online databases, online newspapers and magazines, video games, and multimedia learning material”. These resources, as affirmed by Canadian Education Resource Acquisition Consortium (CERAC) (2008), enhance learning outcomes and assist students in making connections between what they learn in school and its practical application in their lives. Since teaching and learning programmes are guided by curricula content, the information needs of teachers and students are to be met based on curricula needs. The learning resource collections of the school library is selected and acquired so as to achieve the main purpose of curriculum implementation (Williams, Wavell & Morrison, 2013).

A study on the evaluation of the State Universal Basic Education Board (SUBEB) libraries in selected states in South-West Nigeria conducted by Sote, Aramide and Gbotoso (2011) brought to light the importance of functional school libraries in achieving effective implementation of the Universal Basic Education (UBE) programme. In other words, school libraries are found to be very relevant to academic activities of schools in the selected states. Also revealed in the study is inadequate provision of infrastructures such as fans and air conditioners which could make library users feel more comfortable when using the school library. The study recommended that the SUBEB libraries should be funded more by the government to acquire adequate resources and facilities for effective performance of the school library and its personnel, by so doing, implementation of curriculum content will be a smooth and easy one; and students should be encouraged by Government and schools to utilise libraries by creating a period for library study on the school timetable; and library opening hours should be extended beyond school hours to give students more chances to use the library resources and services (Sote, Aramide & Gbotoso, 2011).

The school library is a collection of printed, non-printed and electronic resources systematically organised to meet the needs of students and teachers. The school library is a collection of printed, non-printed and electronic resources systematically organised to meet the needs of students and teachers. According to (Yaya, Achonna & Osisanwo, 2013), the school library offers an enabling environment that encourages students to appreciate reading to achieve 21st century education. Similarly, in the human society, library offers resources for making teaching and learning in any school to be more effective (Yaya et al, 2013). Thus, in actualising the aims and objectives of Universal Basic Education scheme, the role of school library cannot be overemphasized. This denotes that to achieve the aims and objectives of any school, a well-equipped library is required.

A functional school library is one of the surest ways of supporting instruction that is helpful for the teaching and learning process in Nigerian schools because the resources and services provided by school libraries touch the lives of students and inspire their learning, imagination and creativity (Afolabi & Elaturoti, 2016). This is, however, at odds with Awofala and Sopekan's (2013) study on curriculum reforms in primary and secondary schools in Nigeria which only emphasized lack of finance and inadequate teachers in newly introduced subjects as two major factors that could mar the effective implementation of Curriculum 2007. In Curriculum 2007, new subjects were added in the area of entrepreneurship and trade.

According to the Nigerian Educational Research and Development Council (NERDC) (2007), the secondary school curriculum implementation may not be possible without adequate textbooks and instructional materials. However, unlike China, Mexico and Caribbean, the Nigerian government has not been providing free textbooks to each senior secondary student and school (Adebayo, 2018). It is a tough task for students and teachers to work without resources (books) (Okoye & Ogunleye, 2015). However, one of the major roles of a school library is to make various resources (print, non-print and electronic) and services available for both students and teachers. Discussed in the next session are the factors considered to be predicting academic performance in African countries, particularly Nigeria.

2.9. IMPACT OF SCHOOL LIBRARIES ON ACADEMIC ACHIEVEMENT

International studies have unequivocally provided evidence to support the positive impact of school libraries on learners' performance. For instance, Lance's (1994) study on the influence of school libraries on academic achievement in Colorado revealed that library resources and staff size were the second best determinant of students' achievement on standardised tests after poverty. Furthermore, in more than 60 studies carried out in 19 states in the USA and a Canadian province (Gretes, 2013), the major findings of these studies are that students with access to well-supported school libraries with a full-time certified librarian scored higher on reading assessments regardless of their socio-economic status. Ewell and Ries's (2000) study on assessing student learning outcomes in high schools in USA also agreed that there is a significant relationship between libraries and academic performance. All things being equal, in most of the international studies, researchers concluded that, students' performance increases when a school library is stocked, staffed and fully-funded (Friend & Cook, 2010; Lance, 1994; Small, Snyder & Parker, 2009).

On the impact of library on students' performance, Baughman (2000) in Massachusetts and Smith (2001) in Taxas conducted different seminal studies. Baughman revealed that students who attended schools with standard libraries scored highest marks. Similarly, Smith established that, while socio economic variables had partial impact on students' performance, library-related variables had overall influence on students' performance. The findings, therefore, recommended standard library with a fulltime qualified librarian in schools. However, in a critically reviewed study carried out by Chan (2008) to examine the copious literature concerning the impact of school libraries on students' academic performance, and implications this impact had on school library advocacy, evidence has not been persuasive to encourage the development of school libraries, because of the erroneous perceptions of administrators and educators who see school libraries as being peripheral to teaching and learning.

On school libraries and students' achievements, studies have been conducted across the USA. For example, in North Carolina (Burgin & Bracy, 2003), Illinois (Lance, Hamilton-Pennell & Rodney, 2005), and New York (Small, Snyder & Parker, 2009). All the findings showed a statistically positive and significant relationship between school library services and student academic performance. More recently, a study conducted by Lance and Hofschire (2012) on change in school librarian staffing associated with change in the Colorado Student Assessment Programme (CSAP) reading performance (from 2005 to 2011) revealed that students at schools with a professional librarian manage\ing the library programme achived higher scores in the CSAP reading scores and higher improvements in those scores over time than students at schools with library programmes being managed by non-professional librarians. This shows that having somebody managing the school library is not enough but a fulltime professional librarian is what can actually impact positively students' academic performance.

In Scotland, a study carried out by Williams, Wavell and Morrison (2013) on the influence of school libraries on learning, revealed that school libraries had influence on exam scores resulting in academic attainment; effective curriculum implementation or learning outcomes (academic performance), including IL practice, good project work development, and positive attitudes towards learning. Similarly, in The Netherlands, Nielen and Bus (2015) carried out a study to compare students from schools with an enriched/equipped school library, that is, one with more up-to-date resources with students from schools with a typical (not well equipped) school library. They verified impacts of an equipped school library on reading motivation and academic skills reading frequency. Students in schools with well-equipped libraries scored higher on a standardized reading comprehension test than students in control schools (Nielen & Bus, 2015). With the revelation of studies from Williams, Wavell and Morrison (2013) and Nielen and Bus (2015), one can easily conclude that a well-resourced school library is one of the most important factors that determines students' performance in schools.

In contrast, in a study to determine whether facilities in schools have an impact on students' achievement, the Government of Pakistan's (2005) national assessment report, adopting a quantitative approach and using two instruments, 1) achievement tests in language and mathematics, and 2) student, teacher and head teacher background questionnaires, revealed the mixed effects of facilities in school, and that the availability of libraries, did not affect students' achievement. In a related development, a study conducted on the impact of school environment on academic performance of secondary school students in Punjab, Pakistan, Dahar, Dahar and Dahar (2009) did not consider school libraries as an important predictor of students' academic achievement. This could be attributed to the poor condition of most school libraries in Pakistan. For instance, a study by Ramzan, (2009) on school library development in Pakistan revealed that in primary and middle schools there was no idea of libraries. Only a very few books are kept in closed cupboards in one office, or in a multipurpose room. Students were rarely allowed to use or borrow library books. The period of the library is the same with that of the school period, so very little time is available for teachers and students to use the few available resources in libraries. The libraries were disorganised in the arrangement of space and stock, and managed by unqualified staff. The Ramzan (2009) study recommended, among others, professionals with a librarianship background to manage school libraries. This is also corroborated in a recently conducted study which examined the impact of the school library on students' academic achievement at secondary schools in the Southern Districts of Khyber Pakhtunkhwa, Pakistan (Ayaz, Ali, Khan, Ulaah & Ullah, 2017, p. 95), where their findings revealed that there is a positive relationship between the library and academic performance of students, and that the library has a positive impact on the academic performance of secondary school students. This shows that without a well-resourced library the secondary school education system in Pakistan might not run effectively.

Yusuf (2014) investigated the impact of school library services and library utilisation on student performance in Eastern Hararghe, Ethiopia. The study determined that school library utilisation does impact students' academic performance positively. He recommended broadening the range of information sources and services provided in school libraries through equipping them with enough current and relevant information sources and services in addition to employing adequate qualified library staff. In Tanzania, Ida (2016) carried out a study to determine the influence library services have on students' performance in the Certificate of Secondary Education Examination (CSEE) in Mtwara Mikindani Municipality. The students from secondary schools with well-equipped libraries performed better in the CSEE than students from secondary schools without school libraries. The availability of well-equipped school libraries encouraged learning habits and strengthened students' study skills which ultimately resulted in better performance of the students in the CSEE.

In Nigeria, as in other countries around the world, the dissenting opinions that the education standard has fallen has seriously brought about arguments of what could be responsible for the decline (Owate & Iroha, 2013). Various factors responsible for this decline in education standards have been debated by researchers and scholars. However, at the centre of these arguments, school libraries have not been recognised by researchers and scholars as one of the significant and viable educational vehicles for national development. Based on the importance of the library as highlighted by the NNPE, it is surprising that secondary schools are still being established without a functional library (Owate & Iroha, 2013). Good standard education cannot be achieved in isolation from school libraries (Nigeria National Policy on Education, 2013; Owate & Iroha, 2013).

Adeyemi's (2010) study on the school library and students' learning outcomes in secondary schools in Ekiti State, Nigeria employed an inventory as the instrument of data collection for the study, which contained information about the level of school library development and secondary school students' learning outcomes in the State. The findings showed that the level of development of school libraries in the state was low, while school library conditions were poor. However, with just an inventory as the instrument of data collection, the findings of the study could not be subjected to the parameters of validity since there was no opportunity for data triangulation. Owoeye and Yara (2011) studied school facilities and secondary school academic achievement in agriculture in Ekiti State, Nigeria. The study population was final year students, and the data collection method was the West African Senior School Certificate Examinations (WASSCE) results conducted between the years 1990 and 1997 in some secondary schools in the state. In this study's findings there were no significant differences in the students' performance in agricultural science between rural and urban schools in the state. Both these studies adopted a descriptive survey design. The current study (this dissertation) employs both qualitative and quantitative approaches to enable validity through triangulation of the results.

Ekundayo's (2012, p. 208) study on "school facilities as correlates of students' achievement in the affective and psychomotor domains of learning in Nigeria" used a study population consisting of all the public secondary school teachers in South-West Nigeria. The study revealed a positive relationship between the libraries and the students' achievement in the affective domain as well as a positive relationship between school libraries and students' achievement in the psychomotor domain of learning. The study recommended improvement of physical facilities such as classrooms, laboratories, and libraries to improve the students' achievement in these areas (affective and psychomotor domains) of learning.

Olaojo's (2013,p. iv) study on the "influence of availability and teachers' utilization of library media resources on the cognitive achievement of secondary school students in social science subjects in Oyo State" reported that providing library resources in the required quantity and quality would influence the students cognitive achievement in social science subjects in senior secondary schools. Jato, Ogunniyi and Olubiyo's (2014, p. 57) study on the "use of school libraries and students' academic performance in selected secondary schools in Ondo West Local Government Area of Ondo State", adopting descriptive survey research, found that students' irregular utilisation of libraries as one of the factors responsible for poor academic performance, particularly in English language and mathematics. The study, therefore, recommended a "library study hour" in schools to enable students have a definite time to use the library on a regular basis; and extension of library opening hours to afford the students the opportunity to study after school lecture period. Similarly, Odeh, Oguche and Ivagher (2015, p. 4914) examined the "influence of the school environment on secondary school students' academic achievement in Zone "A" senatorial district of Benue State, Nigeria". Their findings identified a conducive school environment, effective school discipline and adequate school physical facilities, such as libraries, as factors that positively influence the secondary schools academic achievement in the state.

2.10. CONCLUSION

The review revealed that many studies, most especially from Australia, the USA (Baughman, 2000; Burgin & Bracy, 2003; Ewell & Ries, 2000; Gretes, 2013; Kachel, 2013; Lance, 1994; Lance, Hamilton-Pennell & Rodney, 2005; Lance & Hofschire 2012; Small, Snyder & Parker, 2009; Smith, 2001), UK (Williams, Wavell & Morrison, 2013), Netherlands (Nielen & Bus, 2015) and some African (Adeyemi, 2010; Ayanlola, 2014; Ida, 2016; Olaojo, 2013; Yusuf, 2014) have examined the influence of the school library on academic performance as well as predictors of science students' performance in secondary schools. Countries such as the USA, UK and Australia have long understood that school libraries have a positive impact on the academic performance of students in secondary schools. However, it seems some of African countries, in theory, tend to agree with this but in practice they are far behind. Adeyemi's (2010) study concerned the school library and learning outcomes of students in secondary schools in general and was not grounded in any learning theoretical framework, the gap this present study seeks to address. There seems to be varied factors predicting academic performance in secondary schools. This could be as a result of geographical settings, culture and socio-economic variations, and the school library standard in various secondary schools in nations of the world. There is inconsistency in the literature in general acceptability/acknowledgement of the roles of school libraries in curriculum implementation and performance of students, particularly in African and a few Asian countries like Pakistan. This may be as a result of a poor situation of most of the school libraries in Pakistan and most of African countries. From the literature emanating from Nigeria, it could be deduced that school libraries have not been seriously considered as one of the predictors of academic performance of science students in secondary schools. However, it is glaring that school libraries in Nigeria have not been well funded, which has resulted to their poor state.

CHAPTER THREE

THEORETICAL AND CONCEPTUAL FRAMEWORKS

3.1 INTRODUCTION

A theoretical framework (Timperly, Wilson, Barrar & Fung, 2007, p. 285) "is a structure of concepts and theories that provides a map to guide thinking, research and action", while a conceptual framework (Timperly, et al, 2007, p. 281) "is a foundation of factual and conceptual knowledge that is organised in ways that allow the retrieval of prior understandings and integration of new information". This study is grounded in the theory of constructivism and inquiry-based learning approaches applied in secondary schools, particularly in science education (NUBEC, 2010; Çelik, Ilhan & Pocan, 2016; Kenny & Wirth, 2009; Kuhlthau, 2004; Omenyo, 2016; Semerci & Batdi, 2015).

3.2 CONSTRUCTIVISM AND INQUIRY-BASED LEARNING

The theory of constructivism is the one upon which inquiry is based (Bozzuto, 2017). Inquiry-based learning (IBL) is primarily a pedagogical method, which requires learners to experience the process of knowledge creation and/or acquisition and was developed in 1960s as an answer to traditional methods of instructional based learning led by the teachers in the classroom (Bozzuto, 2017). This means, students learn from situations in the world (families, friends, media and libraries) around them to construct knowledge via their interaction or exposure. In so doing, the knowledge base of students is enriched and expanded as their social and communication skills are improved by making a classroom environment that underscores collaboration and exchange of ideas (Bada, 2015). Constructivism is an epistemology or a theory of knowledge that argues that human knowledge and meaning are generated from their interaction between their ideas and experiences. Constructivism also refers to the idea that students createt/generate knowledge for themselves, (that is, applied to explain and understand how people know what they know), and each student whether individually and/or socially creates/generates meaning as they learn (Hein, 1991; Bhattacharjee, 2015). Inquiry-based learning is a pedagogy that is considered to be authentic, holistic, constructivist and underpinned by a set of ideologies which include the idea that inquiry is natural and universal to human experience (Barell, 2008; Scardamalia & Bereiter, 2010).

Inquiry-based learning is rooted in a constructivist approach to learning. Students engage actively with various sources of ideas and information to build new understandings, and to develop personal viewpoints and perspectives. The strength of an inquiry-based approach to teaching and learning science lies in its ability to advance intellectual engagement and foster deep understanding via the development of a minds-on, hands-on and research-based disposition towards teaching and learning science in a country that seeks to build a knowledge-based society. In a broad sense, inquiry-based learning is a term that refers to any process of learning that involves inquiry. According to (Todd, Kuhlthau & Heinström, 2005, p. 8), guided-inquiry, which is the one of the most used methods of IBL, is

> carefully planned, closely supervised targeted intervention of an instructional team of school librarians and teachers to guide students through curriculum based inquiry units that build deep knowledge and understanding of a curriculum topic, and gradually lead towards independent learning (p. 8).

According to Kuhlthau (2010, p. 3), since the 1980s and 1990s school librarianship has passed through many phases from library skills, information skills to information literacy, and now to inquiry as a way of teaching and learning in the 21st century. When guided through an inquiry process by school librarians and teachers, students gain proficiency at each grade level. Guided-inquiry instructional teams develop in students subject knowledge, research competency and equally foster motivation, language development, cooperative learning, reading comprehension, writing ability and social skills. All these have been recognised for fruitful lifelong learning (Kuhlthau, et al, 2007, p. 3).

Kuhlthau (1993, 2010) and Todd (2002, p. 5) have conducted several studies which provide the field of education with some of the invaluable research on the nature and dynamics of constructivism and inquiry-based learning. For example, Kuhlthau (2004) affirms that constructivism helps learners (students) through learning stages as they experience doubt and anxiety when they initiate a search process and begin to explore new information (Kuhlthau, 1993). Besides, the constructivist learning environment steered many librarians and teachers to reconsider approaches to library orientation and teaching methods respectively, as it uncovers the weakness of a teacher centred approach.

Research has shown a widespread application of constructivist principles in teaching and learning science. The theory of constructivism and inquiry-based learning approaches are connected with behavioural and cognitive theorists such as: Jean Piaget, Lev Vygotsky, Jerome Bruner and John Dewey (Lutz and Huitt, 2004). Constructivism and the pedagogical method of inquiry-based learning has broad applications, particularly in the field of education. For instance, in Turkey, Semerci and Batdi (2015, p. 176) applied constructivist learning theory in a study: “comprehensive meta-analysis of learners’ academic achievement, retention and attitudes”. They concluded that the application of the theory of constructivism and inquiry-based learning influenced positively learners’ academic achievement and high level of retention. Similarly, Çelik, Ilhan and Pocan’s (2016) study on “the effect of a constructivist learning approach in the field of mathematics assessment”, asserts that mathematics education based on constructivist and inquiry-based learning approaches significantly increases the mathematics achievement and academic self-perception.

In Korea, Kim (2005, p. 1) carried out a study on “the effects of a constructivist approach on academic achievement, self-concept and learning strategies”, which investigated student preferences. The elementary sixth graders were divided into two groups (experimental and control). The constructivist approach was used to teach the experimental group, while the traditional method was used to teach the control group. A self-concept inventory, mathematics tests administered by the teacher, learning strategies inventory, and a classroom environment survey were the instruments used. The findings revealed a constructivist environment as the learning strategy preferred by students to a traditional classroom setting, and a constructivist teaching approach was more effective compared to a traditional teaching method in terms of academic performance of students.

In India, Chowdhury’s (2016, p. 35) study on “the effect of a constructivist approach on the achievement in mathematics of IX standard students” revealed that: 1) a constructivist learning approach improves student’s achievement in mathematics than traditional teaching approach; 2) a constructivist learning approach was equally effective for both male and female in improving their performance in mathematics; and 3) Students taught in a constructivist learning environment have significant enhancement in their understanding and application abilities. More recently, Pangat’s (2017) study on constructivist pedagogy and secondary school mathematics students revealed that using a constructivist learning approach improved significantly students’ achievement in mathematics in India, than using a traditional teaching approach. Besides, majority of students were showing amazing improvements in their abilities to understand and reflect.

In Jordan, Qarareh (2016) carried out research on the “effect of using the constructivist learning model in teaching science and scientific thinking of 8th grade students”. The findings revealed “that there is a statistically significant difference at (α= 0.05) for the effect of the constructivist learning model on the achievement and scientific thinking in favour of the experimental group”. The study therefore recommends paying more attention to adopting of constructivist learning approach for teaching science courses.

In Orlando, United States, Kenny and Wirth’s (2009, p. 36) study on “implementing participatory, constructivist learning experiences through best practices in live interactive performance” equally affirmed that constructivist and inquiry-based learning approaches greatly influence high academic performance, since it creates room for non-threatening situations which are relevant for academic performance in science.

In a study conducted by (Montiel-Overall & Grimes, 2013, p. 41) on “teachers and librarians collaborating on inquiry-based science instruction”, from the finding, it is suggested that librarians and teachers should to collaborate on: information literacy; “structured English immersion standards” and inquiry-based science lessons. Findings further revealed that experience and enough time are needed for teachers and librarians collaboration on teaching instruction. Besides, the findinds revealed lack of experience of inquiry-based science in schools with a culture of teacher centred approach. The study, therefore, recommended smooth communication between the professions (librarianship and teaching) for successful implementation of teacher and librarian collaboration which could boost student achievement in science.

Maxwell, Lambeth and Cox (2015, p. 1) examined “the effects of inquiry-based learning on the academic achievement, attitudes, and engagement of fifth-grade science students”. The study’s respondents were from two science classes. The first class was the experimental group, which was taught with IBL approach, while the second class was the control group, which was taught with traditional approach. Students who were taught with received IBL approach displayed a negligible decrease in their constructive attitudes towards science but greater commitment as compared to students who were taught with traditional approach (Maxwell, Lambeth, and Cox, 2015).

In Ghana, Omenyo (2016, p. 27) investigated “the role of the school library in teaching and learning”. The study which is underpinned by the theory of constructivist learning, found that strong teacher and librarian collaboration provides significant mediation opportunities for students to build their own meanings and understanding from the library resources accessed. The two studies (Montiel-Overall & Grimes, 2013; Omenyo, 2016), however, affirmed the strength of constructivism in the process of librarian and teacher collaboration as well teaching and learning science.

In Nigeria, Nwagbo and Obiekwe (2010, p. 26) studied the “effect of a constructivist instructional approach in biology”, and revealed that the approach was more active in facilitating the students’ achievement in ecological concepts. Similarly, (Oludipe& Oludipe, 2010, p. 347) also studied “constructivist teaching strategies in integrated science at secondary school level in Ogun State, Nigeria”. They revealed that the students being taught with a constructivist approach scored higher marks on the post-test and the delayed post-test compared to students taught with traditional method (lecture) of teaching. The findings recommended incorporation of constructivist-based approach into teacher’s methods of teaching.

In summary, various studies across the world have acknowledged the significance of constructivism and inquiry-based learning in science education. From the literature reviewed, it is evident that the constructivism and pedagogical method of inquiry-based learning positively influence students’ academic achievement, particularly in secondary school science education. Constructivism is therefore be employed to anchor this study as there is a stronger link between it and inquiry based learning than any other learning theories.

3.2.1 INFORMATION INQUIRY

Information inquiry (Callison & Preddy, 2006, p. 4) which is also referred to as guided-inquiry (Kuhlthau, Maniotes & Caspari 2007), is a term that was first established in 1991 as one of graduation education courses at Indiana University by Professor Daniel Callison, Director of School Library Media Education. Information inquiry is the teaching and learning process that combines inquiry strategies to seek answers to questions, raise new questions and further question the content from the wide array of information resources accessed. It is also referred to as the processes of engaging with texts and other media to analyse, extract, synthesise and infer information that will address student questions (Callison & Preddy, 2006, p. 4).

Figure 3.1: Cycle and interaction of information inquiry elements

Source: https://www.eduscapes.com/sessions/ssinquiry/2.htm

In the application of information inquiry to the student research process, a student, as an information scientist, engages in the process that can excite them to learn more. Through questions, exploration, assimilation, inference and reflection teachers and learners (students) grow in the expanding knowledge base of the information age. Information inquiry involves those processes that determine the adequacy of the information needed, located and selected for use. There are five elements of information inquiry, which are also commonly found in the many models and strategies devised to teach the information search and use processes. These elements – questioning, exploration, assimilation, inference and reflection are illustrated in Figure 3.1 in a continuous cycle. Several of these elements interact, maybe many times, before the learners move to the next element of experience. Sometimes the learners move on purposefully and times naturally without consciously taking the next step. For those who use information inquiry to understand information literacy, the cycle will trigger each time a new piece of information is presented. The level of degree and depth of each element will depend on information received or the stage of the investigation (Callison & Preddy, 2006).

3.2.2 INQUIRY-BASED LEARNING IN AUSTRALIA

The Australian curriculum's inquiry skills as described by Lupton (2013) are represented as:

- information literacy (i.e. seeking, evaluating, selecting and using information)
- questioning skills (i.e. posing and evaluating questions and hypotheses)
- discipline specific skills (i.e. data gathering, mathematical measurement, data analysis and presentation of data), and
- ICT literacy (i.e. fluency with computer hardware and software).

Inquiry learning, according to Lupton (2013), encompasses three elements; information literacy/information seeking process, questioning frameworks, and action research cycle. As illustrated in Figure 3.2, these components overlap and are inclusive in inquiry instructional methods.

In planning an inquiry task, the role of asking questions by the teachers and students is important. In some circumstances, the broader topic or overarching question may be chosen by the teacher, which then require the students ask a various sub-questions. This serves two purposes, 1) to slim the topic to manageable size, and 2) to allow students follow their interests. The amount of teacher-led versus student-led questioning is correlated to the type of inquiry pedagogy that is followed. For instance, a structured inquiry is teacher-directed, and a guided inquiry is a direction of teacher and student combination, while an open inquiry is student directed (Bell, Smetana, & Binns, 2005; Martin-Hansen, 2002). As a result of some challenges faced in applying the Lupton inquiry model, it cannot be fully employed to inform this study. The model requires integrating it into the school curriculum which requires a critical role to be played by the librarian and teacher for the results to be achieved.

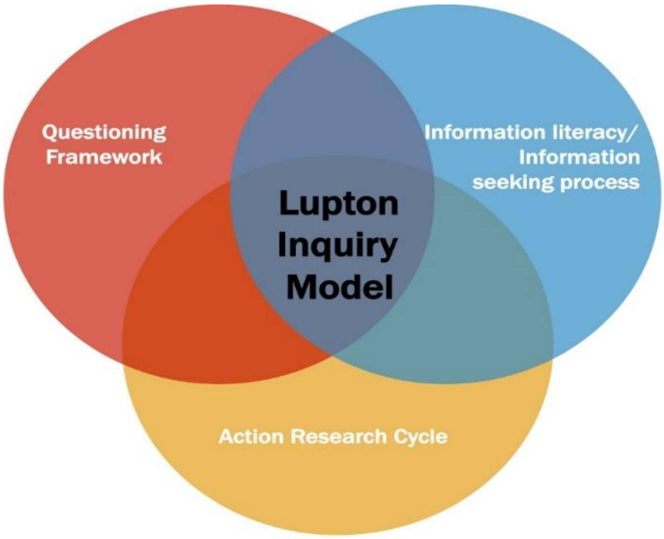


Figure 3.2: Lupton inquiry model (2012)

Source: https://informationisnotknowledge.wordpress.com/tag/inquiry-based-learning/

3.2.3 ALBERTA'S INQUIRY-BASED LEARNING

In a document, *Inspiring Education*, prepared for the Alberta Ministry of Education, Friesen and Scott (2013, p. 2) affirmed that "students develop competencies through a process of inquiry and discovery, as they would collaborate to learn how to think critically and creatively, which will result in discoveries—through inquiry, reflection, exploration, experimentation, and trial and error". The *Inspiring Education* document emphasises engaging students in genuine knowledge creation and authentic inquiry. According to Alberta Learning (2004, pp. 1-3), "reflecting on the process is integral to all phases in the Inquiry Model—Planning, Retrieving, Processing, Creating, Sharing and Evaluating. Reflection should address both the affective and cognitive elements associated with metacognition". These concepts are well explained by Alberta Learning (2004, pp. 1-3) as follows:

- **Planning:** Find information sources for chosen topic area for inquiry with presentation format. Also, sketch a plan for inquiry with evaluation criteria. Normally, at this stage of the inquiry practice, students experience a sense of hopefulness about the tasks ahead.
- **Retrieving:** In this phase, sketch an information retrieval plan that will enable selection, evaluation, location and collection of information resources. Review and revise the plan for Inquiry. At this stage, teachers are expected to assist students by

stressing that feelings of obstruction are normal, and teach the students the skills and strategies needed for selecting relevant information for inquiries.

- **Processing**: In this phase, students need to establish a focus for inquiry and **c**hoose relevant information, make connections and inferences, review and revise the plan for inquiry. At this stage, it is normal that the information accessed by student could be puzzling or conflicting, and may make them feel stunned.
- **Creating:** The creating phase involves organising of information by putting it into one's own words. Create a product and think about the audience by editing, reviewing and revising plan for inquiry. Students are expected to be assisted by teachers so as to stay focused in their presentation feel more confident. At this phase, students may want to include all of their new learning in their product, which could result in too much information to handle easily.
- **Sharing: S**tudents should be confident to communicate with the audience, present new understandings, regardless of the format or audience, if enough support has been given throughout the inquiry process.
- **Evaluation:** In order to make sense of the inquiry process, students should evaluate the product and the inquiry process and plan. Review and revise personal inquiry model and transfer learning to new situations beyond school. Students should be able to reflect on how their experience has influenced their personal inquiry model and on what they have learned about themselves as inquirers (pp. 1-3).

These concepts are well illustrated in Figure 3.3.

Figure 3.3: Alberta learning inquiry model

Source: (Oberg, 2013, p. 17)

3.2.4 THE INTERSECTION OF INQUIRY MODELS

Constructivism is connected with pedagogical approaches that create a learning environment that promotes learning by exploiting ways in which the students are actively involved in problem solving (Callison & Preddy, 2006). Constructivism provides room for the teacher to scaffold a group of students to solve a problem which ultimately helps students to develop metacognitive skills (Savery & Duffy, 1995). Besides, the constructivist classroom offers the student various opportunities to build on prior knowledge, construct new knowledge and understanding from genuine experience. Constructivism inspires students to invent alternative solutions, collaborate with one another, explore possibilities, try out ideas and hypotheses, re-thinking and providing solutions to the problems (Pulkkinen & Ruotsalainen, 1997). Information (guided) inquiry (Callison & Preddy, 2006), the Alberta Learning inquiry and the Lupton inquiry models are all rooted in constructivism.

As illustrated in Table 3.1, the Lupton inquiry model which is about questioning skills, information literacy, ICT literacy and discipline specific skills comprises three elements which are: information literacy/information seeking process; questioning frameworks, and action research cycle, while Alberta Learning reflects on the process as integral to all phases in the inquiry model - planning, retrieving, processing, creating, sharing and evaluating. Both the affective and cognitive elements associated with metacognition should be addressed by reflection. Information (guided) inquiry has been widely embraced because it assists students in building social and emotional learning capacity, problem-solving prowess, and college and career-ready skills. The various elements of these inquiry models overlap and are inclusive in inquiry instructional methods that steers students away from a traditional learning environment where the teacher lectures, the students take notes, answer questions, complete homework, and sit for an exam (Wabisabi Learning, 2019).

Information (guided) inquiry seems to be more implementable considering that "it combines all strategies of inquiry to find answers to questions, advance new questions and further query the content from the extensive collection of information resources accessed" (Callison & Preddy, 2006, p. 4). Thus, information (guided) inquiry approaches could have a significant effect on students' performance in science. Besides, it makes room for the exchange of ideas and flexible guidelines/rubrics that suit secondary school science education in the 21st century which is expected to forge ahead with ICTs and innovations.

Information (guided) inquiry is founded on the constructivist approach to learning. As asserted by Jonassen (1995), the constructivist learning environment has effects on the secondary school condition. Information (guided) inquiry is a suitable model to study school libraries and science education, particularly in Nigeria where government has adopted science in a bid to achieve its vision of economic growth. Criticisms and limitations in the application of information (guided) inquiry include its unsuitability for large class sizes, that is, more than 18 students (Mathis, 2016; Tam, 2000); students need access to information resources (such as in a library); it is a more time-consuming teaching/learning approach; the process can be frustrating for both students and teachers (teachers need to be immersed and convinced of the approach); and it does not fit well with typical final examinations (Wabisabi Learning, 2019). Its strengths (which outweigh its criticisms) lie with the ability to combine all strategies of inquiry such as; knowledge creation with observation, seeking answers to questions, and querying the content from the broad collection of information resources retrieved. See Table 3.1. It is on this basis that the study is anchored in information (guided) inquiry as it does not encourage the idea of regarding students as tabulae rasae who are always waiting to be spoon-fed, rather it encourages students to be knowledge creators (Callison & Preddy, 2006), and this practice is concerned with students to experience and learn by doing.

Table 3.1: The intersection of the information inquiry model (Callison & Preddy, 2006, pp.6-9), Alberta Learning inquiry model (Alberta Learning, 2004) and the Lupton inquiry model (Lupton, 2013)

Elements of Information (guided) inquiry model	Elements of Alberta learning inquiry model	Elements of Lupton inquiry model
Questioning Ask more focused, relevant and insightful questions	**Planning** Find a topic area for inquiry Find possible information sources Find audience and presentation format Establish evaluation criteria Sketch a plan for inquiry	**Questioning frameworks** Ask explicit questions Pose topic, Pose question
Exploration Read, view, listen to, and search through information sources	**Retrieving** Draw an information retrieval plan Locate and collect resources Select relevant information Evaluate information Review and revise the plan for inquiry	**Information literacy/Information seeking process** Seeking/gathering, Selecting, Evaluating, Analysing, Organising Presenting data and information
Assimilation Reinforcing and confirming what is already known	**Processing** Establish a focus for inquiry Choose pertinent information Record information Make connections and inferences Review and revise the plan for inquiry	**Action research cycle** Planning, Acting, Observing Evaluating
Inference Decision process to accept or reject new information	**Creating** Organise information Create a product Think about the audience Revise and edit Review and revise plan for inquiry	
Reflection Evaluate the information Assess the information	**Sharing** Communicate with the audience Present new understandings Demonstrate appropriate audience behaviour	

	Evaluation Evaluate the product Evaluate the inquiry process and inquiry plan Review and revise personal inquiry model Transfer learning to new situations/beyond school	

3.2.5 INQUIRY IN SCIENCE EDUCATION

Science subjects are important in school education. Science subjects should develop science process skills where students ask questions; do background research; construct hypotheses; test with experiments to see if the procedure is working; analyse data and draw conclusions; if not, troubleshoot the procedure, communicate the results as the new data will become background research for future projects (Callison, 2015). Application of inquiry in teaching science enhances students in putting all the acquired resources into a meaningful setting, thereby develop in students the positive attitudes toward science, promotes their critical thinking with improvement in their communication skills. Inquiry is central to science as it assists in shifting the focus of education to cognitive abilities. Inquiry develops new basic skills (such as: constructing an argument; reasoning with data to make a rational conclusion) in students that prepare them for the 21st century world of work. (Innovation Reform Vision, 2008).

Constructivist theories are based on "the beliefs that learners actively construct meaning for themselves and with others by questioning, thinking critically and solving problems" (Timperly, et al, 2007, p. 283). The inquiry-based learning method of teaching science can be effectively used when students are actively engaged in the learning process, and the learning environment permits freedom of movement and expression (Todd, Kuhlthau & Heinström, 2005). The teacher must provide this kind of climate so that students can collect data, form and test their theories using their own methods. This is affirmed in a study by Odeh et al (2015), when they emphasized the dictum that "teaching is inseparable from learning but learning is separable from teaching" which means teachers teach to make the students learn, but students can learn without the teachers (Odeh et al, 2015). The inquiry technique can help learners (students) develop the capacity to critically think and aid in the skills development such as defining, questioning, observing, classifying, generalizing, verifying and applying.

These skills are vital in the acquisition of the knowledge and nature of science. Inquiry based learning (Callison & Preddy, 2006, pp. 6-9) helps students develop capacity to:

- Question (pose insightful and purposeful questions)
- Exploration (read, view, listen to, and search through information sources)
- Assimilation (reinforcing and confirming what is already known)
- Inference (decide on the process if to accept or reject new information)
- Reflection (evaluate and assess the information) (pp. 6-9)

3.2.6 THE INQUIRY SCIENCE CONTINUUM

According to Callison (2015), Bonnstetter and one of his students, Lyke, at the University of Nebraska-Lincoln created a continuum in 1998, to show the evolutionary processes of scientific inquiry. Greater or lesser teacher control of the inquiry process was classified across basic learning tasks. Callison (2015) expanded and re-categorized the continuum to demonstrate a deeper understanding of the various shades of inquiry. In the inquiry science continuum, there is the idea that the teacher and student roles change depending on the purpose of inquiry, the expectations for the student performance and the philosophy, which allows for better student creativities. Teachers need to become facilitators to their students in their classroom to allow many projects happening under them. In the inquiry science continuum, the first stage is more teacher centred, but it allows the teacher to assess previous knowledge and ascertain misconceptions. The next (exploring) stage is largely student centred but teacher may need to offer varying levels of instruction. The last stages extend the learning and allow students to apply their understanding to real life situations (Dana, Thomas and Boynton, 2011 cited in Callison, 2015). The inquiry science continuum model could not be adopted for this study because it requires that the researcher should be following and studying how teachers teach in their various classes. Considering the limited time of the researcher and large number of teachers the researcher wished to include in the study, it would have been difficult to use the inquiry science continuum as the lens for this study.

3.3 CONCLUSION

This study adopted the theory of constructivism and an inquiry-based learning approach to investigate the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools. The theory of constructivism and inquiry-based learning underpinning the study has provided the lens through which to examine the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools. This theory provided a framework for interpreting the school library's role in learning environments and science curriculum implementation in Nigeria.

CHAPTER FOUR

RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

The methodology chapter in research, especially doctoral research, usually provides "a systematic framework to describe, understand, explain and predict research phenomena. It is a way for the researcher to systematically solve the research problems scientifically" (Kothari, 2004, p. 8). Quantitative, qualitative and mixed methods are commonly employed approaches in reseach, and they were discussed in detail. This chapter also focused on the research method, research paradigm, sampling technique, target population, data collection, pilot study and data analyses and interpretation. The study investigated the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria. The study addressed the following research questions:

1. What is the status of public school libraries in Ekiti State, Nigeria?
    a. What are the qualifications and experience of school librarians?
    b. What are the available library resources for science curricula implementation?
    c. How adequate are the available science library resources in terms of quantity and quality?
2. To what extent does the quality of library resources influence science curriculum implementation?
3. Do science teachers advocate using information resources beyond textbooks?

4.2 RESEARCH METHODOLOGY

Research methodology is a systematic way of solving a problem. It is a science of studying how research is to be carried out. Basically, the procedures by which a researcher goes about his/her work of describing, explaining and predicting phenomena are referred to as research methodology. It is also defined as the study of methods by which knowledge is gained. Its aim is to give the work plan of research (Rajasekar, Philominathan & Chinnathambi, 2013). Similarly, Kothari (2004) describes research methodology as a way to systematically solve the research problem. Research methodology is an approach/method/technique that guides a study; considers and explains the logic behind research methods and techniques (Welman, Kruger, Mitchell & Huysame, 2005, p. 2). The discussion of the research design and methodology provided the research a plan or blueprint that enabled the researcher to evaluate and select the suitable research design that guaranteed the validity of the final results.

4.3 RESEARCH PARADIGM

Research paradigm denotes “the research methodology of an individual’s view of how the world dictates the nature of the research they engage with” (Pickard, 2007, p. 5). A paradigm is “a basic set of beliefs that guide action” (Creswell, 2014, philosophical worldview, para 2). Therefore, “research paradigm is formulations of reality (ontology), knowledge (epistemology), phenomenon (theory) and how best to learn about the world (methodology)” (Babbie & Mouton, 2007). Ontology refers to “assumptions about the nature of reality or human existence, while epistemology refers to the science of knowledge while theory denotes a generalisation that offers a particular explanation of a phenomenon” (DuPlooy, 2009, p. 20).

There are different research paradigms such as positivist, post positivist, constructivist/ interpretivist and pragmatist. The positivist paradigm is grounded in a research philosophy that asserts that the “social world exists externally, and that its properties should be measured through objective methods, rather than being inferred subjectively through sensations, reflection or intuition” (Easterby-Smith, Thorpe & Lowe, 2002, p. 28). The post positivist assumptions, according to Creswell (2014, the postpositivist worldview, para 1)

> have represented the traditional form of research, and these assumptions hold true more for quantitative research than qualitative research. This worldview is sometimes called the scientific method, or doing science research. It is also called positivist/post positivist research, empirical science, and post positivism.

Constructivism/interpretivism is a perspective that is typically seen as an approach to qualitative research. The constructivist/interpretivist paradigm is predicated on the premise that the individual seeks understanding of the world in which they live and work. Individuals develop subjective meanings of their experiences – meanings directed toward certain objects or things. These meanings are varied and multiple, leading the researcher to look for the complexity of views rather than narrowing meanings into a few categories or ideas (Creswell, 2014). It is the belief of constructivists that the social world is understood and/or interpreted by different people in diverse situations since people move from different cultures and contexts to another.

The pragmatist worldview “arises out of actions, situations, and consequences rather than antecedent conditions” (Creswell, 2014: The pragmatic worldview, para. 1). Pragmatists believe that researchers should emphasize the research problem and use all approaches available to understand the problem, instead of focusing on method (Creswell, 2014). As a philosophical underpinning for mixed methods studies, Teddlie and Tashakkori (2009) express its significance in social science research as its concentrate attention on the research problem and then using diversified approaches to get knowledge about the problem. According to Creswell (2014: The pragmatic worldview, para. 2), pragmatism provides a philosophical basis for research because:

- It is not limited to any one system of philosophy and reality, as it provides room for researchers to draw liberally from both qualitative and quantitative assumptions when he/she engages in research.
- It gives researchers freedom of choice to choose the methods, techniques, and procedures of research that best meet their needs and purposes.
- Mixed methods researchers look for many approaches when collecting and analysing data (for example, qualitative or quantitative), rather than using only one method.

For the mixed methods researcher, pragmatism opens the door to different worldviews, different assumptions, and different methods of data collection and analysis (The pragmatic worldview, para. 2).

This study relied on the pragmatic worldview or paradigm as it provided the framework for these quantitative and qualitative approaches respectively. The pragmatic worldview or paradigm offered the researcher a deep understanding of the world or views in which the respondents (science teachers, school librarians, science students and other education stakeholders) being investigated exist and the way things (school library management) occurred in a given arrangement. Pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as different forms of data collection and analysis for mixed methods researchers (Creswell, 2014).

4.4 THE RESEARCH DESIGN AND METHOD

The research design, which some scholars called 'strategies of inquiry (Denzin & Lincoln, 2011) is applied so that suitable research methods are used so as to ensure the realization of the main aims and objectives set out in chapter one. Research methods are the various procedures, schemes and algorithms used in research. All the methods used by a researcher during a research study are termed as research methods.

4.5 MIXED METHODS

Mixed methods research is the kind of research where the researcher combined quantitative and qualitative techniques, methods and concepts in a single study or series of related studies during single or multiple phases within a pragmatic philosophical worldview (paradigm) and theoretical lenses that direct the plan for conducting the study (Creswell, 2014). The mixed-methods approach was chosen for the study because the researcher combined elements of quantitative and qualitative approaches for the purposes of breadth and depth of understanding and corroboration. Mixed methods research is "an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks" (Creswell, 2014, Glossary, para. 46). The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone (Creswell, 2014).

Quantitative research is about use of numbers or statistics (Silverman, 2001), which is at odd with qualitative research. Trumbull (2000, p. 79) maintains that "qualitative research is not represented by numbers; rather it is focused on meaning and involvement of the researcher in the research process". In contention, advocates of qualitative research believe that "quantitative research turns human beings into numbers" (Seidman, 2006). Thus, quantitative research is connected with the use of numbers, while qualitative research is associated with the use of words, sentences, photos and symbols (Neuman, 2011). In generalising research outcomes, a quantitative approach commonly deals with larger numbers of people (population), while the qualitative approach usually involves small samples of people (Welman et al, 2005). On the other hand, rather than generalising the outcome of the study to a larger population, qualitative research stresses process rather than outcome in order to offer deep understanding of social action contextually (Babbie & Mouton, 2007). It is against this background that the mixed methods approach was deemed appropriate for this study because it assisted the researcher to gather data available on the school library resources and its utilization as well as science curriculum implementation in senior secondary schools in Ekiti State, Nigeria.

4.5.1 QUANTITATIVE APPROACH

In the quantitative approach, a structured questionnaire was designed to collect quantitative data. This type of research method is not simply amassing and tabulating facts but includes proper analyses, interpretation, comparisons, identification of trends and relationships. It is concerned not only with the characteristics of individuals but with the characteristics of the whole sample thereof. It provides information useful to the solutions of local problems - issues (Salaria, 2012).

4.5.2 QUALITATIVE APPROACH

A qualitative approach is "focused on process rather than outcome and tends to be rich with quotations, descriptions and narration, as the researcher attempts to capture conversations, experiences, perspectives, voices and meanings" (Willis, 2008, p. 40). This type of research is associated with words instead of numbers. As such, a qualitative study is concerned with non-statistical methods with small samples, and often purposively selected (Delport & Fouché, 2011). The characteristics of qualitative research (Creswell, 2014; Kumar, 2005; Leedy & Ormrod, 2010, p. 94) are as follows:

- It is usually conducted in natural settings. Natural settings (such as classrooms, schools and sports fields) are the overwhelming preference for qualitative studies.
- The extensive use of descriptive data. Qualitative researchers are likely to describe a phenomenon with words, rather than with numbers.
- The emphasis is on process rather than on product.
- It is often based on inductive logic: going from the specific to the general.

The search for meaning is often evident. The search for meaning focuses in qualitative research on how people try to make sense of their lives. 'How it is' may be nearly as important in a qualitative study as 'how the participants think it is'.

4.6 POPULATION

Population means the entire number in the study, which is the parent group from which a sample is to be drawn. The term population conveys a different meaning than a traditional one. In census survey, the count of individuals (men, women and children) is known as population (Pandey & Pandey, 2015). The population of this study comprised the senior secondary school (SSS) 3 science students, school librarians, science teachers teaching mathematics, physics, chemistry and biology in 187 public senior secondary schools (see Table 4.1) in both rural and urban areas in the state, as well as the major stakeholders in education associated with provision, management and utilization of library resources for science curricula implemntation such as: the permanent secretary (PS) - Ekiti State Ministry of Education, Science and Technology; director – Ekiti State Teaching Service Commission; director – Ekiti State Library Board, and area education officers (AEOs).

Table 4.1: Population

S/N	North Senatorial district (Local governments/No. of senior secondary school)		Central Senatorial district (Local governments/No. of senior secondary school		South Senatorial district (Local governments/No. of senior secondary school	
1	Ido/Osi	15	Ado	15	Ekiti East	11
2	Ikole	17	Efon	6	Ekiti South West	10
3	Ilejemeje	6	Ekiti West	13	Emure	6
4	Moba	12	Ijero	17	Gbonyin	13
5	Oye	15	Irepodun/Ifelodun	13	Ikere	10
	-	-	-	-	Ise/Orun	8
Total		**65**		**64**		**58**

Source: Department of Evaluation and Standard (2017), Ministry of Education, Science & Technology, Ado-Ekiti

4.7 SAMPLING PROCEDURE AND METHOD

A sample design is a definite plan determined before any data is collected for obtaining a sample from a given population (Gupta & Gupta, 2011). Sample designs can either be probability or non-probability (Pandey & Pandey, 2015). The study employed stratified sampling and purposive sampling. Stratified sampling involves separating the population into mutually exclusive sets (homogeneous non-overlapping groups), or strata, while purposive sampling belongs to the category of non-probability sampling techniques (Cozby, 2009). A purposive sampling procedure was used for the selection of knowledgeable and experienced participants. The sample participants were selected on the basis of their knowledge, relationships and expertise regarding a research subject (Freedman & Carver, 2007). In this study, the sample participants who were selected had a special relationship with the phenomenon under investigation, sufficient and relevant work experience in the field of school librarianship and science education. Within this context, the participants of this study are:

- Science teachers
- Science students
- School librarians
- Permanent Secretary, Ministry of Education, Science & Technology
- Director of State Library Board
- Director of Teaching Service Commission
- Area Education Officers (AEOs) of the three selected local government areas

Ekiti State has 187 public secondary schools scattered across the three senatorial districts (see the above Table 3). In this study, each senatorial district forms a stratum where one local government each (i.e. Ado, Ikere and Ido/Osi) was selected from each district with simple random sampling for the study so as to have state coverage. The schools in these local governments teach science subjects. Purposive sampling techniques involve selecting certain units or cases based on a specific purpose rather than randomly (Teddlie & Yu, 2007). Therefore, nine public senior secondary schools each in rural and urban areas of Ado, Ikere and Ido/Osi local governments were selected for the study. Since the total population of all science teachers, school librarians and SSS3 science students in all the public senior secondary schools in the three selected local governments was not readily available, Raosoft Inc's (2004) calculator was used to determine a sample size of 377 for the study. According to Raosoft Inc (2004), when the population is unknown, it is suggested that 20,000 be used, because the sample size does not change much for a population larger than 20,000. The margin of error is taken to be 5%, the confidence level for this margin of error is 95%, while response distribution is taken to be 50% (Creswell, 2014). Fiftteen participants (i.e. 4 science teachers, 1 school principal, 1 school librarian and 9 science students – randomly selected) were selected to respond to a questionnaire/interview from each of the twenty-seven schools from three selected local governments (Ado, Ikere and Ido/Osi) which represent the three senatorial districts of the state. In addition, six participants, that is, the PS - Ekiti State Ministry of Education, Science and Technology; director of Ekiti State Teaching Service

Commission; director of State Library Board and AEOs in the three selected local governments were purposively selected for the interviews. Therefore, the total sample size for the study was 411 participants.

4.8 DATA COLLECTION METHOD AND TOOLS

In order to enhance the validity of any reseach, appropriate methods of data collection are very important. The study made use of questionnaires (to elicit data from science teachers, school librarians and science students), interviews with school principals and other concerned education stakeholders and an observation checklist (document analysis).

4.8.1 QUESTIONNAIRES

Data was collected through the use of three sets of structured questionnaires. One questionnaire was for school librarians, the second for science teachers while the third was for science students. The copies of questionnaires were administered to the science teachers, school librarians and science students of the selected secondary schools in the state by the researcher and six research assistants who visited the schools in the three local government areas. See Appendices 2, 3 and 4 for the Questionnaires.

4.8.2 INTERVIEWS

The main advantage of personal interviews is that it involves personal and direct contact between interviewer and interviewee, and it eliminates non-response rate, but interviewers need to have developed the necessary skills to successfully carry out an interview. Unstructured interviews offer flexibility in terms of the flow of the interview, thereby leaving room for the generation of conclusions that were not initially meant to be derived regarding a research subject. Though, there is risk of the interview deviating from the pre-specified study aims and objectives (Gill & Johnson, 2010). The researcher used semi-structured interviews, so as to guide the interview towards the satisfaction of research objectives. However, there was still room for any additional questions during the interviews. The researcher used the mobile phone to record the voice interview with the permission of the respondents. See Appendices 5, 6, 7, 8 and 9 for the Interview Guides.

Interviews were conducted with the following stakeholders in the education sector:

- Permanent Secretary - Ekiti State Ministry of Education, Science and Technology;
- Director of State Teaching Service Commission;
- Director of State Library Board,
- School principals of selected secondary schools
- Area Education Officers in the three selected local governments.

4.8.3 OBSERVATION AND DOCUMENTS ANALYSIS METHOD

In studies relating to behavioural sciences, the most commonly used method is observation. Observation becomes a scientific tool and the data collection method for the researcher, when it serves a formulated research purpose, is systematically planned and recorded and is subjected to checks and controls on validity and reliability (Kothari, 2004). Nevertheless, the observation method has various limitations: it is an expensive method; the information provided by this method is very limited and sometimes unforeseen factors may interfere with the observational task. On occasion, the fact that some people are rarely accessible to direct observation generates obstacles for this method to collect data effectively.

On the other hand, document analysis is simply defined as the process of summarising and reporting written data (i.e. the main content of data and their messages). It is a research technique for making replicable and valid inferences from texts, or other meaningful matter, to the contexts of their use (Krippendorff, 2004). Document analysis "is critical in interview or observation-based research, and may corroborate or refute interview or observational data" (Yanow (2007, p. 411). Yanow (2007) adds that documentary review 'arms' the researcher with evidence that clarifies or challenges what the researcher is being told. Documents in most social science research have been marginalized, yet they often carry invaluable information (Prior, 2003, p. 4). Therefore, a review of documents related to the study was undertaken, in connection with the decision of the researcher to undertake a mixed methods approach to data collection.

In the event, the observation is characterised by a careful definition of the units to be observed, the style of recording the observed information, standardised conditions of observation and the selection of pertinent data of observation, then the observation is referred to as *structured observation.* But when observation is to take place without these characteristics to be thought of in advance, the same is termed *as unstructured observation.*

According to Kothari (2004), structured observation is considered appropriate in descriptive studies. Libraries in Nigeria are mostly evaluated based on traditional metrics such as loan, number of registered users, etc. this study, therefore, employed structured observation method to observe the physical facilities such as: school library building, accession register; ledger for borrowing library resources; attendance register of library users as well as state of science and computer laboratories. Observation guide was designed for this purpose. This guide (see Appendix 10) assisted the researcher and research assistants in carrying out conscious observation of the following:

- The records of registered users of the school library.
- The accession register of the school library so as to determine the number of library holdings.
- The catalogue of the school library.
- The loan records of the library.
- Physical assessment of the book shelves to ascertain the spread of science library material.
- Physical assessment of the computer and science laboratories to ascertain if they are well equipped.
- Photographs

4.9 TRIANGULATION

The need to enhance the validity in social science research requires collection of information about different events and relationships from different and diverse points of view. This involves asking various questions, seeking different and diverse sources, and using multiple methods of data collection. This process of employing multiple methods or techniques in conducting research is known as triangulation. Because of its importance, Mason (2002) submits that triangulation is necessary as it offers the opportunity to explore various parts of a phenomenon. It also assists in proffering answers to different research questions with different methods relating one source of information with another to enrich the quality of information. Triangulating data allows the researcher to provide “a confluence of evidence that breeds credibility” (Bowen, 2009, p. 28). As can be observed in Table 4.2, a number of different data sources have been triangulated to address the research questions.

Table 4.2: Alignment of research questions and method of data collection

Research question		Data sources
1	What is the status of the library in the school? What are the qualifications and experience of school librarians? What are the available library resources for science curricula implementation? How adequate are the available library resources in terms of quality and quantity?	Inventory of library resources (e.g. accession register) Questionnaire for school librarian Questionnaire for science teacher Questionnaire for science students Observation
2	To what extent does the quality of science resources influence science curriculum implementation:	Questionnaire for science teacher Questionnaire for school librarian Questionnaire for science student
3	Do the science teacher advocate using information resources beyond the textbooks?	Questionnaire for science teacher Questionnaire for school librarian Questionnaire for school students Interview– stakeholders in education

4.10 PRE-TEST

A pilot study is a mini-version of a full-scale study or a trial run done in preparation of the complete study. It is also called a feasibility study. It can also be a specific pre-testing of research instruments, including questionnaires or interview schedules (Polit, Beck & Hungler, 2001; Van Teijlingen & Hundley, 2002). In social science research, the term 'pilot study' is used in two different ways. It can refer to so-called feasibility studies which are 'small scale versions' or 'trial runs', done in preparation for the major study (Polit et al, 2001). Conversely, pilot study can also be the pre-testing (Baker 1994) or 'trying out' of a particular research instrument. Conducting a pilot study or a pre-test assists in eliminating ambiguous questions in questionnaire and generate useful feedback on the structure and flow of the intended interview. Welman et al (2005, p. 148) summarise the purpose of the pilot study as follows:

- To detect possible flaws in the measurement process (such as ambiguous instructions, and inadequate time limits);
- To identify unclear or ambiguously formulated items. In such a pilot study the actual questions are put to the participants and they are then asked to indicate how they have interpreted the formulated questions; and

- An opportunity for researchers and assistants to notice non-verbal behaviour (on the part of participants) that may possibly signify discomfort or wording of the questions (p. 148).

In this study, the pre-test was conducted using a small number of respondents with characteristics similar to those of the main study, that is, school librarians, science subject's teachers, science students and principals of a Comprehensive High school, High School and Commercial Grammar School as well as Area Education Officer in Oye Local Government Area which was not part of the sample study. Even though Polit et al. (2001) and Welman et al. (2005) make no categorical recommendations of the sample size to adopt for a pilot study, other scholars recommend approximately 10% of the size of final study (Nieswiadomy, 2002). A pre-test was carried out with three (3) school librarians, (12) science teachers and (27) science students. The pre-test addressed problems such as flaws in the measurement procedures, unclear or ambiguously formulated questions and check the time required for the completion of the questionnaire prior to carrying out the study.

The pre-test showed that students of SSS3 class were better placed to respond to the questionnaire compared to students in SSS1 or SSS2 class. The questionnaires were re-adjusted to include more options where respondents could provide answers (e.g. other, please specify or provide details, etc.) that were not mentioned earlier. This helped in ensuring that the questionnaire did not contain any vague or ambiguous statements. Creswell (2014) confirms the importance of pre-testing on typical respondents before going for data collection. This was carried out to ascertain that the instructions and questions are clear, straightforward and easy to understand.

4.11 RELIABILITY AND VALIDITY

Reliability refers to consistency when an instrument provides similar results when used continually over time on the same participants or when used by two researchers (Babbie, 2010; Polit & Beck, 2012), while validity could be described as the ability of the researcher to meaningfully and accurately draw conclusions from all the data gathered in the study (6 & Bellamy, 2012; Creswell & Plano Clark, 2007). A pre-test of the questionnaires was done in three schools in Oye local government. In order to validate the qualitative data, the rigor (i.e. the demonstration of integrity, competence in qualitative research and ethical considerations) of the overall planning and implementation during the research were adhered to by the researcher so as to ensure the authenticity and trustworthiness of the research process (Gratton & Jones, 2004). Triangulation of data (i.e. data collected through multiple sources which include questionnaires, interviews, observations and document analysis) assisted the researcher to either clarify or invalidate irrelevant influences.

4.12 DATA ANALYSIS AND INTERPRETATION METHOD

Data analysis, as described by Antonious (2003), involves inputting of the data in an electronic file which require using some statistical software package (such as SPSS); and execution of proper statistical analysis. Analysis methods, according to 6 and Bellamy (2012), are processes for handling data so that the research questions can be answered, usually by classifying important patterns. Antonius (2003, p. 2) concisely states that the word 'data' points to information that is collected in a systematic way, organised and recorded to enable the reader to interpret the information correctly. Because of this, data are not haphazardly collected, but in response to some questions that the researcher wishes to answer (Antonius, 2003). Basically, data analysis in quantitative research involves the use of statistical procedures (Antonious, 2003; 6 & Bellamy, 2012), while in qualitative research, thematic analysis is usually used (Braun & Clarke, 2006).

In this study, quantitative data were sorted, coded and analysed with the use of SPSS, while the qualitative data collected through the interviews and observation method were transcribed verbatim as much as possible, and this is followed by thematic content analysis of the data with the aid of software (ATLAS.ti) which made it possible for the researcher to be able to manage, sort, organize, locate words, phrases and segments of data so as to extract quotes from the interview responses. Thematic analysis (Braun & Clarke, 2006) is a method for identifying, analysing, and reporting patterns (themes) within data. It categorizes data into themes and sub-themes, so as to be able to be comparable. The main advantage of content analysis is that it helps in data collected being reduced and simplified, while at the same time producing results that may then be measured using quantitative techniques. Likewise, content analysis gives researchers the ability to structure the qualitative data collected in a way that satisfies the accomplishment of research aim and objectives. Nevertheless, human error is highly involved in content analysis, since there is the risk for researchers to misinterpret the data gathered (Krippendorff & Bock, 2008), thereby generating false and unreliable conclusions. Accession registers, borrowing ledgers and attendance lists were analysed statistically.

4.13 ETHICS STATEMENT

The researcher obtained the permission from the University of the Western Cape (UWC) to conduct the study. Participants were provided information consent letters about the study for both questionnaires and interview guide. The anonymity of all participants who took part in the questionnaire and interviews was maintained by the researcher through using pseudonyms and no reference was made to the names of schools selected for the study in the thesis, presentations or publications based on the study. All personal information divulged by the participants for the purpose of this study was kept strictly confidential, by ensuring that only the researcher and the supervisor have access to the information. All personal data containing information about the participants were securely stored until the study report had been completed. The participants were informed and assured that confidentiality in terms of the information they divulged would be strictly used for research purposes, and that their participation was voluntary and that they could withdraw from the study at any stage and for any reason without any form of disadvantage.

4.14 CONCLUSION

In this chapter, the different methods and approaches adopted to guide the study were discussed. The study employed a pragmatist paradigm and used the mixed method approach. Mixed approach was adopted for this study because it is consistent with the pragmatist paradigm that employs different data collection tools such as questionnaires, interviews, observation, documents, and so on. Questionnaires, semi-structured interviews, and review of policy documents (such accession registers and book loan records) are the three methods employed for data collection. Twenty-seven (27) secondary schools were used as the study areas, while 411 was a sample size used for the study. Stratified sampling process was used to select three local governments from the sixteen local governments in the state. Purposive sampling procedure was used to select 15 respondents (four science teachers, one principal, one school librarian and nine science students) from each of the twenty-seven schools across the three selected local governments in the three senatorial districts of the state. The PS - Ekiti State Ministry of Education, Science and Technology; director of State Teaching Service Commission; director of State Library Board and AEOs in the three selected local governments were purposively selected for the interviews.

The study population consisted of school principals, school librarians, science teachers and SSS3 science students as well as the stakeholders in education sector such as: Director of State Library Board, Permanent Secretary - Ministry of Education, Science & Technology, Director of Teaching Service Commission and Area Education Officers in three selected local governments. The questionnaires were administered face-to-face by the researcher and other research assistants to the school librarians, science teachers and SSS3 science students at their various schools. The instruments were pre-tested at three secondary schools in Oye local government area (which is not part of the sample study) of the state, and the questions in the data collection tools (questionnaires and interview schedule) were revised based on the feedback during the pilot study before embarking on the main survey. The researcher secured gatekeepers' permission to access both staff and students in the selected schools and equally adhered strictly to UWC ethical protocols.

CHAPTER FIVE

DATA ANALYSIS AND PRESENTATION OF FINDINGS

5.1. INTRODUCTION

This chapter presents the findings of the study derived from the three instruments - questionnaires, interviews and observation/documentary analysis used for the collection of data. According to Perron and Gillespie (2015, p. 30), “the purpose of data analysis and presentation of findings is to summarise the information collected to formulate an answer to the research questions”. In a similar vein, Grinnell and Unrau (2011, p. 448) describe the aim of data analysis as “[to] sift, sort and organise masses of data acquired during data collection into a meaningful way which address the original research problems that have previously been identified”.

As discussed in the Chapter four, the mixed methods which combine both quantitative and qualitative approaches were employed in the study. The qualitative approach was used to complement the quantitative method. Quantitative data were gathered through three different categories of questionnaires while qualitative data were collected through interviews and observation/documentary analysis. Data collected through questionnaires were coded and analysed using descriptive statistics and the SPSS. Both descriptive and inferential statistics were used to present the findings in the form of frequency tables and figures as recommended by Katz (2006). The qualitative data collected through interviews were transcribed verbatim as much as possible, and this was followed by thematic content analysis of the data with the aid of ATLAS.ti software which made it possible for the researcher to manage, sort, organize, locate words, phrases and segments of data so as to extract quotes from the interview responses (Woods, Paulus, Atkins & Macklin, 2016). The school principals are alternatively referred to as the SP in these findings or when more accuracy is required, they will be referred to as a numbered interviewee; for example, SP#11 means school principal number eleven.

The list of semi structured interview questions put to the principals and other education stakeholders can be found in Appendices 3, 5 to 9 respectively. Most importantly, the questioning revolved around using information resources beyond textbooks; standard of school libraries in term of adequate resources and qualified personnel; and the standard of science and computer laboratories in schools. Therefore, their responses are reflected verbatim as much as possible and presented together for easy understanding. The quantitative findings of the study are organised and presented according to the questionnaire's questions.

5.2.RESPONSE RATE

Response rate, according to Johnson and Wislar (2012, p. 1805) "is the proportion of individuals selected into a sample who are eligible and ultimately participate in the survey". The goal of every researcher is to attain a response rate of approximating 60% (Fincham, 2008). Fincham (2008) further adds that a low response rate diminishes the validity and reliability of survey outcomes, while a high response rate decreases the risk of bias. Rogelberg, Luong, Sederburg and Cristol (2000) state that the outcome of a low response rate is too little data which may eventually limit the choices of statistical tests.

Three hundred and seventy-eight (378) copies of the questionnaires were hand-delivered to science teachers, science students and school librarians across the 27 schools in the three selected local governments who were invited to participate in the research. However, 370 respondents filled and returned the questionnaires, a response rate of 97.9%, while 33 participants selected for the interviews all participated, a response rate of 100%. The response rate from the questionnaires and the interviews in this study was excellent. This was accomplished by following up on the participants involved in the survey. The response rates of 97.9% (questionnaires) and 100% (interviews) respectively were considered representative for the entire population of interest (Maxfield & Babbie, 2015). See details in Table 5.1.

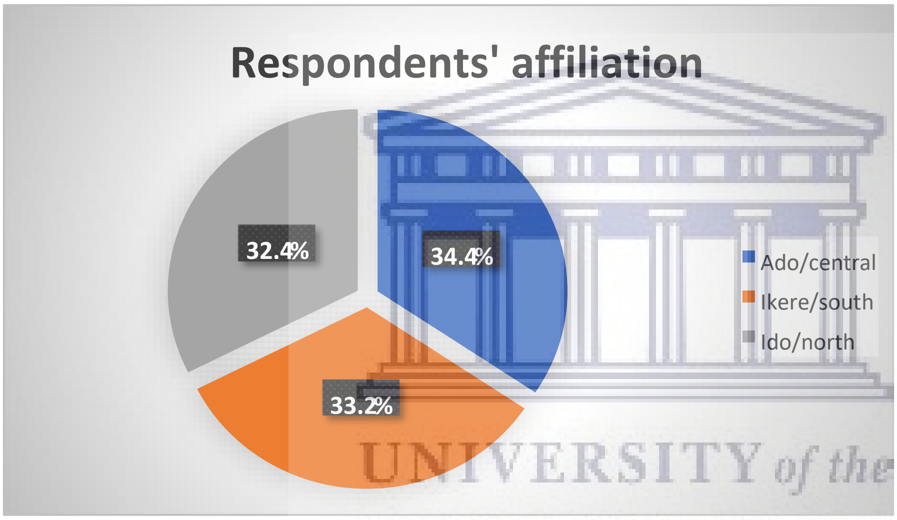
Table 5.1: Response rates

N = 403

Sample (Questionnaire)	**Frequency**	**% Response rate**
School librarians (27)	n = 27	100
Science teachers (108)	n = 103	95.4
Science students (243)	n = 240	98.8
Total	**N = 370**	**97.9**
Sample (Interviews)		
Education stakeholders (6)	n = 6	100
School principals (27)	n = 27	100
Total	**N = 33**	**100.0**

5.3.RESPONDENTS' LOCAL GOVERNMENT/ SENATORIAL DISTRICTS AFFILIATION

Figure 5.1 shows the results of the local governments/senatorial districts' affiliation of the respondents in the study. The majority of respondents 139 (34.5%) were from Ado local government in Ekiti central senatorial district; this was closely followed by 133 (33.0%) respondents from Ikere local government in Ekiti south senatorial district and 131 (32.5%) from Ido Osi local government in Ekiti north senatorial district. The results showed that Ado local government in Ekiti central senatorial district had more respondents than Ikere and Ido/Osi local governments in Ekiti south senatorial district and Ekiti north senatorial district respectively as presented in Figure 5.1.



N = 27

Figure 5.1: Respondents' local government/senatorial districts affiliation

5.4.ANALYSIS OF QUANTITATIVE DATA

In analysing the questionnaire, various statistical analyses were carried out using descriptive statistics to analyse the quantitative data. In this study, the quantitative data was coded and inputted into an Excel spreadsheet before it was exported into SPSS software (version 2.0) for graphical analysis and presentation, and for the data screening and cleaning process (Pallant, 2007, p. 8) so as to ensure accurate analysis. Three sets of questionnaires were used in this study to elicit information from respondents (school librarians, science teachers and science students). Originally, 378 copies of the questionnaires were administered to school librarians, science teachers and science students who were 27, 108 and 243 in number respectively. The school librarians completed all 27 copies of the questionnaire. The completed copies of the questionnaire collected from science teachers were 103, while science students were 240.

5.4.1. ANALYSIS OF SCHOOL LIBRARIANS' QUESTIONNAIRE

The questionnaire (see Appendix 2) for school librarians has the following five sections:

Section A: This section enquires about the background information of school librarians, such as certification status, educational qualifications, years of experience, names of their schools, date of establishment, local government/town, location of schools (urban or rural).

Section B: This section focuses on the availability of school libraries and its resources in schools.

Section C: This section examines the influence of the school library on science subjects. The essence of this section is to explore whether school libraries in Ekiti State have a positive influence on science curriculum implementation.

Section D: This section focuses on the support rendered by school librarians to both science teachers and science students in the course of achieving effective curriculum implementation in schools.

Section E: This section is about the evaluation of library use competency skills.

5.4.1.1. BACKGROUND INFORMATION OF THE SCHOOL LIBRARIANS AND SCHOOLS

This section presents data on the background information of school librarians, such as: full-time certification status, educational qualifications, years of work experience, date of establishment of the schools, location (urban or rural) of schools, location of library within the school, which are covered by Questions 2, 4, 5, 6, 7, 8 and 9 of the school librarians' questionnaire. Table 5.2 conveys the results.

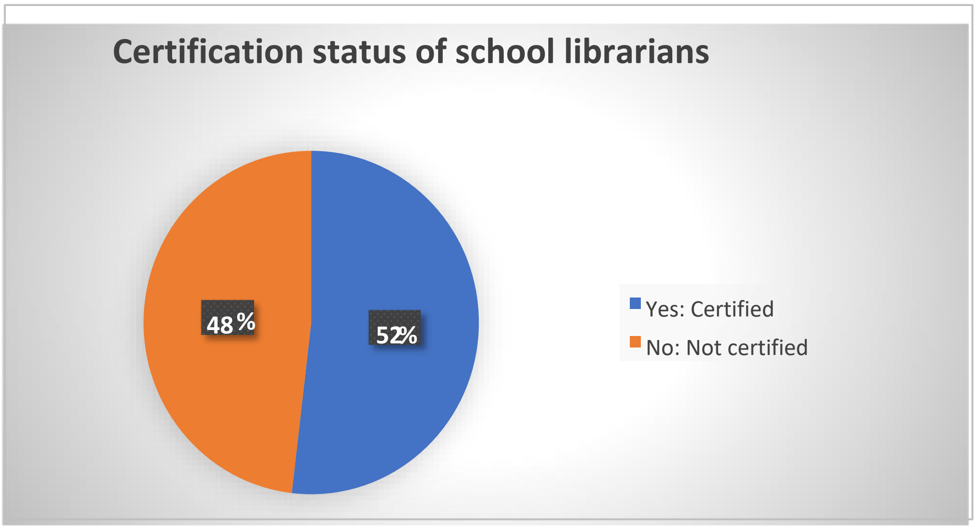
Table 5.2: Background information of the school librarians and the schools

N=27

Background information	Frequency	Percentage
Full time certified librarian?		
Yes	14	52
No	13	48
Highest educational qualification:		
Senior Secondary Certificate Examination (SSCE)	10	37.0
Diploma in Librarianship	3	11.1
Masters	2	7.4
Others: e.g. BSc/Higher National Diploma (HND)	12	44.5
Years of working experience:		
Less than 10 years	8	29.6
10-14 years	11	40.7
15 years and above	8	29.6
Location of the school libraries:		
Classrooms	8	29.6
Separate /Purpose-built building	18	66.7
Store House/Room	1	3.7
Location of schools:		
Urban	17	63
Rural	10	37
Date of establishment the schools:		
1930 – 1939	1	3.7
1940 – 1949	0	0
1950 – 1959	4	14.8
1960 – 1969	7	25.9
1970 – 1979	6	22.2
1980 – 1989	9	33.3

Fulltime certification status

Fifty-two percent (52%) of school librarians claimed to be full time certified school librarians while 48% were not certified. However, for a librarian to be certified in Nigeria, he/she must have a minimum qualification of first or postgraduate degree in the field of Library and Information Science or its equivalents as determined by Librarians' Registration Council of Nigeria (LRCN). This is covered by Question 5 of the school librarians' questionnaire. Figure 5.2 conveys the results.



N = 27

Figure 5.2: Full time certification status of school librarians

Location (urban or rural) of the schools and library location within the school

Most of the school librarians (66.7%) said their school libraries were in separated/purpose-built buildings, while 29.6% said classrooms were being used as a library. Less than 5% used store house/rooms as their libraries. Also, the selected schools cut across both rural and urban areas in the state, with the majority of respondents (63%) locating their schools in urban areas, while 37% located their schools in rural areas. The 27 schools were selected from all the three local governments of the three senatorial districts in the Ekiti State, that is, nine schools each were selected from Ado, Ido/Osi and Ikere local governments respectively.

Highest educational qualifications and years of experience

Three (11.1%) school librarians had a Diploma in Librarianship while the majority 12 (44.5%) had other qualifications such as B.Sc. /HND, followed by 10 (37%) who did not possess more than a Senior School Certificate Examination (SSCE) while those who claimed to possess a Master's degree were 2 (7.4%) and no respondent had a Bachelor's degree in Library and Information Science (B.L.I.S.). The majority of the school librarians (40.7%) had working experience between 10-14 years. Those with less than 10 years of working experience were 29.6%, while another 29.6% had more than 15 years of working experience.

Years of establishment of the schools

Only one (3.7%) school was established between the years 1930 and 1939, four (14.8%) schools were established between 1950 and 1959, seven (25.9%) schools were established between 1960 and 1969, six (22.2%) schools were established between 1970 and 1979, while the majority (33.3%) of schools were established between 1980 – 1989. However, no school was established between the years 1940 and 1949.

5.4.1.2. AVAILABILITY OF SCHOOL LIBRARIES AND ITS RESOURCES

Data gathered from Questions 8 to 15 of the questionnaire on the availability of the school library and its resources in schools, availability of library study period, location of library within the school, available resources that support implementation of science curriculum and level of provision of school library and its resources are presented in this section.

Availability of library in schools

All the schools had some place they called a library. This is covered by Question 10 of the school librarians' questionnaire. See Table5.3

Table 5.3: Availability of school library

N = 27

Availability of school library	Frequency	Percentage
Yes	27	100
No	0	0
Total	**27**	**100**

Location of the library within the school

The majority (59.3%) of the schools had separate/purpose-built buildings for their library, 10 (37%) used classrooms as their library and only one school used a store house/room as its library. Question 12 of librarians' questionnaire covers this. See details in Table 5.4.

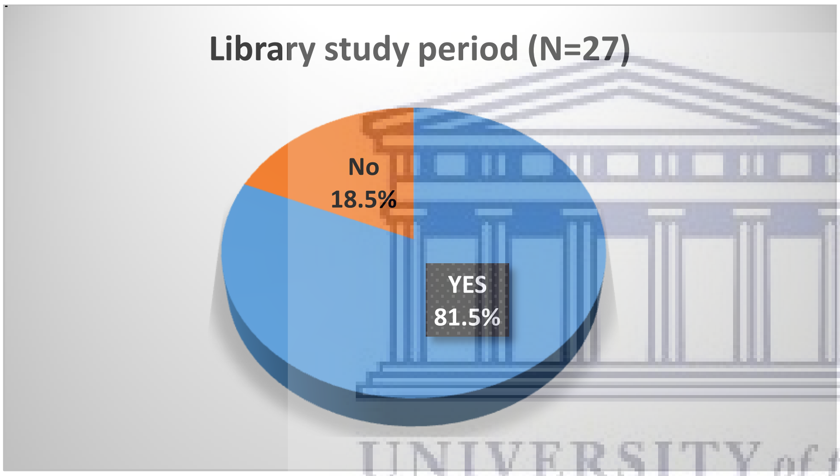
Table 5.4: Location of library within the school

N = 27

Location	Frequency	Percentage
Book boxes	0	0
Classrooms	10	37
Principal's office	0	0
Separate/purpose-built building	16	59.3
Store house/room	1	3.7
Cupboards	0	0
Others	0	0

Library study period

To find out if secondary schools in Ekiti State create a period in their school timetable for library study (question 13 of librarians' questionnaire), Figure 5.3 presents the results from the respondents (school librarians) on whether their schools had a library study period**.** The results revealed that more than two-thirds 22 (81.5%) of school librarians said their school had a library study period while 5 (18.5%) said their schools did not have such a period on their timetable. Probing further in question 14 about how students were being encouraged to use the library, the 18.5% of respondents who said their schools did not have a library study period on their school timetable, stated that their students were being encouraged to use the library during their free period or lunch break.



.**N = 27**
Figure 5.3: Library study period

Types of available library resources that support implementation of the science curriculum

Table 5.5 reveals that approximately 96% of the school librarians reported that textbooks were available in their school libraries, 77.8% reported availability of dictionaries in the school libraries while other resources like newspaper and magazine cuttings were reported by all respondents as absent. It could be deduced that the school libraries in Ekiti State placed a higher premium on the acquisition of textbooks than any other type of library resource. This is covered by question 15 of librarians' questionnaire.

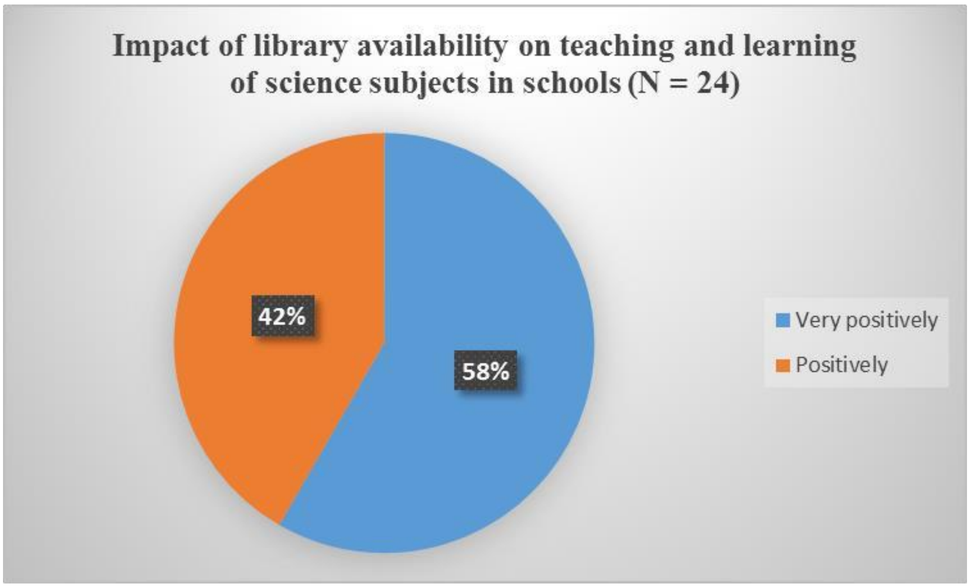
Table 5.5: Types of Available library resources that support implementation of science curriculum

N = 27

Types of resources in school library that support implementation of science curriculum	Available		Not Available	
	Frequency	%	Frequency	%
Textbooks	26	96.3	1	3.7
Nonfiction science books	5	18.5	22	81.7
Reference books	12	44.4	15	55.6
Encyclopaedias	14	51.9	13	48.1
Dictionaries	21	77.8	6	22.1
Magazines	6	22.2	21	77.8
Newspapers	7	25.9	20	74.1
Journals	5	18.5	21	77.8
Year book	4	14.8	23	85.2
Internet facilities	4	14.8	23	85.2
CD-ROM/DVD-ROM	3	11.1	24	88.9
Computer games	5	18.5	22	81.5
Documentaries	3	11.1	24	88.9
Charts & Pictorials	7	25.9	20	74.1
Pictures	7	25.9	20	74.1
Wall Charts	6	22.2	21	77.8
Flip charts	4	14.8	23	81.5
Real Objects/sample	2	7.4	25	92.6
Television	3	11.1	24	88.9
Microscopic slides	1	3.7	26	96.3
Articles collections (e.g. newspapers and magazine cuttings)	0	0	27	100

Impact of library availability on teaching and learning of science subjects in schools

On the impact of library availability on teaching and learning of science subjects in schools, Figure 5.4 interestingly reveals that the majority (58%) of the respondents indicated that availability of libraries in schools impacts very positively on teaching and learning of science subjects, followed by 42% who indicated that availability of library in school impacts positively teaching and learning of science subjects. However, none of the respondents indicated that the availability of library in schools has no impact or not applicable to teaching and learning of science subjects. This is covered by question 16 of librarians' questionnaire.



N = 24

Figure 5.4: Impact of library availability on teaching and learning of science subjects in schools

Level of provision of library resources in schools

To find out the level of provision of school library resources for science curricula implementation, respondents (school librarians) were asked to rate provision of school library resources for science curricula implementation from 'very adequate', 'adequate', 'fairly adequate' and 'not adequate'. Table 5.6 presents the results, which showed that more than 81% of respondents rated that the level of provision of library resources to be adequate for implementation of science curriculum, while 18.5% rated their library and its resources to be inadequate. This is covered by question 17 of librarians' questionnaire.

Table 5.6: Level of provision of library resources in schools

N = 27

Level of provision of library and its resources in schools	Local Government Area/Senatorial Districts Ido Osi/ EKiti North Senatorial District	Ado Ekiti/Ekiti Central Senatorial District	Ikere/Ekiti South Senatorial District	Pooled (average) percentage
very adequate	22.2%	44.4%	44.4%	37.0%
Adequate	44.4%	55.6%	33.3%	44.4%
fairly adequate	0%	0%	0%	0%
Not adequate	33.3%	0.0%	22.2%	18.5%

5.4.1.3. INFLUENCE OF THE SCHOOL LIBRARY ON SCIENCE SUBJECTS

Data generated from Questions 18 and 19 of the questionnaire on the influence of the school library on science subjects as well as knowledge of librarians about science are presented in this section.

Influence of school library resources on science curriculum implementation

The school librarians were asked to rate the influence school library resources have on science curriculum implementation from these options; 'maximum influence', 'minimum influence' and 'no influence'. This was to seek answers to question 18 of librarians' questionnaire. Table 5.7 reveals that 12 or (44.4 %) respondents stated that library resources had maximum influence on the science curriculum implementation, followed by 37% who stated that library resources had minimum influence. Only 5 (18.5%) stated that library resources had no influence on the implementation of the science curriculum.

Table 5.7: Influence of library resources on science curriculum implementation

N = 27

Degree of influence of library resources on science curriculum implementation	Frequency	Percent
maximum influence	12	44.4
minimum influence	10	37.0
no influence	5	18.5
Total	27	100.0

Level of influence of available library resources on teaching of science subjects in schools

On the level of influence library resources have on the teaching of science subjects in schools, respondents were asked to rate all the available library resources from; 'high influence', to 'low influence', 'no influence' to 'not available'. This covered in question 19 of librarians' questionnaire. Table 5.8 reveals that textbooks (79.2%) were the major library resources that had high influence on the teaching of science subjects. All other resources either had a low influence, no influence or were not available.

Table 5.8: Level of the available library resources' influence on teaching science subjects in schools

N = 27

Influence of library resources on teaching of science subjects in the schools	**High influence**	**%**	**Low influence**	**%**	**No influence**	**%**	**Not available**	**%**
Textbooks	19	79.2	2	8.3	1	4.2	2	8.3
Nonfiction science books	1	4.2	3	12.5	2	8.3	18	75
Reference books	8	33.3	4	16.7			12	50
Encyclopaedias	5	20.9	5	20.9	2	8.3	12	50
Dictionaries	19	79.2	1	4.2			4	16.7
Magazines	2	8.3	3	12.5	3	12.5	16	66.7
Newspapers	4	16.7	5	20.9	3	12.5	12	50
Journals	1	4.2	2	8.3	5	20.9	16	66.7
Year book	1	4.2	2	8.3	1	4.2	20	83.3
Internet facilities	2	8.3			2	8,3	20	83.3
CD-ROM/DVD-ROM	2	8.3	3	12.5			19	79.2
Computer games	1	4.2	3	12.5	1	4.2	19	79.2
Documentaries	1	4.2	3	12.5			20	83.3
Charts & Pictorials	6	25	2	8.3		.	16	66.7
Pictures	4	16.7	2	8.3	1	4.2	17	70.8
Wall Charts	9	37.5	1	4.2	1	4.2	13	54.2
Flip charts	3	12.5	2	8.3			19	79.2
Real Objects/sample	2	8.3	1	4.2	1	4.2.	20	83.3
Television	1	4.2			2	8.3	21	87.5
Microscopic slides	2	8.3			1	4.2	21	87.5
Articles collections (e.g. newspapers and magazine cuttings)			5	20.9	1	18 .	19	79.2

5.4.1.4. USE OF THE SCHOOL LIBRARY BY TEACHERS

Data gathered from Questions 21 to 25 of the questionnaire on the use of the school library are presented in this section.

Setting of assignments that require students to use the library

Results from Table 5.9 reveal that the majority (81.5%) of school librarians said teachers do give assignments/projects that require students to use the school library.

Frequency of students' utilization of the library for science assignments/projects

A follow up question asked how often students use the library for science assignments/projects. Table 5.9 reveals that 37.5% of respondents each said students were daily and occasional used the library for their science assignments/projects, while 25% said that students used the library once a week.

Table 5.9: Setting of assignments that require students to use the library

N = 27

Setting of assignments that require students to use the library	**Frequency**	**Percentage (%)**
YES No	22 5	81.5 18.5
If your answer is Yes, how often do students use the library for science assignments/projects? (N=24)	**Frequency**	**Percentage (%)**
Daily	9	37.5
Once in week	6	25
Once in month	0	0
Occasionally	9	37.5
Others	0	0

Nature/examples of assignments/projects students have to investigate using the library

An open-ended question asked respondents to state the nature of assignments/projects students were using the library to investigate. This covered by question 22 of librarians' questionnaire. Only seven responded to this question. The majority of them mentioned different assignments/projects in biology. Students were using the libraries to draw and label the human skeleton and state its function; compare and contrast the human eye with a photographic camera; investigate features that adapt animals to their aquatic habitats; to list different types of insects, or functions of the heart and blood circulation. In chemistry, more than half of respondents listed different topics such as: calculations that involve empirical and molecular formulas; explanations of the chemical equations, mixture, base and salts. In physics, less than half indicated topics which included: forming of notes on the application of light waves, prism light, and magnetic fields. Not one respondent indicated any topics in mathematics.

Frequency of teachers' utilization of library resources for the implementation of their subject

Table 5.10 provides answers to question 23 of the questionnaire which sought to know how regularly teachers use the particular library resources for implementation of their subject content. Respondents were asked to rate the frequency from; "regularly", 'fairly regularly', 'not regularly' to 'not available'. Results on table 5.10 show that textbooks were the major resources in the library regularly used by the science teachers for implementation of their science subject content, followed by dictionaries while other resources were mainly either not used regularly or not available.

Table 5.10: Frequency of teachers' utilization of library resources for implementation of their subject contents
N = 27

Science teachers use of library resources for implementing their subject contents	Regularly	%	Fairly regularly	%	Not regularly	%	Not available	%
Textbooks	14	58.3	3	12.5	3	12.5	4	16.7
Nonfiction science books	2	8.3	2	8.3	2	8.3	18	75
Reference books	5	20.8	3	12.5	2	8.3	14	58.3
Encyclopaedias	2	8.3	3	12.5	3	12.5	16	66.7
Dictionaries	8	33.3	5	16.7	1	4.2	10	41.7
Magazines	1	4.2	3	12.5	4	16.7	16	66.7
Newspapers	2	8.3	2	8.3	3	12.5	17	70.8
Journals	1	4.2	2	8.3	3	12.5	17	70.8
Year book	1	4.2	2	8.3	3	12.5	17	70.8
Internet facilities	2	8.3			3	12.5	19	79.2
CD-ROM/DVD-ROM	3	12.5			2	8.3	18	75
Computer games	2	8.3	2	8.3	3	12.5	17	70.8
Documentaries	2	8.3	1	4.2	1	4.2	20	83.3
Charts & Pictorials	3	12.5	1	4.2	2	8.2	18	75
Pictures	2	8.3	1	4.2	4	16.7	17	70.8
Wall Charts	6	25	2	8.3	1	4.2	15	62.5
Flip charts	2	8.3	2	8.3	1	4.2	19	79.2
Real Objects/sample	2	8.3	1	4.2	2	8.3	19	79.2
Television			1	4.2	3	12.5	20	83.3
Microscopic slides	2	8.2			2	8.3	20	83.3
Articles collections (e.g. newspapers and magazine cuttings)			1	4.2	2	8.3	21	87.5

Activities science teachers use school library resources for

The majority of respondents (59.1%) indicated that science teachers were using library resources to prepare lesson notes, followed by 27.3% who indicated that library resources were being used by science teacher as instructional materials in classes, while 13.6% said science teachers were using library resources to draw up examination questions/continuous assessment. Only 18.2% indicated that science teachers did not use library resources at all. Question 24 of librarians' questionnaire covers this. See detail results in Table 5.11.

Table 5.11: Activities science teachers use school library resources for

N = 27

Activities science teachers use school library resources for	Frequency	Percentage (%)
Prepare lesson note	13	59.1
As instructional materials in classes	6	27.3
Draw up examination questions/continuous assessment	3	13.6
Don't use them at all	4	18.2
Others	0	0

Factors hindering the effective utilisation of the school library

In finding out from respondents the reasons why they think science teachers do not use the library for science curriculum implementation. This is covered by question 25 of librarians' questionnaire. The results which is presented in Table 5.12 show that only 15 respondents answered this questions. Some respondents picked more than one option. The options chosen most were "obsoleteness of library resources" (33.3%) and "their personal collection is richer than the library's" (33.3%) "Inconvenient opening hours" and "frustration in locating materials" were chosen by 4 (26.7%) respondents each.

Table 5.12: Factors hindering effective utilisation of school library

N = 15

Factors hindering effective utilisation of library	Frequency	Percentage (%)
It is located in a noisy environment	2	13.3
Lack of adequate space	0	0
Their personal collection is richer than the library's	5	33.3
Obsolete material	5	33.3
Opening hours not convenient	4	26.7
User frustration in locating materials	4	26.7

5.4.1.5. SUPPORT RENDERED AS THE SCHOOL LIBRARIAN

This section presents the data gathered from Question 26 of the questionnaire on the assistance librarians rendered to science teachers through the provision of library resources for the implementation of science subject curricula. The majority of respondents, as revealed in Table 5.13, agreed that textbooks were the major library resources they provided that influenced implementation of science subject contents. On the other hand, they disagreed on rendering any assistance through the provision of the other resources like nonfiction science books, documentaries, CD-ROM/DVD-ROM, internet facilities, and so on. This may be due to the fact that other resources were neither adequate nor available in the library.

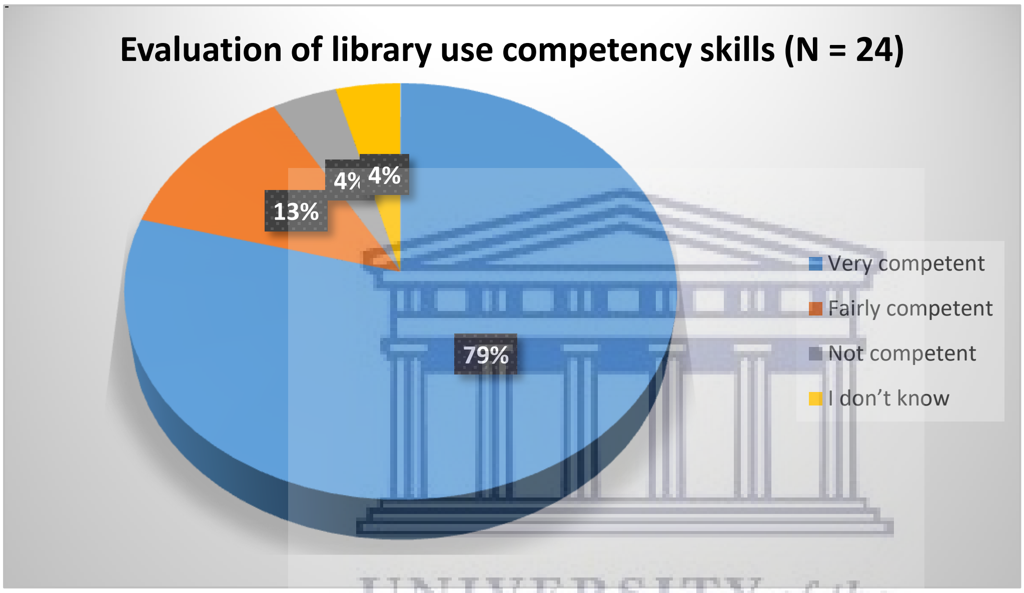
Table 5.13: Assistance rendered as the school librarians

N = 24

The assistance I rendered through the provision of the following resources influenced the curricula implementation of science subjects	Strongly agree	%	Agree	%	Neutral	%	Disagree	%	Strongly disagree	%
Textbooks	15	62.5	3	12.5	2	8.3			4	16.7
Nonfiction science books	3	12.5	3	12.5	2	8.3			16	66.7
Reference books	5	20.8	5	20.8	1	4.2	1	4.2	12	50
Encyclopaedias	7	29.2	4	16.7	2	8.3	1	4.2	10	41.7
Dictionaries	7	29.2	6	25	3	12.5			8	33.3
Magazines	1	4.2	3	12.5	4	4	3	12.5	13	54.2
Newspapers	2	8.3	4	16.7	2	8.3	4	16.7	12	50
Journals	1	4.2	3	12.5	3	12.5	2	8.3	15	62.5
Year book	4	16.7	2	8.3.	3	12.5	1	4.2	14	58.3
Internet facilities	2	8.3	1	4.2	4	16.7	2	8.3	15	62.5
CD-ROM/DVD-ROM	1	4.2	1	4.2	1	4.2	1	4.2	20	
Computer games	1	4.2	4	16.7	2	8.3	2	8.3	15	62.5
Documentaries	3	12.5	1	4.2	2	8.3	1	4.2	17	70.8
Charts & Pictorials	3	12.5	4	16.7	2	8.3	1	4.2	14	14
Pictures			4	16.	2	8.3	2	8.3	16	66.7
Wall Charts	7	29.2	2	8.3	2	8.3	1	4.2	13	54.2
Flip charts	4	16.7	1	4.2	2	8.3	2	8.3	15	62.5
Real Objects/sample	3	12.5	2	8.3	2	8.3	1	4.2	16	66.7
Television	1	4.2	2	8.3	3	12.5	3	12.5	15	62.5
Microscopic slides	3	12.5	1	4.2	3	12.5	2	8.3	15	62.5
Articles collections (e.g. newspapers and magazine cuttings)	1	4.2	3	12.5	2	8.3	3	12.5	15	62.5

5.4.1.6. EVALUATION OF LIBRARY USE COMPETENCY SKILLS

Respondents were asked to rate the competency (knowledge and skills) of science teachers in using the library on a scale from very competent, to fairly competent, not competent or "I don't know". Figure 5.5 shows that the majority (79%) of respondents rated the science teachers as very competent in using the library followed by 13% who rated them fairly competent, while four percent each rated them either not competent or not sure of their competency in using the library. This is covered in question 27 of librarians' questionnaire.

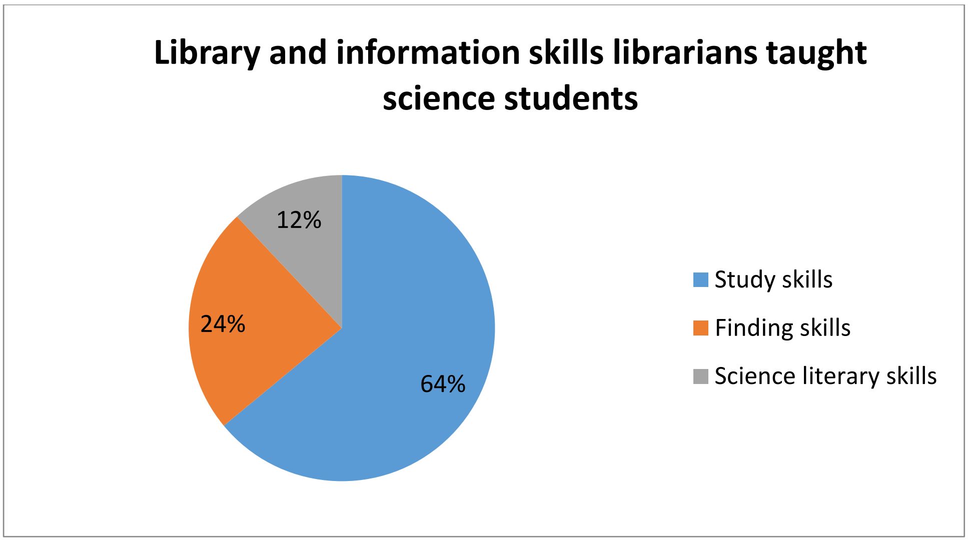


N = 24

Figure 5.5: Evaluation of library use competency skills

Library and information skills librarians taught science students

In a bid to find out the library and information skills being taught, school librarians were requested to mention the library skills they were teaching students. This is in question 28 of librarians' questionnaire. The majority 16 (64%) of the respondents, as revealed in Figure 5.6, indicated they were teaching students study skills, followed by 6 (24%) who indicated they taught the students finding skills, while only 3 (12%) indicated they taught science literacy skills.



N = 25

Figure 5.6: Library and information skills librarians taught science students

5.4.1.7. GENERAL COMMENTS

The final question allowed respondents to comment freely on any aspect of the study not covered. Only 11 out of 27 respondents reacted to this question, however, some of their comments were either in the form of requests or suggestions. For instance, two respondents stated that majority of books in the library were obsolete, and suggested provision of more books in the library. The bane of library underdevelopment as stated by one respondent has been unqualified librarians, while another respondent stated that the library is significant to learning. However, a respondent stated that the questions have not covered the steps taken to encourage science teachers for more research so as to make science subjects more relevant and interesting. Another respondent stated that the questions have not covered the negative effect of library not having current texts.

5.4.2. ANALYSIS OF SCIENCE TEACHERS' QUESTIONNAIRE

The science teachers' questionnaire (see Appendix 3) has the following ten sections:

Section A: This section enquires about the background information of science teachers, such as educational qualifications, years of experience, teaching subjects, level of classes they teach.

Section B: This section focuses on availability of school libraries and its resources in schools.

Section C: In this section of the questionnaire, the questionnaire sought to know the teaching approaches adopted by the teachers.

Section D: This section enquires about the nature of assignments/projects teachers give to students that require them to use information resources other than textbooks.

Section E: This section examines the mode of assessment of assignments/projects

Section F: This section enquires about the scaffolding of the assignments.

Section G: This section sought to know the awareness of teachers about school library resources that support science curriculum implementation.

Section H: In this section of the questionnaire, the questionnaire examines the relevance and adequacy of school library resources and factors hindering effective utilization of library resources.

Section I: This section of the questionnaire examines the influence of school library on science subjects. The essence of this section is to explore whether school libraries have positive influence on science curriculum implementation.

Section J: Lastly, this section focuses on the adequacy of the science and computer laboratories in schools.

5.4.2.1. GENERAL INFORMATION

The background information of science subjects' teachers which is covered in questions 1 to 9 of teachers' questionnaire includes the educational qualifications, years of working experience, location of schools, the name of school, local government area/town, subject taught, number of students taught, level of classes they taught, and total number of students in the school. Table 5.14 presents the results.

Table 5.14: Background information of science teachers

N = 103

Local Government Areas/Town	Schools	No of students taught by science subject' teacher:					No of students in school
		Classes	**Maths**	**Biology**	**Chemistry**	**Physics**	
Ado	**SCHL# 1**	SSS1	-	-	118	100	1,800
		SSS2	-	-	150	90	
		SSS3	80	84	93	96	
	SCHL# 2	SSS1	150	-	85	75	1,000
		SSS2	-	-	60	-	
		SSS3	-	60	-	42	
	SCHL# 3	SSS1	-	-	120	132	1,600
		SSS2	-	120	120	102	
		SSS3	180	120	120	84	
	SCHL# 4	SSS1	90	-	-	-	400
		SSS2	71	47	-	-	
		SSS3	71	46	46	46	
	SCHL# 5	SSS1	-	106	80	80	1,800
		SSS2	54	-	65	65	
		SSS3	55	-	42	42	
	SCHL# 6	SSS1	-	-	-	157	1,980
		SSS2	-	-	-	115	
		SSS3	165	-	98	131	
	SCHL# 7	SSS1	320	-	120	-	2,000
		SSS2	-	-	-	-	
		SSS3	-	-	110	-	
	SCHL# 8	SSS1	-	-	100	-	1,200
		SSS2	230	-	90	100	
		SSS3		-	45	90	
	SCHL# 9	SSS1	-	-	49	51	500
		SSS2	-	51	52	51	
		SSS3	78	78	37	35	
Ido/Osi	**SCHL# 10**	SSS1	57	51	-	53	627
		SSS2	28	45	24	25	
		SSS3	32	40	-	31	
	SCHL# 11	SSS1	82	20	20	20	528
		SSS2	-	25	25	25	
		SSS3	49	22	22	22	
	SCHL# 12	SSS1	49	23	25	20	220
		SSS2	29	22	15	15	
		SSS3	37	19	17	20	
	SCHL# 13	SSS1	-	20	20	-	330
		SSS2	-	36	36	35	
		SSS3	25	9	-	9	
	SCHL#	SSS1	40	43	-	-	

	14	SSS2	94	96	87	92	
		SSS3	32	27	25	27	900
	SCHL# 15	SSS1	-	50	-	50	
		SSS2	-	38	-	38	
		SSS3	94	48	-	48	715
	SCHL# 16	SSS1	31	13	17	10	
		SSS2	37	7	7	10	
		SSS3	39	15	15	14	190
	SCHL# 17	SSS1	27	12	-	11	
		SSS2	37	15	-	11	
		SSS3	30	15	17	17	250
	SCHL# 18	SSS1	52	33	31	31	
		SSS2	-	20	19	19	
		SSS3	47	25	25	25	294
Ikere	**SCHL# 19**	SSS1	108	65	65	-	
		SSS2	-	60	-	60	
		SSS3	-	50	-	54	1,500
	SCHL# 20	SSS1	25	25	25	25	
		SSS2	30	14	14	14	
		SSS3	40	17	17	17	440
	SCHL# 21	SSS1	-	40	40	40	
		SSS2	-	37	37	37	
		SSS3	74	33	33	33	700
	SCHL# 22	SSS1	-	68	-	-	
		SSS2	-	-	78	63	
		SSS3	83	-	-	44	900
	SCHL# 23	SSS1	-	-	34	-	
		SSS2	-	-	26	-	
		SSS3	65	-	13	-	650
	SCHL# 24	SSS1	125	72	80	-	
		SSS2	110	-	76	82	
		SSS3	-	50	66	-	702
	SCHL# 25	SSS1	89	33	33	33	
		SSS2	71	29	29	29	
		SSS3	43	21	21	21	480
	SCHL# 26	SSS1	64	28	-	-	
		SSS2	-	16	-	16	
		SSS3	-	18	9	-	835
	SCHL# 27	SSS1	-	-	162	162	
		SSS2	138	138	-	-	
		SSS3	-	-	-	-	1,441
Total			**3,557**	**2,315**	**3,059**	**3,046**	**23,982**
Location of schools:						**Frequency**	**Percentage**
Urban						65	63.1
Rural						38	36.9
Highest qualification:							
Diploma						1	1.0

NCE				2	1.9
BSc				84	81.6
Masters				12	11.7
Others				4	3.9
Years of experience:					
1 – 10 years				26	25.2
11 – 20 years				56	54.4
21 years and above				21	20.4
Date of establishment of the schools					
1930 – 1939				4	3.9
1940 – 1949				0	0
1950 – 1959				16	15.5
1960 – 1969				27	26.2
1970 – 1979				23	22.3
1980 – 1989				33	32.0

Highest educational qualifications

The majority of respondents (84 or 81.6%) had a B.Sc. degree while 12 (11.7%) had a Master's degree. Respondents with a Diploma and NCE were less than 3%, while respondents with others qualifications such as the HND and PGDE were less than 4%.

Years of working experience

The majority of teachers (54%) had taught between 11-20 years, 20.4% had taught for more than 20 years, while 25.2% had taught for more than 10 years.

Level of class taught

Majority of the respondents 53 (51.5%) taught all the classes (SSS1 to 3), followed by 16 (15.3%) who taught SSS3 only and 10 (9.7%) who taught SSS2 and 3 only. Nine (8.7%) taught SSS1 only, seven (6.8%) taught SSS2 only, five (4.9%) taught SSS1 and 3 only, while three (2.9%) taught SSS1 and 2 only.

Subjects taught

The majority of respondents 27(26.2%) taught Mathematics, followed by 25.2% who taught chemistry, 25 (24.2%) taught physics, while 23 (22.3%) taught biology.

Number of students taught

Majority of the respondents 38 (36.9%) taught between 51 and 100 students, followed by 28 (27.2%) who taught between 101 and 150 students. Twenty-four (23.3%) taught more than 150 students, while 13 (12.6%) did not teach more than 50 students.

Local government area and location (urban or rural) of the schools

The 27 selected secondary schools cut across the three local governments: Ido/Osi, Ado and Ikere with an average of three teachers from each school who teach the following subjects: mathematics, physics, chemistry and biology. The majority of respondents (63.1%) indicated that their schools were located in urban areas, while 36.9% said their schools were in rural areas.

Years of establishment of the schools

The majority (32%) of respondents indicated that their schools were established between 1980-1989, followed by 27 (26.2%) who indicated that their schools were established between 1960- 1969. Twenty-three (22.3%) respondents indicated that their schools were created between 1970-1979, while only four respondents (3.9%) indicated that their school was established between the years 1930-1939. However, no school was established between the years 1940- 1949.

5.4.2.2.AVAILABILITY OF LIBRARY AND ITS RESOURCES

Data gathered from Questions 10 to 13 of the teachers' questionnaire on the availability of a school library and its resources in schools, location of library within the schools and influence of availability of library on teaching and learning science subjects in schools are presented in Table 5.15, Table 5.16 and Figure 5.7 respectively.

Availability of library in schools

Results in Table 5.15 reveal that all selected schools have some place they call a library.

Table 5.15: Availability of library in schools

N = 103

Availability of library in schools	**Frequency**	**Percentage (%)**
Yes	103	100
No	0	0
Total	103	100

Location of the library within the school

The majority of the schools, as revealed in Table 5.16, had separate/purpose-built library, followed by schools with a classroom as their library, while only seven (6.8%) used a store house/room as their library. One respondent mentioned that the library was in the principal's office. However, none of the schools used either book boxes, cupboards or other places as their library.

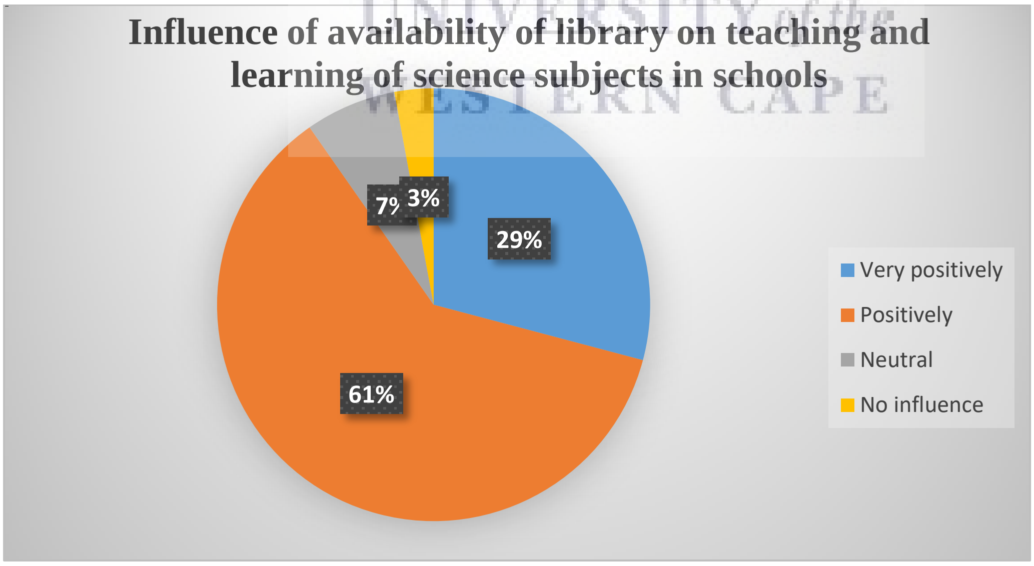
Table 5.16: Location of library within the school

N = 103

Location of library within the school	Frequency	Percentage (%)
Book boxes	0	
Classrooms	15	14.6
Principal's office	1	1
Separate/purpose-built building	80	77.7
Store house/room	7	6.8
Cupboard	0	0
Others (please specify)	0	0

Influence of availability of library on teaching and learning science subjects in schools

Figure 5.7 reveals that more than 90.3% of respondents indicated that the school library had a positive or very positive influence on their teaching and learning of science subjects in schools, while very few, less than 3% of respondents, indicated that the school library had no influence on their teaching and learning of science subjects in schools. Seven (7%) were neutral.



N = 103

Figure 5.7: Influence of availability of library on teaching and learning of science subjects in schools

5.4.2.3.TEACHING APPROACH

Question 14 on the teachers' questionnaire sought to find out from teachers their teaching approach that best describes their teaching. This time, respondents were provided with three approaches with their definitions to choose ONE that best describes their teaching. This was done so as to give respondents hints on each teaching approach. As revealed in Table 5.17, more than half (63) of respondents answered this question. Results reveal that majority (54.0%) of respondents adopted teacher centred approach in teaching students, followed by 38.1% who adopted student centred approach and only few (7.9%) used inquiry-based learning (guided).

Table 5.17: Teaching approach

N = 63

Teaching Approaches	**Frequency**	**Percentage (%)**
Teacher centred	34	54.0
Student centred	24	38.1
Inquiry-based learning (Guided)	5	7.9
Total	**63**	**100**

5.4.2.4. NATURE OF ASSIGNMENTS/ PROJECTS THAT REQUIRE USE OF INFORMATION SOURCES OTHER THAN TEXTBOOKS

Questions 15 to 21 sought to find out if science teachers had been giving assignment/projects that require students to use information resources other than textbooks. If they had not been giving such assignments/projects, they were asked to state their reasons. Those who claimed to have been giving such assignments/projects were asked to provide detailed description of the assignments/projects. Curiously, with assurance that respondents' anonymity and confidentiality would remain intact, researcher requested from respondents copies of such assignment/project so as to have clear knowledge of the nature/examples of assignment/project given to students. Unfortunately, no teacher could provide copy of such assignment to complement the description they already stated. Out of 103, only 75 (72.8 %) stated that they were giving students assignments/projects that require students to use information resources other than textbooks, while 28 (27.1%) said they had not been giving such assignments/projects. Their reasons for not giving such assignments/projects are stated in the next section.

Reasons for not giving assignments/projects that require students to use information resources other than textbooks

From the findings, (question 16 of teachers' questionnaire), there are reasons for not giving out assignments/projects that require students to use information resources other than textbooks. Respondents submitted the following responses:

- *Mathematics as a subject needs to be taught and learned with direct source of information (textbooks) otherwise students will be put to disadvantage.*
- *Due to the nature of some newly introduced topics in the curriculum*
- *Government and the school do not make provision for that.*
- *We have no project to carry out in the senior classes.*
- *Because the textbooks are still good for their level for any information need.*
- *Because it is not in the curriculum*
- *There are no power and internet facilities in school.*
- *Because the topics we are teaching do not involve projects*
- *It will be outside the school curriculum*
- *Teachers focus on examination requirements particularly within the learning demands of practical examination.*
- *No ICT centre to do such assignment*
- *Most of the students are from poor background and cannot afford materials for project*
- *Students do not have access to information resources other than textbooks*
- *The school management has given instruction that no teacher should give students assignment that would not be found within the recommended textbooks*
- *The available textbooks cover all their (students) information needs*
- *Most of them (students) do not have access to those materials apart from textbooks*
- *Time constraints*
- *Because the school syllabus does not encourage it*
- *Our aim in school is to prepare students towards passing WAEC and NECO exams*
- *We strictly stick to the school syllabus.*

Considering the various reasons alluded to by teachers for not giving out assignment/project that require utilizing other sources of information different from textbooks, one could conclude that non-provision of such assignment/project in the 2007 Curriculum may not have encouraged teachers to give out such assignments/projects, as they may not want to go outside the curriculum.

Description of assignments/projects that require students to use information resources other than textbooks

Those who claimed they were giving assignments/projects that require students to use information sources other than textbooks were asked to give detailed description of such assignments/projects (question 17 of teachers' questionnaire). Further, they were equally asked to provide copies of such assignment/project with assurance that their anonymity and confidentiality would remain intact. However, no respondent could readily provide copies of the assignments/projects other than stating the description of assignments/projects. Respondents' responses are stated verbatim below:

Physics teachers' responses

- *Connection of bulb with two or three batteries in series and parallel circuit. The students are to observe the intensity of the bulb when those two connections are made.*
- *Requesting them (students) to draw gold leaf electroscope*
- *Making a vacuum cleaner: materials used are plastic, empty bottle, foil, rotor, battery (dry cell), small iron sheet, cardboards, gum*
- *Manufacturing of ray boxes*
- *Design a process or a device that can convert mechanical energy to electrical energy*
- *Construction of single moveable pulley*
- *How to launch a rocket by using some local materials, as this is not explained in textbooks. Students need to google for it (information).*
- *Improvisation of calorimeter to determine the specific heat capacity by mixture method*
- *Making of a siren; galvanometer; magnetic door and electric bell.*

Chemistry teachers' responses

- *Practical work based on the topic taught e.g. five states of matter*
- *Production of gel used in making Mclean (toothpaste)*
- *Search for other radioactive elements and adverse effects of pollution apart from the ones listed in the textbooks*
- *Separation of salt from water*

- *Prepare different indicators that can be used for titration in the laboratory.*
- *Production of antiseptics e.g. soap and Dettol*
- *Making monoclinic and chronic sulphur from molten sulphur*

Biology teachers' responses

- *Assignment on detailed structure of the chloroplasts: the pathway of an enzyme*
- *Making of insect net and quadrant (ecological instrument);*
- *Experiment on soil profile.*
- *Blood donation (transfusion) to accident victim.*

Mathematics teachers' responses

- *Experimental probability: the students are encouraged to carry out the experiment on their own through guidance by the teacher. This will enhance thorough understanding and appreciation of probability.*
- *Prove that radius and height of a hemisphere is equal.*
- *Punch tape: this is used in storing vital information about people, object or event and it requires five-bit binary number in representing the information about the person in question. It is divided into eight columns. The first three are for the set of instructions to be influenced by the programmer. The remaining five columns are meant for the programmer to be input into the computer by the programmer. The small holes between columns 5 and 6 which run down the tape are to guide the tape while running through the computer.*
- *Representation of solid shapes with cardboards*

Sources and where to find/access information teachers would like students to use for assignments/projects

To find out the sources of information teachers would like students to use for assignments/projects, where to find/access information sources for such assignment/projects and sources of information student have been using most of the time for the assignments/projects (questions 18 to 20 of teachers' questionnaire). Respondents were asked to clearly state the answers to these questions. Their responses which are interwoven are submitted as follows:

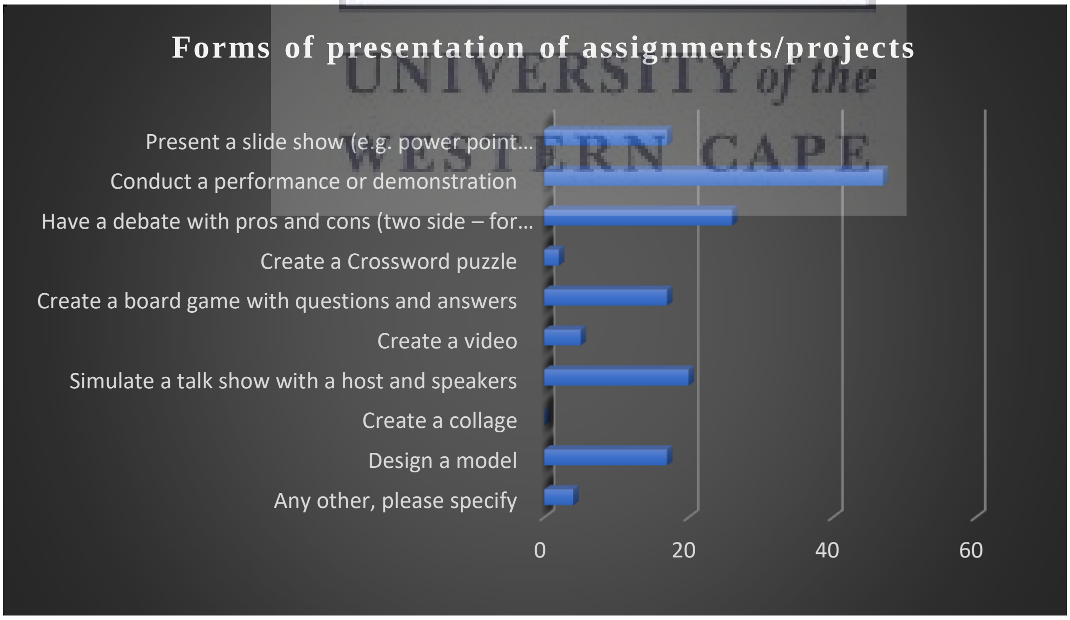
> Internet (the most common tool), followed by Google, library; ICT laboratory/centre; science laboratory; videos, tele tutors; microscope; coin and dice; audio visual materials**;** their environment; textbooks; fieldtrip; excursion; chart and object;

compiled past questions and answers (series); locally made materials and natural plants.

Going by the wealth of information available online and the significance of the internet as an important tool to access e-resources, it will be a good attempt for teachers to encourage their students to explore other sources (different from recommended textbooks) that can further aid their understanding of the subject matter.

Forms of presentation of assignments/projects

Question 21 is to find out from respondents, forms of presentation other than writing a report or essay, students were encouraged to use for presenting their assignments/projects. Some of the respondents chose more than one option in encouraging their students to present their assignment. Results reveal that majority (45.6%) of respondents encouraged students to conduct a performance or demonstration in presenting their project, followed by 25.2% who encouraged their students to present their project through a debate with pros and cons (two side – for or against) and 19.4% encouraged students to present through simulate a talk show with a host and speakers. Very few (3.9%) encouraged students to present through 'other' such as; wrote quiz representation and competitions within the class. See Figure 5.8.



N = 103

Figure 5.8: Forms of presentation of assignments/projects

5.4.2.5. ASSESSMENT OF ASSIGNMENTS/PROJECTS

Data gathered from Questions 22 to 24 of the teachers' questionnaire on the assessment of assignments/projects are presented in this section.

Rubrics (marking guide) provided for students when giving out assignments/projects

Almost all respondents answered in affirmative to question 22 of teachers' questionnaire that they provided rubric or guidelines on how marks would be awarded when giving out assignments/project to students. However, 99 out of 103 (96.1%) respondents actually stated the kinds of marking scheme (guide) they provided when giving out assignments/projects to students. Findings reveal that majority (69.7%) of respondents provided marking scheme (guide) designed by exam bodies like WAEC and NECO. See details in Table 5.18. This could be attributed to the fact that teachers in secondary schools in Nigeria are meant to prepare students towards the exams conducted by these two bodies (WAEC and NECO). Self-designed marking scheme is next form of rubric or guideline provided for students when giving them assignment/project. However, flipping through the questionnaire during retrieving process, researcher was able to spot those who indicated 'self-designed marking scheme.

Curiously, researcher wanted to have a copy so as to compare it with that of WAEC/NECO but no teacher could readily provide one but researcher was only told that self-designed marking scheme was prepared using that of WAEC/NECO. Taking a detailed look at some of the marking schemes (all designed by exam bodies like WAEC and NECO) used by teachers, researcher could observe that the total marks in percentage allocated for practical range between 30% to 40%. Further, it was observed that no form of project like assignments were being set for students. This may be as a result of 2007 Curriculum that does not make provision for such. Therefore, teachers may not want to go outside the curriculum.

Table 5.18: Rubrics (marking guide) provided for students when giving out assignments/ projects

N = 99

Kind of marking guide provided for students when giving out assignments/projects	Frequency	Percentage (%)
Marking (scheme) guide designed by exam bodies like WAEC, NECO, etc.	69	69.7
Self-designed marking scheme	41	42.3
All of the above	11	11.3

Contribution of the marks towards student's promotion and percentage of the marks that comes from assignments/projects

Majority (76.2%) of respondents answered in affirmative to question 23 of teachers' questionnaire that these assignments/projects contributed to students' promotion examination and equally stated the actual marks in percentage these assignments/projects contribute towards the promotion examination. The table below shows the percentage of final marks that comes from assignments/projects.

Table 5.19: Final marks that comes from assignments/projects

N = 79

Marks	**0 – 10**	**11 – 20**	**21 – 30**	**31 – 40**	**41 – 50**	**51 and above**
Frequency	8	26	14	16	8	7
Percentage (%)	10.4%	33.8%	17.2%	20.8%	10.4%	9.1%

As observed from Table 5.19, majority (33.8%) of respondents awarded between 11%-20% marks for assignment/projects, followed by 20.8% who awarded between 31%-40% marks. Only 9.1% claimed that they awarded more than 50% marks for assignment/projects.

Methods of assessment of student's assignments/projects

Table 5.20 provides answers to question 24 of the questionnaire which sought to know how students' assignments/projects are being assessed. Results reveal that majority (76.7%) of respondents (teachers) assessed the assignments/projects alone (assessment by subject teacher alone), followed by 11.7% who claimed they used collaborative assessment (involving other professionals in their discipline or the librarian in the marking). Only few (1.9%) said they were using other methods of assessment such as; teacher giving final assessment to determine the marks awarded by students to each other assignment/project. This is still amount to assessment by subject teacher.

Table 5.20: Methods of assessment of student's assignments/projects

N = 103

Methods	Frequency	Percentage
Using peer assessment (students mark each other's work)	11	10.7
Authentic assessment (involving people in real life setting e.g. a nurse, biologist, physicist)	3	2.9
Collaborative assessment (involving other professionals in your discipline or the librarian in the marking)	12	11.7
Assessment by subject teacher alone	79	76.7
Other, please specify……	2	1.9

Note: Respondents were allowed to choose more than one option

5.4.2.6. SCAFFOLDING OF THE ASSIGNMENT

To achieve the aim and objectives of any assignment/project, the scaffolding of learning through projects is importance. Data gathered from Questions 25 and 26 of the questionnaire on the scaffolding of the assignment/project are presented in this section.

Support rendered for students at different stages of a project

In question 25 of teachers' questionnaire, teachers were asked to state the support rendered to students at different stages (planning, during and end) of a project. Majority (42.8%) of respondents stated that they assisted students in locating and accessing information, followed by those (38.8%) who provided students with examples of the end product (for example, a template for a poster) and (37.8%) who assisted students with brainstorming and mind mapping their project. Only (4.9%) of respondents rendered other support such as; assisting students by proving the correct answers; work a similar example on the chalkboard; and giving them hints on how to go about it (assignment/project). However, nineteen (18.4%) respondents said they did not provide any assistance as they believed students should be able to do the project independently. From interactions of researcher with some science students, the only time they (students) received major assistance was during the science practical classes where teachers would assist and guide in setting up the apparatus in laboratory. This may suggest that most of the teachers had seen conducting science practical with students as only project expected of them. Detail results are presented in Table 5.21.

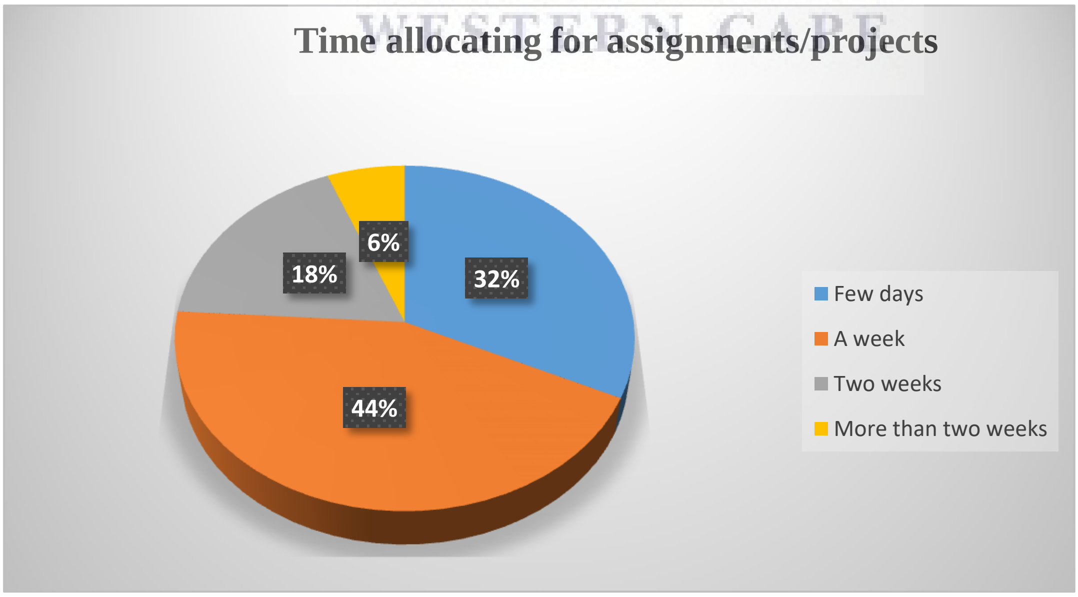
Table 5.21: Support rendered (Scaffolding) for students at different stages (planning, during and end) of a project

N = 103

Support rendered for students	**Frequency**	**Percentage**
I do not provide support because students should be able to do the project independently	19	18.4
I assist students with brainstorming and mind mapping their project	39	37.8
I assist students in locating and accessing information	42	40.8
I provide students with examples of the end product (for example, a template for a poster)	40	38.8
Other, please specify other kinds of support to students…..	5	4.9

Time allocating for assignments/projects

Results for question 26 of teachers' questionnaire reveal that the majority (44%) of respondents gave students 'a week' for the assignment/projects, followed by 32% who gave 'few days for the assignment/project and 18% who gave 'two weeks. Only a few (6%) respondents gave more than two weeks for the assignment/project. From the marking schemes (all designed by exam bodies like WAEC and NECO) used by teachers, it is observable that the period assigned to attempt the practical exams is between 2-3 hours. See detail results in Figure 5.9.



N = 100

Figure 5.9: Time allocating for assignments/projects

5.4.2.7. TEACHERS' AWARENESS OF LIBRARY RESOURCES THAT SUPPORT THE SCIENCE CURRICULUM IMPLEMENTATION

This section provides the data gathered from questions 27 and 28 of the teachers' questionnaire on awareness of teachers and the frequency of utilization of school library resources that support science curriculum implementation.

Awareness of resources in the school libraries that support implementation of science curriculum

To find answers to question 27 of the teachers' questionnaire, science teachers were asked to state the available library resources for science curricula implementation. Results reveal that most (95.1%) of the available library resources were textbooks, followed by dictionaries (33%) and encyclopaedias (25.2%), while majority of other resources like; article topics collections (e.g. newspapers and magazine cuttings) (91.4%), newspapers (91.2%), CD-ROM/DVD-ROM (88.3%), Internet facilities (79.6%) were not available. See Table 5.22.

Table 5.22: Awareness of resources in the school libraries that support implementation of science curriculum

N = 103

Local governments/Senatorial districts in Ekiti State					
Resources in school library that support implementation of science curriculum		Ido Osi/ EKiti North Senatorial District	Ado Ekiti/Ekiti Central Senatorial District	Ikere/Ekiti South Senatorial District	Pooled (average) percentage
Textbooks	Available	93.8%	97.2%	94.3%	95.1%
	Not available	6.3%	2.8%	5.7%	4.9%
Nonfiction science books	Available	15.6%	19.4%	14.3%	16.5%
	Not available	84.4%	80.6%	85.7%	83.5%
Reference books	Available	25.0%	30.6%	28.6%	28.2%
	Not available	75.0%	69.4%	71.4%	71.8%
Encyclopaedias	Available	21.9%	33.3%	20.0%	25.2%
	Not available	78.1%	66.7%	80.0%	74.8%
Dictionaries	Available	31.3%	41.7%	25.7%	33.0%
	Not available	68.8%	58.3%	74.3%	67.0%
Magazines	Available	0.0%	27.8%	14.3%	14.6%

	Not available	100.0%	72.2%	85.7%	85.4%
Newspapers	Available	6.5%	8.3%	11.4%	8.8%
	Not available	93.5%	91.7%	88.6%	91.2%
Journals	Available	3.1%	19.4%	11.4%	11.7%
	Not available	96.9%	80.6%	88.6%	88.3%
Yearbooks	Available	9.4%	11.1%	2.9%	7.8%
	Not available	90.6%	88.9%	97.1%	92.2%
Internet facilities	Available	12.5%	25.0%	22.9%	20.4%
	Not available	87.5%	75.0%	77.1%	79.6%
CD-ROM/DVD-ROM	Available	0.0%	19.4%	14.3%	11.7%
	Not available	100.0%	80.6%	85.7%	88.3%
Computer games	Available	0.0%	13.9%	8.6%	7.8%
	Not available	100.0%	86.1%	91.4%	92.2%
Documentaries	Available	3.1%	16.7%	17.1%	12.6%
	Not available	96.9%	83.3%	82.9%	87.4%
Charts & Pictorials	Available	18.8%	44.4%	31.4%	32.0%
	Not available	81.3%	55.6%	68.6%	68.0%
Pictures	Available	18.8%	27.8%	20.0%	22.3%
	Not available	81.3%	72.2%	80.0%	77.7%
Wall Charts	Available	28.1%	33.3%	22.9%	28.2%
	Not available	71.9%	66.7%	77.1%	71.8%
Flip charts	Available	9.4%	19.4%	11.4%	13.6%
	Not available	90.6%	80.6%	88.6%	86.4%
Real Object/Sample	Available	15.6%	36.1%	17.1%	23.3%
	Not available	84.4%	63.9%	82.9%	76.7%
Television	Available	6.3%	19.4%	11.4%	12.6%
	Not available	93.8%	80.6%	88.6%	87.4%
Microscopic slides	Available	15.6%	22.2%	8.6%	15.5%
	Not available	84.4%	77.8%	91.4%	84.5%
Article topics collections (e.g. newspapers and magazine cuttings)	Available	6.3%	16.7%	2.9%	8.7%
	Not available	93.8%	83.3%	97.1%	91.4%

5.4.2.8. RELEVANCE AND ADEQUACY OF LIBRARY RESOURCES FOR SCIENCE SUBJECTS

Data gathered in the questionnaire on the relevance and adequacy of school library resources and factors hindering effective utilization of library resources are presented in this section.

Relevance of library resources for science subjects

In question 28 of teachers' questionnaire, teachers were requsted to 'grade all the science resources utilized in a 5 point Likert-scale from 'strongly agree', to 'agree', 'undecided', 'disagree' or 'strongly disagree'. Their responses are presented in Table 5.23.

Results which are presented in descriptive statistics such as:standard deviations and mean revealed that some resources such as textbooks, reference books, encyclopaedias, dictionary, internet facilities have the mean score less than 1.5. Since a 'five- point Likert-scale' was used to rate the items, 2.5 being an average of Likert-scale used is picked as the mean cut off for the rating scale. Therefore, all items that have the mean score higher than the cut off mean score implies that the respondents did not agree that the said library resources were adequate in delivering of science curriculum contents. Thus, textbooks, nonfiction science books, reference books, encyclopaedias, dictionary, internet facilities, charts and pictorials, pictures, wall charts, flip charts, real object/sample, microscopic slides with mean scores less than 2.50 were the library resources the teachers agreed to be relevant in delivering science curriculum contents. However, it was observed that most of the resources such as: internet facilities, charts and pictorials, pictures, wall charts, flip charts, real object/sample, nonfiction science books, reference books, and others were either inadequate or unavailable in most of the schools but respondents still believe that they were relevant to the teaching of science subjects in schools.

Table 5.23: Relevance of library resources to science subjects

N = 103

The following library resources are relevant to the teaching of science subject(s) in my school	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**	Mean	Standard Deviation
Textbooks	80.6	17.3	2.0	0	0	1.2062	.45502
Nonfiction science books	9.5	44.6	32.4	8.1	5.4	2.5479	.98659
Reference books	44.9	42.3	10.3	1.3	1.3	1.7013	.81216
Encyclopaedias	19.4	44.4	22.2	11.1	2.8	2.3380	1.04120
Dictionaries	33.3	42.7	14.7	5.3	4.0	2.0270	1.04649
Magazines	8.6	37.1	40.0	7.1	7.1	2.6957	.98972
Newspapers	10.4	29.9	38.8	10.4	10.4	2.8485	1.08475
Journals	20.6	32.4	29.4	7.4	10.3	2.5821	1.20792
Year book	17.9	29.9	31.3	9.0	11.9	2.7727	1.21270
Internet facilities	28.8	34.2	21.9	6.8	8.2	2.3194	1.20826
CD-ROM/DVD-ROM	23.2	33.3	21.7	11.6	10.1	2.5735	1.23767
Computer games	20.6	30.9	27.9	10.3	10.3	2.6418	1.22724
Documentaries	23.2	26.1	29.0	8.7	13.0	2.6471	1.31313
Charts & Pictorials	40.8	31.6	15.8	3.9	7.9	2.2400	1.59255
Pictures	40.0	36.0	10.7	5.3	8.0	2.4730	3.79337
Wall Charts	46.1	31.6	10.5	5.3	6.6	1.9200	1.15968
Flip charts	28.2	43.7	12.7	8.5	7.0	2.2000	1.16221
Real Objects/sample	48.6	22.2	11.1	11.1	6.9	2.0000	1.28730
Television	21.4	30.0	20.0	18.6	10.0	2.5797	1.26498
Microscopic slides	24.3	34.3	20.0	11.4	10.0	2.4493	1.27805
Articles collections (e.g. newspapers and magazine cuttings)	20.0	32.3	32.3	6.2	9.2	2.5469	1.18093

Purpose for using school library resources

Responding to question 29 of the teachers' questionnaire, the descriptor chosen the most (38%) by the respondents was "all of the above", implying that teachers used the library for different purposes such as: preparation of lesson notes; as instructional materials in classes, drawing up of examination questions/continuous assessments, setting of assignments/projects, and creating reading/reference list for students. Results are presented in Table 5.24.

Table 5.24: Purpose of using school library resources

N = 103

Purpose of using school library resources	**Frequency**	**Percentage (%)**
Prepare lesson notes	38	36.9
As instructional materials in classes	27	26.2
Draw up examination questions/continuous assessment	14	13.6
For setting assignments/projects	13	12.6
For creating reading/reference lists for students	11	10.7
All of the above	39	37.9
Others (please specify)	0	0

Adequacy of school libraries for teaching science subjects

To answer questions 30 and 31 of the questionnaire: "how adequate are the available science library resources in terms of **quality** and **quantity**?", teachers were asked to rate items using a Likert scale, from; 'adequate', 'fairly adequate', 'not adequate' to not available.

Results are presented in descriptive statistics - mean and standard deviations. Since a 'four-point Likert-scale' was used to rate the items, 2.00 being an average of Likert-scale used, is picked as the mean cut off for the rating scale. Therefore, all items that have the mean score higher than the cut off mean score implies that the resources were not adequate in delivering of science curriculum content. This means that textbooks were the most chosen item as a library resource both in terms of quality and quantity for delivering of science curriculum content. Detail results are presented in Table 5.25 and Table 5.26.

Table 5.25: Adequacy of science library resources in term of QUALITY

N = 103

Rating of science resources in term of quality	**Adequate (%)**	**Fairly adequate (%)**	**Not adequate (%)**	**Not available (%)**	**Mean**	**Standard Deviation**
Textbooks	61.4	30.7	4.0	4.0	1.50	0.76
Nonfiction science books	10.1	28.1	19.1	42.7	2.94	1.06
Reference books	26.4	37.4	12.1	24.2	2.34	1.12
Encyclopaedias	12.4	32.6	16.9	38.2	2.81	1.09
Dictionaries	35.2	26.4	8.8	29.7	2.33	1.24
Magazines	10.0	22.2	15.6	52.2	3.54	4.44
Newspapers	9.0	16.9	19.1	55.1	3.20	1.02
Journals	7.8	20.0	17.8	54.4	3.19	1.02
Year book	11.2	12.4	22.5	53.9	3.19	1.04
Internet facilities	15.6	15.6	14.4	54.4	3.08	1.15
CD-ROM/DVD-ROM	10.1	16.9	13.5	59.6	3.22	1.06
Computer games	9.0	15.7	15.7	59.6	3.26	1.03
Documentaries	12.4	20.2	12.4	55.1	3.10	1.12
Charts & Pictorials	28.9	28.9	5.6	36.7	2.50	1.26
Pictures	28.1	30.3	5.6	36.0	2.49	1.24
Wall Charts	34.8	23.9	9.8	31.5	2.38	1.26
Flip charts	25.8	23.6	10.1	40.4	2.65	1.25
Real Object/Sample	28.4	17.0	9.1	45.5	2.72	1.30
Television	11.5	13.8	16.1	58.6	3.22	1.07
Microscopic slides	12.4	19.1	15.7	52.8	3.09	1.10
Article topics collections (e.g. newspapers and magazine cuttings)	6.7	10.1	25.8	57.3	3.34	0.92

Table 5.26: Adequacy of science library resources in term of QUANTITY

N = 103

Rating of science resources in term of quantity	**Adequate (%)**	**Fairly adequate (%)**	**Not adequate (%)**	**Not available (%)**	Mean	Standard Deviation
Textbooks	63.3	27.6	4.1	5.1	1.51	0.80
Nonfiction science books	13.3	28.9	12.2	45.5	3.10	2.31
Reference books	29.5	29.5	11.4	29.5	2.41	1.20
Encyclopaedias	15.9	27.3	17.0	39.8	2.81	1.13
Dictionaries	27.0	31.5	12.4	29.2	2.44	1.18
Magazines	11.1	26.7	16.7	45.6	2.97	1.09
Newspapers	10.1	15.7	25.8	48.3	3.12	1.02
Journals	9.1	15.9	17.0	58.0	3.24	1.03
Year book	8.0	13.8	21.8	56.3	3.26	0.98
Internet facilities	14.6	14.6	15.7	55.1	3.11	1.13
CD-ROM/DVD-ROM	12.6	17.2	13.8	56.3	3.14	1.11
Computer games	13.8	14.9	17.2	54.0	3.11	1.11
Documentaries	13.8	18.4	11.5	56.3	3.10	1.14
Charts & Pictorials	23.9	27.3	8.0	40.9	2.66	1.24
Pictures	25.8	28.1	9.0	37.1	2.57	1.23
Wall Charts	29.5	30.7	6.8	33.0	2.43	1.23
Flip charts	26.4	24.1	9.2	40.2	2.63	1.26
Real Object/Sample	26.4	24.1	9.2	40.2	2.63	1.26
Television	13.8	19.5	16.1	50.6	3.03	1.13
Microscopic slides	14.0	18.6	11.6	55.8	3.09	1.14
Article topics collections e.g. newspapers and magazine cuttings	9.3	17.4	19.8	53.5	3.17	1.03

Adequacy of library resources for the implementation of science subjects' learning instruction in schools

Rating the adequacy of library resources for the implementation of science subjects' learning instruction in schools is covered by question 32 of teachers' questionnaire. Results are presented in Table 5.27 which shows that most (64.1%) of the respondents rated their library resources to be either adequate or very adequate, while 20.4% rated theirs to be fairly adequate. However, 15 (15.5%) respondents rated their library resources in adequate.

Table 5.27: Adequacy of library resources for the implementation of science subjects' learning instruction in schools

N = 103

Rate generally the adequacy of school library resources on the implementation of your subject's learning instruction in your school	Frequency	Percentage (%)
Very adequate	27	26.2
Adequate	39	37.9
Fairly adequate	21	20.4
Not adequate	16	15.5

Factors hindering utilisation of school library for science curriculum implementation

Science teachers were asked to choose the factors hindering them from using the school library for delivering the science curriculum. This is covered by question 33 of teachers' questionnaire. They could choose more than one item. Data gathered are presented in table 5.28. The item chosen most frequently by respondents for not using the library was the sufficiency of their own textbooks (42.3%). The second highest hindrance was obsolete materials in the library (18%), followed by lack of space (15.5%).

Table 5.28: Factors hindering the utilisation of the library for science curriculum implementation

N = 103

Factors hindering regular the utilisation of the library for science curriculum implementation	Frequency	Percentage (%)
It is located in a noisy environment	3	4.2
Lack of adequate space	11	15.5
My personal collection is richer than the library's	9	12.7
Obsolete materials	13	18.3
Opening hours not convenient	3	4.2
User frustration in locating materials	2	2.8
My textbook is enough	30	42.3

5.4.2.9. INFLUENCE OF THE SCHOOL LIBRARY ON SCIENCE SUBJECTS

Data gathered in the teachers' questionnaire on the influence of school library on science subjects are presented in this section.

Influence of library resources on science subject implementation

In finding answers to question 34 of teachers' questionnaire, science teachers were asked to rate how often library resources influenced the implementation of their science curriculum on a three-point scale: 'regularly influence', 'occasionally influence' and 'never influence'. Results reveal that textbooks had a mean score (M=1.17, SD=0.41), nonfiction science books (M=2.31, SD=0.73), reference books (M=1.87, SD=0.849), and so on. Since a three point Likert-scale was used to rate the items, 1.5, being an average of Likert-scale used, is picked as the mean cut off for the rating scale. Therefore, all items that have the mean score higher than the cut off mean of 1.50 implies that the respondents rated that the library resources as not regularly influenced implementation of science curriculum contents. Therefore, textbooks with mean score less than 1.50 were the only library resources that regularly influenced the implementation of science curriculum contents. Table 5.29 presents the detail results.

Table 5.29: Influence of school library on science subjects

N = 103

The quality of the following library resources influences my science subject implementation	Regularly	Occasionally	Never	Mean	SD
Textbooks	83.8	15.2	1.0	1.1717	.40508
Nonfiction science books	15.4	38.5	46.2	2.3077	.72560
Reference books	38.8	24.3	36.9	1.8710	.84988
Encyclopaedias	18.5	35.9	45.7	2.2717	.75743
Dictionaries	29.8	37.2	33.0	2.0319	.79585
Magazines	13.2	26.4	60.4	2.4725	.72020
Newspaper	13.2	22.0	64.8	2.5165	.72053
Journals	11.8	25.8	62.4	2.5054	.70130
Yearbook	12.0	23.9	64.1	2.5217	.70130
Internet facilities	25.0	20.7	54.3	2.2935	.84565
CD-ROM/DVD-ROM	19.8	17.6	62.6	2.4286	.80475
Computer games	13.2	23.1	63.7	2.5055	.72070
Documentaries	21.7	18.5	59.8	2.3804	.82332
Charts & Pictorials	40.0	22.1	37.9	1.9789	.88701
Pictures	40.9	22.6	36.6	1.9570	.88359
Wall charts	43.2	20.0	36.8	1.9368	.89693
Flip charts	27.2	25.0	47.8	2.2065	.84565
Real object/sample	33.7	18.5	47.8	2.1413	.89665
Television	16.3	23.9	59.8	2.4348	.76034
Microscopic slides	21.7	21.7	56.5	2.3478	.81786
Article Topic Collection (e.g. newspapers and magazine cuttings)	11.0	30.8	58.2	2.4725	.68865

Influence of availability library resources on science curriculum implementation

In question 36 of teachers' questionnaire, the teachers were asked to rate the influence library resources had on science curriculum implementation from the options; 'maximum influence', 'minimum influence', and 'no influence'. Table 5.30 reveals that majority of respondents (60.2 %) stated that library resources had maximum influence on science curriculum implementation, followed by 33% who stated that library resources had minimum influence. Only 7 representing 6.8% stated that library resources had no influence on their implementation of science curriculum.

Table 5.30: Degree of influence the availability of school library has on science curriculum implementation
N = 103

Degree of influence the quality of a school library resources has on science curriculum implementation	**Frequency**	**Percent**
Maximum influence	62	60.2
Minimum influence	34	33.0
No influence	7	6.8
Total	**103**	**100.0**

5.4.3.0.ADEQUACY OF THE SCIENCE AND COMPUTER LABORATORIES

Data gathered for questions 37 and 38 of the teachers' questionnaire on the adequacy of the science and computer laboratories and computer laboratory as teaching aid respectively in schools are presented in this section. Results are presented in Table 5.31 and Table 5.32.

Adequacy of science laboratories in schools

A slim majority of the respondents (51.8%) said their physics laboratories were adequate, while 42.2% said theirs were not adequate and 6% said they did not have physics laboratories in their schools. Similarly, 48.3% of respondents said their chemistry laboratories were adequate, 47.1% said theirs were not adequate while 4.6% said they did not have chemistry laboratory. Further, 43.5% of respondents said their biology laboratories were adequate, while the majority (48.2%) said theirs were not adequate and 8.2% said they did not have biology laboratories.

Table 5.31: Adequacy of the science laboratories in schools

N = 103

Adequate science laboratories in schools	**Adequate**	**Not adequate**	**Not available**
Physics laboratory	51.8	42.2	6.0
Chemistry laboratory	48.3	47.1	4.6
Biology laboratory	43.5	48.2	8.2

Computer laboratory as science teaching and learning aid

Table 5.32 shows that about 45% of teachers agreed that computer laboratories in their schools were being used for teaching and learning science, while 27.2% disagreed. However, more than 15% were indifferent or neutral, while 11.6% said they did not have computer laboratories in their schools.

Table 5.32: Computer laboratory as science teaching and learning aid

N = 103

The computer laboratory is used for science teaching and learning in your school		
Options	**Frequency**	**Percentage**
Strongly Agree	19	18.4
Agree	28	27.2
Neutral	16	15.5
Disagree	21	20.4
Strongly Disagree	7	6.8
Not available	12	11.6

General comments

The respondents were asked to freely make general comments on any area of the study the questionnaire had no covered. Only 25 out of 103 commented. There comments range from non-inclusion of mathematics laboratory; non-inclusion of agricultural science as part of science subjects; non-inclusion of information and communication technologies such as satellite, as part of library resources; non-involvement of library in teaching science subjects; questions on laboratory not comprehensive e.g. not much emphasis on period for teaching practical; inadequate library building/facilities e.g. tables, chairs; inadequate library staff; lack of laboratory technicians; inadequate of science teachers; role of school management in teaching science subjects; request for more current textbooks on physics and other science subjects in the school library; three in one (multipurpose) laboratory is not adequate for teaching to improvement of all laboratories.

5.4.3. ANALYSIS OF SCIENCE STUDENTS' QUESTIONNAIRE

The questionnaire (see Appendix 4) for science students has the following four sections:

Section A: This section enquires about the background information of science students, such as gender, science subjects taken, location of their schools (urban or rural).

Section B: This section focuses on availability, accessibility, utilization and adequacy of library for teaching and learning science subjects.

Section C: This section asked students to self-evaluate their library use competency skills.

Section D: This section enquires about the adequacy of science and computer laboratories in schools.

5.4.3.1. BACKGROUND INFORMATION OF SCIENCE STUDENTS

This section provides the background information of science students in the study which includes gender, science subjects taken, location of their schools (urban or rural). This is covered by questions 2 to 4. Table 5.33 presents the results.

Table 5.33: Background information of science students
N = 240

Science students' local government/senatorial districts:	**Frequency**	**Percentages**
Ado local government/Ekiti Central senatorial district	80	33.33
Ido/Osi local government/Ekiti north senatorial district	80	33.33
Ikere local government/ Ekiti south senatorial district	80	33.33
Schools		
School#1, Ekiti central senatorial district	**9**	**3.8**
School#2, Ekiti central senatorial district	8	3.3
School#3, Ekiti central senatorial district	9	3.8
School#4, Ekiti central senatorial district	9	3.8
School#5, Ekiti central senatorial district	9	3.8
School#6, Ekiti central senatorial district	9	3.8
School#7, Ekiti central senatorial district	9	3.8
School#8, Ekiti central senatorial district	9	3.8
School#9, Ekiti central senatorial district	9	3.8
School#10, Ekiti north senatorial district	**9**	**3.8**
School#11, Ekiti north senatorial district	9	3.8
School#12, Ekiti north senatorial district	9	3.8
School#13, Ekiti north senatorial district	9	3.8
School#14, Ekiti north senatorial district	9	3.8
School#15, Ekiti north senatorial district	9	3.8
School#16, Ekiti north senatorial district	9	3.8
School#17, Ekiti north senatorial district	8	3.3
School#18, Ekiti north senatorial district	9	3.8
School#19, Ekiti south senatorial district	**9**	**3.8**
School#20, Ekiti south senatorial district	8	3.3
School#21, Ekiti south senatorial district	9	3.8
School#22, Ekiti south senatorial district	9	3.8
School#23, Ekiti south senatorial district	9	3.8
School#24, Ekiti south senatorial district	9	3.8
School#25, Ekiti south senatorial district	9	3.8
School#26, Ekiti south senatorial district	9	3.8
School#27, Ekiti south senatorial district	9	3.8
Location of schools:		
Urban	151	63
Rural	89	37
Gender:		
Male	116	48.3
Female	124	51.7
Science subject taken		
Physics	1	0.4
Chemistry	6	2.5
Biology	13	5.4
Mathematics	9	3.8
All of the above	211	87.9

Location of schools

Urban areas accounted for 63% of the schools, while rural schools totalled 37%.

Gender

There were more female (51.7%) than male (48.3%) students.

Subject taken

Most students (211 or 87.9%) were taking all four science subjects (physics, chemistry, biology and mathematics). There were students who took only biology (13 or 5.4%), chemistry (6 or 2.5%), mathematics (3.8%), or physics (1 or 0.4%).

5.4.3.2. AVAILABILITY, ACCESSIBILITY, UTILISATION AND ADEQUACY OF THE LIBRARY FOR SCIENCE SUBJECTS

Data collected in the students' questionnaire on availability, accessibility and utilisation and adequacy of the library for science subjects are presented in the tables 5.34 to 5.38.

Availability of library in schools

Table 5.34 shows that almost all the schools had a library, with only one respondent indicating that his/her school did not have a library. However, the respondent did not state where science materials could be found to study and do assignments. This is covered by questions 5 and 6

Table 5.34: Availability of library in schools

N = 240)

Availability of library in schools	Frequency	Percentage (%)
Yes	239	99.4
No	1	0.4
Total	**240**	**100**

Location of library within the school

Question 7 of students' questionnaire sought to find out the location of libraries within the schools. Results in Table 5.35 reveal that most schools (201 or 83.8%) had separate/purpose-built buildings for their libraries, 13 (5.4%) chose a storehouse/room, 12 (5%) chose classrooms, eight (3.3%) indicated the principal's office as the location for the library and the rest (less than 1%) chose book boxes, or the staff room as its library. No school had their library in a cupboard.

Table 5.35: Location of library within the school

N = 240

Location	Frequency	Percentage (%)
Book boxes	2	0.8
Classrooms	12	5
Principal's office	8	3.3
Separate/purpose-built building	201	83.8
Store house/room	13	5.4
Cupboards	0	0
Others e.g. staff room, language departments	4	1.7

Frequency of library utilisation

Table 5.36 shows that 50% of the students utilized the library on a daily basis, 25% used it occasionally and 17.1% once a week. In Ikere, 61.3% had the highest utilization of the library on a daily basis, while 25% in Ido/Osi had the highest visit to the library on 'once in a week' basis and 31.3% in Ado had the highest visit to the library on 'occasionally' basis. Further, results reveal that students (61.3%) in Ikere visited the library most on daily basis followed by respondents (46.3%) in Ido/Osi and respondents (42.5%) in Ado respectively. The result of the Pearson Chi-square (X^2=12.010, p=0.151) revealed that there is no relationship between how respondents in the three local governments visited the library. This implies that the location (urban/rural) of schools does not influence the level of utilization of library resources in the state. This is captured by question 8 of students' questionnaire.

Table 5.36: Frequency of school library utilization

N = 240

Frequency of school library utilization (N = 240)	Local Government Area/Senatorial Districts			
	Ido Osi/ EKiti North Senatorial District	Ado Ekiti/Ekiti Central Senatorial District	Ikere/Ekiti South Senatorial District	Total
Daily Once in a week Once in a month Occasionally Others	37 (46.3) 20 (25.0%) 1 (1.3%) 18 (22.5%) 4 (5.0%)	34 (42.5%) 13 (16.3%) 3 (3.8%) 25 (31.3%) 5 (6.3%)	49 (61.3%) 8 (10.0%) 3 (3.8%) 17 (21.3%) 3 (3.8%)	120 (50%) 41 (17.1%) 7 (2.9%) 60 (25%) 12 (5%)
Pearson Chi-Square Statistics	X^2=12.010,	p=0.151		

Frequency of setting assignments that require access to information resources beyond textbooks (advocacy)

Question 9 of students' question sought to find out the frequency of setting assignments that require access to information resources beyond textbooks. Results reveal that science teachers were regularly or very regularly (84.4%) advocating the use of information resources beyond textbooks for science assignments. In Ido/Osi 91.3% indicated teachers regularly/very regularly set assignments requiring students to go beyond the textbook, in Ado district, it was 71.3% and in Ikere, it was 90%.

Table 5.37: Frequency of setting assignments that require access to information resources beyond textbooks (advocacy)

N = 27

Frequency of setting assignments that require access to information resources beyond textbooks (advocacy) (n = 240	Local Government Area/Senatorial Districts			
	Ido Osi/ EKiti North Senatorial District	**Ado/Ekiti Central Senatorial District**	**Ikere/Ekiti South Senatorial District**	**Total**
Very regularly	30 (37.5%)	15 (18.8%)	18 (22.5%)	63 (26.5%)
Regularly	43 (53.8%)	42 (52.5%)	54 (67.5%)	139 57.9%)
Fairly regularly	1(1.3%)	13 (16.3%)	3 (3.8%)	17 (7.1%)
Not regularly	6(7.5%)	10 (12.5%)	5 (6.3%)	21 (8.8%)

Frequency of provision of library services by librarians

In question 10 of students' questionnaire, student were asked to state how regularly did they enjoy the services provided by their school librarians. Results in Table 5.38 reveal that students have access to a librarian in the school library on a regular basis 70% of the time. See Table 5.38. Students regularly enjoyed the services of a school librarian 67.6% of the time in Ido Osi, 66.3% in Ado and in Ikere, 76.3% of the time. However, 13.8%, 10% and 3.8% in Ido Osi, Ado and Ikere respectively did not have access to school librarians at all. The result of the Pearson Chi-square (X^2=8.139, p=0.420) showed that there is no significant difference between access to school librarians in the three local governments.

Table 5.38: Frequency of provision of library services by librarians

N = 240

Frequency of provision of library services by librarians	**Local Government Area/Senatorial Districts**			**Total**
	Ido Osi/ EKiti North Senatorial District	Ado-Ekiti/EKiti Central Senatorial District	Ikere-Ekiti/EKiti South Senatorial District	
Very regularly	19 (23.8%)	16 (20.0%)	22 (27.5%)	57 (23.8%)
Regularly	35 (43.8%)	37 (46.3%)	39 (48.8%)	111 (46.3%)
Fairly regularly	11 (13.8%)	13 (16.3%)	8 (10.0%)	32 (13.3%)
Not regularly	4 (5.0%)	6 (7.5%)	8 (10.0%)	18 (7.5%)
Not at all	11 (13.8%)	8 (10.0%)	3 (3.8%)	22 (9.2%)
Pearson Chi-Square		p=0.420 Statistics		X^2=8.139,

Intersection of librarians' responses on availability of library study period and how regularly students enjoy the services they rendered

Comparing the 5 (18.5%) librarians of schools without a library study period with the 22 (9.2%) students who indicated they did not enjoy, at all, the services rendered by the librarians, it is observable that the librarians' responses (Figure 5.3) and that of students' (Table 5.38) are not corresponding. Since nine students were selected from each school, one is expecting about 45 (18.8%) students in five schools without a library study period to indicate "not at all". See Table 5.39.

Table 5.39: Cross tabulation of librarians' responses on availability of library study period with how students indicated they enjoyed the services rendered by the librarians

N = 240 vs N =27

How students enjoy the services rendered by the school librarian (N = 240)	**Frequency/%**	**Availability of library study period (N = 27)**	
		Available	**Not available**
Very regularly	57 (23.8%)	22 (81.5%)	5 (18.5%)
Regularly	111 (46.3%)		
Fairly regularly	32 (13.3%)		
Not regularly	18 (7.5%)		
Not at all	22 (9.2%)		

Evaluation of school libraries

To seek answers to question 11 of the questionnaire on the evaluation of the libraries, science students were asked to evaluate their school libraries in terms of quality and quantity of resources, quality of personnel, quality of services, administration and attitude of the librarians. The results are presented in Table 5.40.

Table 5.40: Evaluation of school libraries

N = 240

Evaluationof school library based on the following variables:	Local Government Area/Senatorial Districts			Pooled Percentage
	Ido Osi/ EKiti North Senatorial District	Ado Ekiti/Ekiti Central Senatorial District	Ikere/Ekiti South Senatorial District	
Quality Personnel				
Very good	30.0%	48.8%	52.5%	43.8%
Good	45.0%	38.8%	40.0%	41.3%
Fairly good	15.0%	7.5%	3.8%	8.8%
Not good	3.8%	5.0%	1.3%	3.3%
Don't know	6.3%	0.0%	2.5%	2.9%
Quality of Service				
Very good	31.3%	40.0%	50.0%	40.4%
Good	43.8%	38.8%	31.3%	37.9%
Fairly good	15.0%	18.8%	16.3%	16.7%
Not good	7.5%	2.5%	1.3%	3.8%
Don't know	2.5%	0.0%	1.3%	1.3%
Quality of Resources				
Very good	38.8%	53.8%	41.3%	44.6%
Good	30.0%	33.8%	37.5%	33.8%
Fairly good	25.0%	11.3%	15.0%	17.1%
Not good	3.8%	1.3%	5.0%	3.3%
Don't know	2.5%	0.0%	1.3%	1.3%
Quantity of Resources Very good	40.0%	50.0%	45.0%	45.0%
Good	28.8%	28.8%	32.5%	30.0%
Fairly good	22.5%	15.0%	11.3%	16.3%
Not good	2.5%	3.8%	6.3%	4.2%
Don't know	6.3%	2.5%	5.0%	4.6%
Administration of school library				
Very good	36.3%	50.0%	45.0%	43.3%
Good	43.8%	37.5%	42.5%	41.3%
Fairly good	13.8%	6.3%	12.5%	10.8%
Not good	2.5%	3.8%	0.0%	2.1%
Don't know	3.8%	2.5%	0.0%	2.1%

Attitude of the librarians Very good	45.0%	38.8%	50.0%	44.6%
Good	23.8%	35.0%	28.8%	29.2%
Fairly good	16.3%	12.5%	12.5%	13.8%
Not good	10.0%	12.5%	5.0%	9.2%
Don't know	5.0%	1.3%	3.8%	3.3%
Total	80 (100%)	80 (100%)	80 (100%)	240 (100%)

Quality of the personnel

In Ado, almost 90% of respondents evaluated the school library as having good quality personnel, while 5% indicated that quality of personnel was poor. In Ido/Osi, more than 70% of respondents affirmed that their school libraries had good quality personnel. Similarly, in Ikere 90% reported that they had good quality personnel. To sum up, 85% of students rated their school librarians to be good, while only a few (6.2%) evaluated their library personnel as either not good or "not sure".

Quality of services

More than 78% of students evaluated the quality of their library services to be good. In Ado, 79% of respondents reported that their libraries offered good service implementation. In Ido/Osi, 73% said that the library service implementation was good while 81% in Ikere also reported their library service as good.

Quality and quantity of resources

More than 78% evaluated the quality of their library resources as good, while 20.4% evaluated the quality of their library resources to be either fairly good or not good. Similarly, 78.8% of students evaluated the quantity of their resources as good, while 20.5% evaluated the quantity as either fairly good or not good.

Administration of the library

On the whole, more than 85% of the respondents evaluated the administration of their library to be good, while very few (2.1%) evaluated their administration as not good.

Attitude of the school librarians

In general, students rated the attitude of the librarian as good (73.8%), while very few (9.2%) found their librarian's attitude as poor.

Relevance of library resources to science subjects

The respondents (students) were asked to rate how relevant the library resources were for their science subjects, using a Likert scale ranging from; 'relevant', 'fairly relevant', 'not relevant' to 'not available'. See question 13 of the questionnaire. Table 5.41 presents the results showing that the majority (89.6%) of respondents found textbooks were relevant, followed by dictionaries (78.8%), while other resources were either not relevant or not available. Worth mentioning are; 42% of students who said non Non fiction science were relevant, 47.1% who said they did not have internet facilities at libraries and 52.5% who said their libraries did not have Television.

Table 5.41: Relevance of library resources to science subjects

N = 240

Relevance of library resources to science subjects		**Local Government Area/Senatorial Districts**			**Total**
		Ido Osi/ EKiti North Senatorial District	**Ado Ekiti/Ekiti Central Senatorial District**	**Ikere/Ekiti South Senatorial District**	
Textbooks	Relevant	68 (85.0%)	73 (91.3%)	75 (93.8%)	215 (89.6%)
	Fairly relevant	12 (15.0%)	7 (8.7%)	4 (5.0%)	23 (9.6%)
	Not relevant	0 (0.0%)	0 (0.0%)	1 (1.3%)	1 (.4%)
	Not available	0 (0.0%)	1 (1.2%)	0 (0.0%)	1 (.4%)
Total					**240 (100%)**
Nonfiction science books	Relevant	31 (38.8%)	37 (46.3%)	33 (41.3%)	102 (42.5%)
	Fairly relevant	29 (36.3%)	25 (31.2%)	31 (38.8%)	85 (35.4%)
	Not relevant	6 (7.5%)	6 (7.5%)	4 (5.0%)	16 (6.7%)
	Not available	14 (17.5%)	12 (15.0%)	12 (15.0%)	37 (15.4%)
Total					**240 (100%)**
Reference books	Relevant	32 (40%)	31 (38.8%)	39 (48.8%)	101 (42.1%)
	Fairly relevant	18 (22.5%)	28 (35.0%)	20 (25.0%)	68 (28.3%)
	Not relevant	10 (12.5%)	5 (6.2%)	7 (8.8%)	22 (9.2%)
	Not available	20 (25.0%)	16 (20.0%)	14 (17.5%)	49 (20.4%)
Total					**240 (100%)**
Encyclopaedias	Relevant	31 (38.8%)	31 (38.8%)	32 (40.0%)	93 (38.8%)
	Fairly relevant	17 (21.2%)	23 (28.7%)	21 (26.3%)	61 (25.4%)
	Not relevant	6 (7.5%)	4 (5.0%)	10 (12.5%)	20 (8.3%)
	Not available	26 (32.5%)	22 (27.5%)	17 (21.3%)	66 (27.5%)

Total					**240 (100%)**
Dictionaries	Relevant	63 (78.8%)	66 (82.5%)	60 (75.0%)	189 (78.8%)
	Fairly relevant	12 (15%)	8 (10.0%)	10 (12.5%)	30 (12.5%)
	Not relevant	1 (1.3%)	1 (1.3%)	2 (2.5%)	4 (1.7%)
	Not available	4 (5.0%)	5 (6.3%)	8 (10.0%)	17 (7.1%)
Total					**240 (100%)**
Magazines	Relevant	15 (18.8%)	26 (32.5%)	25 (31.3%)	66 (27.6%)
	Fairly relevant	25 (31.3%)	22 (27.5%)	21 (26.3%)	68 (28.3%)
	Not relevant	11 (13.8%)	7 (8.8%)	13 (16.3%)	31 (13.0%)
	Not available	28 (35.0%)	25 (31.3%)	21 (26.3%)	75 (31.3%)
Total					**240 (100%)**
Newspapers	Relevant	13 (16.3%)	19 (23.8%)	21 (26.3%)	53 (22.1%)
	Fairly relevant	19 (23.8%)	18 (22.5%)	15 (18.8%)	52 (21.7%)
	Not relevant	14 (17.5)	10 (12.5%)	15 (18.8%)	39 (16.3%)
	Not available	34 (42.5%)	33 (41.3%)	29 (36.3%)	96 (40.0%)
Total					**240 (100%)**
Journals	Relevant	10 (12.5%)	15 (18.8%)	21 (26.3%)	46 (19.2%)
	Fairly relevant	17 (21.3%)	21 (26.3%)	19 (23.8%)	57 (23.8%)
	Not relevant	15 (18.8%)	13 (16.3%)	12 (15.0%)	40 (16.7%)
	Not available	38 (47.5%)	31 (38.8%)	28 (35.0%)	97 (40.4%)
Total					**240 (100%)**
Yearbooks	Relevant	11 (13.8%)	28 (35.0%)	22 (27.5%)	61 (25.5%)
	Fairly relevant	19 (23.8%)	13 (16.3%)	15 (18.8%)	47 (19.7%)
	Not relevant	11 (13.8%)	14 (17.5%)	8 (10.0%)	33 (13.8%)
	Not available	39 (48.8%)	25 (31.3%)	35 (43.8%)	99 (41.3%)
Total					**240 100%)**
Internet facilities	Relevant	17 (21.3%)	20 (25.0%)	24 (30.0%)	61 (25.5%)
	Fairly relevant	13 (16.3%)	15 (18.8%)	11 (13.8%)	39 (16.3%)
	Not relevant	7 (8.8%)	13 (16.3%)	7 (8.8%)	27 (11.3%)
	Not available	43 (53.8%)	32 (40.0%)	38 (47.5%)	113 (47.1%)
Total					**240 (100%)**
CD-ROM/DVD-ROMs	Relevant	19 (23.8%)	20 (25.0%)	20 (25.0%)	59 (24.7%)
	Fairly relevant	14 (17.5%)	14 (17.5%)	8 (10.0%)	36 (15.1%)
	Not relevant	11 (13.8%)	13 (16.3%)	10 (12.5%)	34 (14.2%)
	Not available	36 (45.0%)	33 (41.3%)	42 (52.5%)	111 (46.0%)
Total					**240 (100%)**
Computer games	Relevant	12 (15.0%)	12 (15.0%)	17 (21.3%)	41 (17.2%)
	Fairly relevant	13 (16.3%)	11 (13.8%)	13 (16.3%)	37 (15.5%)
	Not relevant	10 (12.5%)	17 (21.3%)	14 (17.5%)	41 (17.2%)
	Not available	45 (56.3%)	40 (50.0%)	36 (45.0%)	121 (50.0%)
Total					**240 (100%)**
Documentaries	Relevant	19 (24.4%)	28 (35.0%)	29 (36.3%)	76 (31.8%)
	Fairly relevant	14 (17.9%)	21 (26.3%)	18 (22.5%)	53 (22.2%)
	Not relevant	12 (15.4%)	13 (16.3%)	10 (12.5%)	35 (14.6%)

	Not available	35 (42.3%)	18 (22.5%)	23 (28.8%)	76 (31.7%)
Total					**240 (100%)**
Charts & pictorials	Relevant	11 (13.8%)	15 (18.8%)	17 (21.3%)	43 (17.9%)
	Fairly relevant	20 (25.0%)	18 (22.5%)	18 (22.5%)	56 (23.3%)
	Not relevant	9 (11.3%)	16 (20.0%)	13 (16.3%)	38 (15.8%)
	Not available	40 (50.0%)	31 (38.8%)	32 (40.0%)	103 (42.9%)
Total					**240 (100%)**
Pictures	Relevant	19 (24.4%)	16 (19.8%)	27 (34.2%)	62 (26.1%)
	Fairly relevant	14 (17.9%)	15 (18.5%)	10 (12.7%)	39 (16.4%)
	Not relevant	11 (14.1%)	17 (21.0%)	16 (20.3%)	44 (18.5%)
	Not available	36 (45.0%)	32 (40.0%)	26 (32.5%)	94 (39.2%)
Total					**240 (100%)**
Wall charts	Relevant	25 (31.3%)	14 (17.5%)	35 (43.8%)	74 (30.8%)
	Fairly relevant	18 (22.5%)	16 (20.0%)	12 (15.0%)	46 (19.2%)
	Not relevant	10 (12.5%)	20 (25.0%)	13 (16.3%)	43 (17.9%)
	Not available	27 (33.8%)	30 (37.5%)	20 (25.0%)	77 (32.1%)
Total					**240 (100%)**
Flip charts	Relevant	8 (10.1%)	15 (18.8%)	23 (28.8%)	46 (19.3%)
	Fairly relevant	17 (21.5%)	13 (16.3%)	14 (17.5%)	44 (18.4%)
	Not relevant	10 (12.7%)	19 (23.8%)	13 (16.3%)	42 (17.6%)
	Not available	44 (55.7%)	33 (41.3%)	30 (37.5%)	107 (44.8%)
Total					**239 (100%)**
Real objects/samples	Relevant	10 (12.8%)	27 (33.8%)	27 (33.8%)	64 (26.9%)
	Fairly relevant	16 (20.5%)	17 (21.3%)	13 (16.3%)	46 (19.3%)
	Not relevant	14 (17.9%)	9 (11.3%)	12 (15.0%)	35 (14.7%)
	Not available	38 (48.7%)	27 (33.8%)	28 (35.0%)	93 (39.1%)
Total					**238 (100%)**
Television	Relevant	11 (14.1%)	13 (16.3%)	8 (10.0%)	32 (13.4%)
	Fairly relevant	16 (20.5%)	14 (17.5%)	17 (21.3%)	47 (19.7%)
	Not relevant	10 (12.8%)	15 (18.8%)	9 (11.3%)	34 (14.3%)
	Not available	41 (52.6%)	38 (47.5%)	46 (57.5%)	125 (52.5%)
Total					**238 (100%)**
Microscopic slides	Relevant	14 (17.7%)	17 (21.3%)	21 (26.3%)	52 (21.8%)
	Fairly relevant	21 (26.6%)	11 (13.8%)	16 (20.0%)	48 (20.1%)
	Not relevant	6 (7.6%)	13 (16.3%)	8 (10.0%)	27 (11.3%)
	Not available	38 (48.1%)	39 (48.8%)	35 (43.8%)	112 (46.9%)
Total					**239 (100%)**
Article topics collections e.g. newspapers and magazine cuttings	Relevant	10 (12.8%)	19 (23.8%)	22 (27.8%)	51 (21.5%)
	Fairly relevant	12 (15.4%)	17 (21.3%)	16 (20.3%)	45 (19.0%)
	Not relevant	9 (11.5%)	4 (5.0%)	11 (13.9%)	24 (10.1%)
	Not available	47 (60.2%)	40 (50.0%)	30 (38.0%)	117 (49.4%)
Total					**237 (100%)**

5.4.3.3. EVALUATION OF LIBRARY USE COMPETENCY SKILLS

Data gathered in the questionnaire on the evaluation of library use competency skills are presented in tables 5.44 and 5.45.

Evaluation of library use competency skills

In question 15 of the questionnaire, students were asked to evaluate themselves in library use competency skills using the scale; 'very competent', 'competent', 'fairly competent' and 'not competent'. Results are presented in table 5.42. The majority (81.6%) evaluated themselves to be at least competent in library use competency skills, while 16.3% were fairly competent. Very few (2.6%) evaluated themselves as incompetent. Table 5.42 presents the details.

Table 5.42: Evaluation of library use competency skills

N = 240

Evaluation of library use competency skills	Frequency	Percentage (%)
Very competent	87	36.3
Competent	108	45.0
Fairly competent	39	16.3
Not competent	6	2.6

Skills needed for learning science subjects acquired in the school library

Question 16 of students' questionnaire sought to find out the skills students acquired from their school librarians. Table 5.43 reveals the percentage distribution of library skills acquired from the school librarians. The vast majority of the students agreed that they had gained study skills (more than 80%), finding skills (about 78%) and science literacy skills (more than 85%) from their school librarians.

Table 5.43: Skills students acquired from the school librarian

N = 240

Through the school library, I have acquired the following skills for learning science subjects	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Study skills	46.7%	38.3%	10.0%	2.9%	2.1%
Finding skill	35.4%	42.9%	14.6%	3.8%	3.3%
Science literacy skills	45.8%	35.4%	14.6%	0.8%	3.3%

5.4.3.4. ADEQUACY OF SCIENCE AND COMPUTER LABORATORIES

Questions 17 and 18 on the students' questionnaire asked about the adequacy of science and computer laboratories and using of computer laboratory is used for science teaching and learning in schools respectively. Results are presented in Table 5.44 and Table 5.45.

Availability and adequacy of laboratories in schools

Table 5.44 shows that 66.3% of students said their schools had all the laboratories (physics, chemistry, biology and computer). Just more than half (55.8%) claimed they had adequate physics laboratories, while 62.1% had adequate chemistry laboratories, and 52.1% were satisfied with their biology laboratories. In contrast, only 39.6% claimed they had adequate computer laboratories in their schools.

Table 5.44: Availability and adequacy of laboratories in schools

N = 240

Availability and adequacy of laboratories in schools	Frequency	Percentage
Physics Chemistry Biology Computers All of the above More than one laboratory **Total**	3 10 2 2 159 64 **240**	1.3 4.2 .8 .8 66.3 26.7 **100**
Adequate of physics laboratory		
Adequate	134	55.8
Not adequate	82	34.2
Not available	24	10.0
Total	**240**	**100**
Adequate of chemistry laboratory		
Adequate	149	62.1
Not adequate	79	32.9
Not available	12	5.0
Total	**240**	**100**
Adequate of biology laboratory		
Adequate	125	52.1
Not Adequate	72	30.0
Not Available	43	17.9
Total	**240**	**100**
Adequate of computer laboratory		
Adequate		39.6
Not Adequate	68	28.3
Not Available	77	32.1
Total	**240**	**100**

Computer laboratory as science teaching and learning aid

If less than 40% of students thought their computer laboratories were adequate (Table 5.46), it is surprising that 65.9% of students agreed that the computer laboratories in their schools were being used for teaching and learning science subjects (Table 5.45). this is captured in question 18 of students' questionnaire.

Table 5.45: Computer laboratory as science teaching and learning aid

N = 240

The computer laboratory as science teaching and learning aid in schools	Frequency	Percentage
Strongly agree	99	41.3
Agree	59	24.6
Neutral	31	12.9
Disagree	28	11.7
strongly disagree	23	9.6
Total	**240**	**100.0**

General comments

Question 20 of the questionnaire asked students to freely comment on any areas this questionnaire did not cover. Forty comments were forthcoming, a clear majority (27) lamenting the inadequate library and laboratory facilities. Their comments were diverse and cut across different areas in schools, while some were either in the form of a statement or request. See summary in Table 5.46.

Table 5.46: General comments

Comments	Frequency
Inadequate library and laboratory facilities	27
Library inaccessible	2
Request for more current textbooks	3
Request for qualified teachers	1
The questionnaire did not cover laboratory facilities	1
The questionnaire did not cover behavioural attitude of staff	1
Science students need more apparatus	1
Time for practical work in the laboratory	1
No computer training centre/laboratory in my school	2

5.4.4. CONCLUSION

The findings gathered through questionnaires from school librarians, science teachers and science students were presented first in this chapter. The majority of school librarians had a B.Sc. /HND followed by those who did not possess more that Senior School Certificate Examination (SSCE) while no respondents had a Bachelor's degree in Library and Information studies (B.L.I.S.). The majority of school librarians had working experience between 10-14 years. The educational qualifications of majority of science teachers was

B.Sc., while those with HND and PGDE were less than 4%. The majority of teachers taught all the classes (SSS1 to 3). The majority of students was female. Most schools were in urban areas, while more than three quarters of the schools had a library study period in their timetable. Also, majority (32%) of the school were established between the years 1980 – 1989.

Conclusively, the only adequate library resources for teaching science curricula were textbooks, as no library had a computer for either staff or student use. Obsolete material and lack of adequate space were some of the major factors hindering effective utilisation of library resources for science curriculum implementation. The teachers' advocacy via giving assignments that require the use of information resources beyond textbooks had not yielded much. The majority of teachers were still adopting teacher centred approaches in teaching students, while very few used inquiry-based learning (guided).

5.5. ANALYSIS OF QUALITATIVE DATA

This section provides the analysis of observation/documents and data gathered from schools, West Africa Examination Council and the interviews with the school principals and education stakeholders such as the permanent secretary, director of teaching service commission, director of state library and area education officers in the three selected local governments respectively.

5.5.1. OBSERVATION AND DOCUMENTS ANALYSIS IN SCHOOL LIBRARIES AND LABORATORIES

Document analysis is simply defined as the process of summarising and reporting written data (i.e. the main content of data and their messages). In this section, a review of the accession registers in libraries; l book loan records for library resources; attendance registers of library users and other documents related to the study is presented. An observation guide was carefully designed (see Appendix number 10). One observation guide form was used for each school.

Loan records of the libraries

Many of the school libraries did not have lending policies on the number of resources/books to borrow at a time. Individual libraries applied its discretion on this. They lend out resources to both teachers and students ranging from 1 to 5 copies at a time for two weeks for subject textbooks. Three libraries (School#7; School#14; School#17) were not lending books to students and teachers, but only allowing their resources/materials to be used and consulted in their libraries. Their reasons were that students were too careless; they may mutilate/deface borrowed materials or not even return them.

Library study period

During the course of school visits, it was observed that only 10 schools (SCHL#1, SCHL#2, SCHL#6, SCHL#11, SCHL#12, SCHL#15, SCHL#18, SCHL#19, SCHL#23 and SCHL#25) had a 'library study period' on their timetables (see Table 5.47). However, schools had free periods every week and a lunch break daily. Students were expected to be in the library and supervised by librarians during free periods.

Availability of library resources that support implementation of science curriculum contents

All the school libraries had science books, although mainly textbooks. Some libraries did not have appreciable numbers of texts on physics. Some school libraries were still holding on to obsolete textbooks. From the accession registers, the researcher could obtain the total number of science resources in each subject of all the schools. Worthy of mention is three schools (SCHL#12, SCHL#14 and SCHL#24) which could not produce their accession registers during the first visit (March, 2018) to schools due to a lack of proper record keeping on the part of the library staff were able to organize within the period the researcher went back for the second visit in February, 2019.

School type and state of libraries in schools

With the aid of a self-designed observation guide, it was easy for the researcher and research assistant to document some of the activities observed during the school visits. Of the 27 schools, eight were 'single sex schools' (four boys only and four girls only), while the rest were co-ed. The libraries' opening hours were from 8:00am to 2:00pm (length of a school day) from Mondays to Fridays. Virtually all the school libraries had inadequate tables and chairs as no library could comfortably accommodate 40 students (not to talk of average class size of about 90 students in schools) at a time. See Figure 5.10. It was worrisome to observe that no library had a computer for either staff or students to use nor internet facilities. Each library was staffed with one library assistant who was expected to be supervised by a teacher (commonly, English teacher), who hardly stayed in the library due to their additional responsibility of teaching. The majority of library assistants had no qualifications in librarianship, although they claimed they had practical knowledge about how to organise and manage school libraries.

Figure 5.10: Typical school library in the state

Source: Photograph was taken by the reseacher with permission during school visitation

The school library resources in the state cannot be said to be adequate since most of the libraries were still holding on to obsolete materials which were no longer relevant to the current Curriculum 2007. Students were expected, in a situation where there are no relevant textbooks in the library, to buy textbooks on their own, most especially in the core science subjects like mathematics, physics, biology, chemistry. Some students whose parents could afford buy for their wards. Those whose parents could not afford to buy resulted in sharing in some cases with their friends. It was also discovered during the visitation to schools that virtually all the library resources were acquired and put in the library by the government without consulting the librarians and even the end users (majorly teachers and students) for their input in the selection process. Only few schools (SCH#6; SCH#8; SCH#27), had other resources like few non Non fiction science, encyclopaedias and dictionaries, which most of them were obsolete. The OSAs of these schools, according to the librarians were responsible for the supply of these few resources. These schools were long established (1930 – 1949), which may be responsible for their strong and well established OSA. No library actually processed (catalogued and classified) its resources; the resources were arranged on the shelves according to subject discipline for easy retrieval. See Figure 5.11.

Figure 5.11: Typical school library in the state

Source: Photograph was taken by the reseacher with permission during school visitation

Further, during the administration of questionnaire, the researcher had the opportunity to observe the teaching process of teachers at SSS classes. In most cases, the average number of students in a class were about hundred, most especially schools in urban areas. Learning was passive; knowledge is being passed from teacher to students (teacher-centred approach). This teaching method limits students to the low order thinking level; that is, students would not be able to rise from the ladder of mere reading and understanding to knowledge application, comparing, organising, deconstructing, attributing, evaluating, and creating which involves designing, constructing, planning, producing, and inventing, which are not as effective due to the current advancement in science and technology (Al-rawi, 2013, p. 100).

State of science and computer laboratories in schools

Science laboratories: In assessing the state of laboratories, a list (compiled by WAEC) of the apparatus/equipment/chemicals expected to be in laboratories which was obtained from a private school in Ado was used to determine the adequacy of the laboratories. See Appendix

33. The list was compared with the available equipment in each school. Besides, science teachers were asked if their laboratories were well equipped, fairly equipped or not well equipped. Though, the researcher was informed by the teachers that no school in the state had all the resources in the list but the most important thing was to have any of the required ones (see Figure 5.12 and Figure 5.13) to conduct practical exercises expected to perform with students preparing for either WAEC or NECO exam. Be that as it may one could say, fourteen (14) schools had well equipped science laboratories, six had a ‘3 in 1 laboratory’ (i.e. one laboratory used for three subjects – physics, chemistry and biology). According to science teachers, combined laboratories were not appropriate for the school system. The researcher rated them as ‘fair’ since they had the least requirements, as they were only lacking in term of accommodation. On the school timetable virtually all the schools had not more than two periods of 45 minutes each for every science subject practical (see Table 5.47 for details). Also, there was a double period of 45 minutes for computer study (one of the subjects being taught in schools) on the time table.

Figure 5.12: Typical example of science laboratory in school in the state

Source: Photograph was taken by the reseacher with permission during school visitation

Figure 5.13: Typical example of science laboratory in school in the state

Source: Photograph was taken by the reseacher with permission during school visitation

Computer laboratories: The majority of schools had computer laboratories where students could go for ICT skills training. It seems there is a paradigm shift as computer laboratories in some schools (School#4; School#; 5; School#9) were being complemented or replaced with Computer Resource Centres called *Multichoice Resource Centres* (MRC), a project sponsored by Multichoice, South Africa as a teaching aid for both the teachers and students. A MRC is modern media resource centre where there is a television and decoder and many educational videos have been subscribed to. See Figure 5.14. However, nine of the schools had no computer laboratory, while 18 schools had an average of 40 computers (mostly laptops) in their computer laboratories. The average number of computers were in good state, some were faulty, while some (in SCHL#) were not compliant as they were installed with Linux (Ubuntu) software as most teachers and students were only familiar with Windows, according to the computer teachers and as observed in most schools. It is disturbing to observe that none of the 27 schools had internet access as at the time of visit. Students visit computer labs during the period (usually a period of 45 minutes) for computer studies.

Figure 5.14: Typical example of computer laboratory in school in the state

Source: Photograph was taken by the reseacher with permission during school visitation

Table 5.47: Summary of document analysis and the activities observed in school libraries and science/computer laboratories

School	Number of science books (in accession registers) for each subject, i.e. Mathematic (M), Physics (P), Chemistry (C) and Biology (B) and the dates of publication (DOP) which were recorded in range					Nature of resources other than textbooks e.g. Encyclopaedia, Dictionaries, Non fiction science etc. with date of publication (DOP) and copies	Number of computers/ laptops in the computer lab	No of resources allowed to be borrow by teacher (T) and student (S)		Are the science laboratories well equipped? Physics (P), Chemistry (C) and Biology (B)			Practical period for a science subject per week	Availability of library study period	School type
	M	P	C	B	DOP			T	S	P	C	B			
SCHL#1	371	123	243	246	1980-2016	Macmillan School Dictionary (2012) 19 copies	52	1	1	No	No	No	2 periods	A	Mixed
SCHL#2	44	10	150	168	1966-2013	Macmillan School Dictionary (2012) 14 copies	65	2	2	Yes	Yes	Yes	2 periods	A	Mixed
SCHL#3	250	95	120	300	1980-2016	Macmillan School Dictionary (2012) 24 copies	CLNA	2	2	Yes	Yes	Yes	2 periods	NA	Mixed
SCHL#4	250	96	110	250	1980-2016	None	MRC	1	1	Fair (3 in 1)			2 periods	NA	Mixed
SCHL#5	744	140	129	114	1960-2016	Macmillan School Dictionary (2012) 54 copies	13 & MRC	5	2	Yes	Yes	Yes	2 periods	NA	Girls only
SCHL#6	764	35	121	119	1960-2016	Shorter Oxford Dictionary (2002) 5 copies; New book of knowledge manual (2003) 1 copy; Career Discovery Encyclopaedia (1983), 9 copies, Encyclopaedia of Wood (1989) 4 copies; The Golden book Encyclopaedia (1992) 2 copies	140	2	2	Yes	Yes	Yes	2 periods	A	Boys only
SCHL#7	110	80	50	70	1980-2016	Macmillan School Dictionary (2012) 21 copies	MRC	NLOR		Fair (3 in 1)			2 periods	NA	Boy only
SCHL#8	280	48	40	120	1981-2005	Science Explorer: Focus on physical science (1 copy); Encyclopaedia of Science & earth (2012) a set; Macmillan School Dictionary (2012) 25 copies	296	1	1	Yes	Yes	Yes	2 periods	NA	Girls only
SCHL#9	546	150	377	821	1981-2013	Macmillan School Dictionary (2012) 11 copies	30 & MRC	5	2	Yes	Yes	Yes	2 periods	NA	Mixed
SCHL#10	1630	878	889	301	1981-2013	Science Encyclopaedia (1960) 85 copies; Encyclopaedia Science & earth (60 copies); Encyclopaedia Universe & dinosaurs (35 copies), Encyclopaedia Britannica (1961) 1 set; The Atomic energy Desk book (1 copy)	80	2	2	Yes	Yes	Yes	2 periods	NA	Mixed
SCHL#11	120	60	60	7	1960-2016	Life science Library Energy (1 copy)	CLNA	1	1	Fair (3 in 1)			2 periods	A	Boys only
SCHL#12	94	60	69	74	1971-2013	Encyclopaedia of plant & animal biology (1971) Vol II	CLNA	2	4	Fair (3 in 1)			2 periods	A	Mixed

SCHL#13	80	82	82	90	1971-2013		220	1	1	Fair (3 in 1)			2 periods	NA	Girls only
SCHL#14	65	25	108	116	1966-2013	Popular Science Encyclopaedia (Vol 1 -11), Science & Invention (1 set); Dictionary of Mathematics (1971)		NLOR		42	Yes	Yes	2 periods	NA	Mixed
SCHL#15	247	110	139	373	1961-2016	Popular scientist, Young Scientist (1999) 2 copies	29	2	2	No	No	No	2 periods	A	Mixed
SCHL#16	275	29	45	110	1989-2016	Encyclopaedia (1961) a set	CLNA	1	1	Yes	Yes	Yes	2 periods	NA	Mixed
SCHL#17	50	50	55	50	1977-2016	Macmillan School Dictionary (2012) 8 copies	100	NLOR		No	No	No	2 periods	NA	Mixed
SCHL#18	89	86	188	148	1981-2016	Dictionary of Mathematics (2005) 15 copies	40	2	2	No (3 in 1)			2 periods	A	Mixed
SCHL#19	900	560	620	740	1988-2016	None	CLNA	1	1	Yes	No	No	2 periods	A	Mixed
SCHL#20	96	60	50	60	1981-2016	Macmillan School Dictionary (2012) 5 copies	CLNA	2	2	Yes	Yes	Yes	2 periods	NA	Mixed
SCHL#21	66	130	130	35	1965-2018	Encyclopaedia Britannica (1961); Universal Library (1969); Encyclopaedia Universe & dinosaurs (1 copy)	60	1	1	No	No	No	2 periods	NA	Mixed
SCHL#22	63	67	95	185	1981-2018	Encyclopaedia (1960 a set)	30	2	2	Yes	Yes	Yes	2 periods	NA	Boys only
SCHL#23	65	102	72	95	1980-2015	Popular scientist (1979) a set	CLNA	5	1	Yes	Yes	Yes	2 periods	A	Mixed
SCHL#24					1987-2013	American people (1962) a set	10	3	3	Yes	Yes	Yes	2 periods	NA	Mixed
SCHL#25	115	100	100	115	1987-2018	Encyclopaedia Lexicon Webster Dictionary (1971) 1 copy	CLNA	2	2	No	No	No	2 periods	A	Mixed
SCHL#26	63	70	80	106	1971-2016	Popular science (1980) 5 copies	CLNA	2	2	No	No	No	2 periods	NA	Mixed
SCHL#27	700	200	315	178	1976-2016	Popular science (1979); New standard Encyclopaedia, Science Essential (2010); Young Scientist Investigate; Electricity fiction (2007)	76	1	1	Yes	Yes	Yes	2 periods	NA	Girls only

Key: Y = Yes, N = No, MRC = Multichoice Resource Centre, CLNA = computer laboratory not available; 3 in 1 = (Multipurpose) one laboratory being used for physics, chemistry and biology, NLOR = Not lending out resources, A = Available, NA = Not available

5.5.2. ANALYSIS OF THE INTERVIEW CONDUCTED WITH SCHOOL PRINCIPLS AND EDUCATION STAKEHOLDERS

Presented in this section are the findings of the interviews with the school principals and other education major education stakeholders such as: Permanent Secretary of Ministry of Education, Science & Technology, Director of Planning, Research and Statistics, Teaching Service Commission (PR&S TESCOM), Director of State Library Board and area education officers (AEOs)

5.5.2.1. BACKGROUND INFORMATION

The background information of the school principals and education stakeholders (Permanent Secretary, Directors of Teaching Service Commission, Directors of State Library and Area Education Officers) in this study includes the gender, educational qualifications and years of working experience. The results are presented in table 5.48

Table 5.48: Background information of the school principals and education stakeholders

N = 33

Institution	Designation/coding	Gender	Educational qualification	Year of Experience
Ministry of Education	Permanent Secretary/PS	Female	PhD	31
Planning, Research ar Statistics, Teaching Service Commission	Director/PR&S, Director of TESCOM	Male	BSc Ed	34
State Library Board	Director/ Director of SLB	Female	M.L.I.S.	28
Area Education Office, Ado	Area Education Officer/AEO #1	Male	BSc Ed	31
Area Education Office, Ido	Area Education Officer/AEO #2	Female	PhD	24
Area Education Office, Ikere	Area Education Officer/AEO #3	Male	BSc Ed	25
Schools in Ado government	**Designation/coding**	**Gender**	**Educational qualification**	**Year of Experience**
School#1	School principal/SP#1	Female	M.ED	27
School#2	School principal/SP#2	Male	B.ED	34

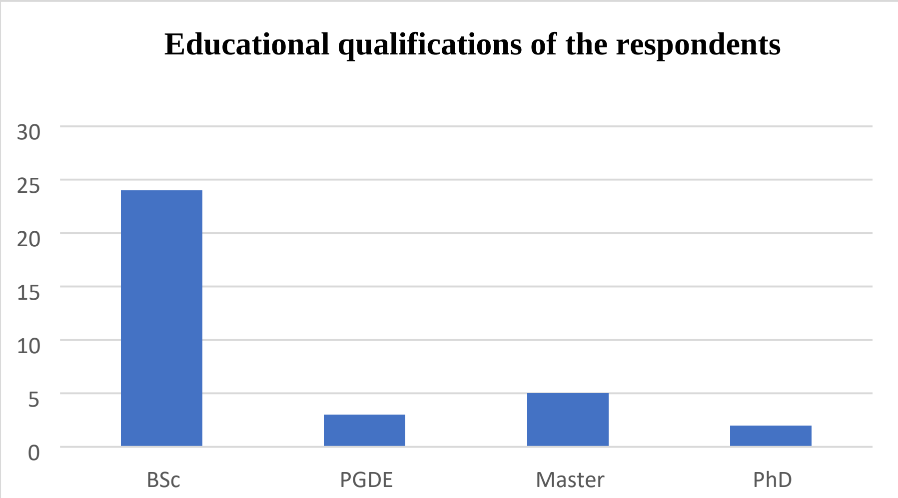
School#3	School principal/SP#3	Male	B.ED	23
School#4	School principal/SP#4	Female	B.ED	35
School#5	School principal/SP#5	Female	M.ED	33
School#6	School principal/SP#6	Male	BSc ED	34
School#7	School principal/SP#7	Male	PGDE	30
School#8	School principal/SP#8	Female	BA. ED	34
School#9	School principal/SP#9	Female	B.ED	33
Schools in Ido/Osi local government	**Designation/coding**	**Gender**	**Educational qualification**	**Year of Experience**
School#10	School principal/SP#10	Male	B.ED	34
School#11	School principal/SP#11	Male	BSc	33
School#12	School principal/SP#12	Female	BSc Ed	34
School#13	School principal/SP#13	Male	BSc Ed	30
School#14	School principal/SP#14	Male	B.ED	34
School#15	School principal/SP#15	Male	B.ED	33
School#16	School principal/SP#16	Male	B.ED	34
School#17	School principal/SP#17	Male	B.ED	31
School#18	School principal/SP#18	Male	B.ED	33
Schools in Ikere local government	**Designation/coding**	**Gender**	**Educational qualification**	**Year of Experience**
School#19	School principal/SP#19	Male	BSc	32
School#20	School principal/SP#20	Female	PGDE	32
School#21	School principal/SP#21	Female	M.ED	32
School#22	School principal/SP#22	Female	B.ED	21
School#23	School principal/SP#23	Male	PGDE	29
School#24	School principal/SP#24	Female	M.ED	20
School#25	School principal/SP#25	Female	BSc ED	30
School#26	School principal/SP#26	Female	PGDE	25
School#27	School principal/SP#27	Female	BSc	34

Gender

There were 13 female and 14 male principals. Of the six education stakeholders, three were female and three were male.

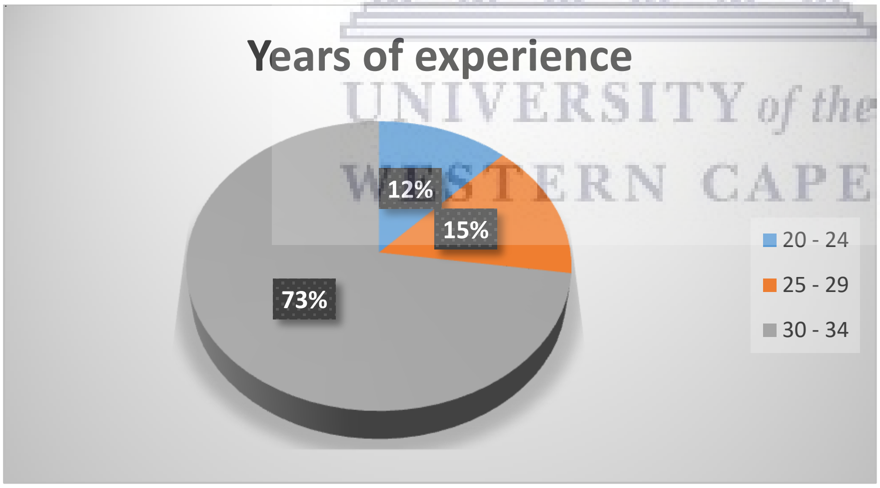
Educational qualifications

Of the school principals, 19 of the 27 had a first degree (BSc, BSc ED, BED), four had a Master’s degree, while four had a Post-Graduate Diploma in Education (PGDE). In the Ministry of Education, Science and Technology, two stakeholders (PS; AEO#2) had a PhD, while three (PR&S Director of TESCOM; AEO#1; AEO#3) of the respondents had first degree. Only the Director of the State Library Board had Master's degree. Detail results are presented in Figure 5.15.



N = 33
Figure 5.15: Educational qualifications of respondents

A majority (73%) of respondents had between 30 and 34 years of experience, 15% between 25 and 29 years, and 12% with 20 to 24 years of experience. Detail results are presented in Figure 5.16.



N = 33
Figure 5.16: Years of experience of school principals and education stakeholders

5.5.2.2. FINDINGS FROM THE INTERVIEWS WITH THE SCHOOL PRINCIPALS

Findings of the interviews with the school principals are presented in this section. The school principals' interview responses were helpful in answering some of the research questions such as: what is the status of secondary school libraries in Ekiti State, Nigeria? To what extent do the science teachers advocate using information resources beyond textbooks? The interviews with school principals were significant and valuable since they were the heads of schools where teaching and learning take place.

Introduction

There is no gainsaying that the school principal's support is important to the establishment and maintenance of functional school libraries. The principal who is the instructional leader of the school must offer support for the school library programme. Research has shown that the support of the principal for the school library development is crucial to its success. Therefore, it is important for the researcher to seek the views of the school principals about the library programme. The face-to-face interview is best used as part of a mixed methods approach. The researcher had interview sessions with the school principals of selected schools so as to seek further clarifications to any form of evasive answers supplied during the filling of interview questions. The dispatching of the interview questions took place in February, 2018 during the administration of the questionnaire to teachers, librarians and students in schools, while the interview took place in June, 2018 (see Appendix 1 for details of the dates) in the different schools. Nineteen principals granted face to face interview, while eight who declined face to face interview provided their answers in written form. Their reasons for decline were personal and political reasons such as; afraid of their statement being used against them as the state was preparing for gubernatorial election which was coming up October, 2018, others were not warm about recording their voice. However, for those who agreed for the interview, approval was granted for the recording of the interview with my personal android phone.

Firstly, the interview findings of the principals will be addressed followed by the findings of the interviews with the AEOs, director of State Library Board, director of the TESCOM and the PS respectively. The school principals are alternatively referred to as the respondents in these findings or when more accuracy is required, they will be referred to as a numbered interviewee: for example, interviewee SP#8 means interviewee number eight (see table 5.57 for details). The list of semi structured interview questions put to the school principals can be found in Appendix 5. The questioning revolved around information resources beyond textbooks; advocacy on using a wide range of information sources; the state of school libraries; employment of fulltime qualified school librarians; the library study period; and the state of science and computer laboratories in schools.

Information resources beyond textbooks

The school principals were asked if students are being encouraged to read and consult other information sources beyond their textbooks for their science subjects. If the answer is yes, they should explain how the students were being encouraged. If the answer is no, they should give reasons.

The qualitative findings revealed that all the principals except SP#12 answered in affirmative that their students were being encouraged to read and consult other information sources beyond their textbooks for their science subjects. They explained how the students were being encouraged in their respective schools. For instance, the respondent SP#2 said: "we create library study period in their weekly timetable for consultation and SP#6 said "we encourage students by telling them to visit the library on regular basis for evening preparatory classes, afternoon intervention classes and group discussion". Respondents SP#1: SP#4; SP#11; SP#15; SP#16; SP#17; SP#20; SP#22 and SP#26 said something along the same lines. SP#19 said "science teachers give them (students) assignments that are not in detail in their textbooks and ask them to go beyond their textbooks. Probing further on how and where students could get their information need, knowing that the school computer lab did not have internet connectivity. The SP#19 said that they could use their personal or parent's phone to browse. Respondents SP#3 said: "the schools encourage students to make use of laboratory equipment and attend science exhibitions. SP#5 said "by asking them (students) to look for information online, through internet." SP#10 said student are directly instructed to go online. Some questions are intentionally tailored for this purpose". SP#21; SP#23; SP#24 and SP#25 said something along the same lines. SP#22 said: "students were also supplied laptops by State Government for this purpose, though, they abused the privilege, the laptops were later retrieved from them".

According to respondents (SP#7 and SP#14), Ekiti State Government had just supplied schools with various textbooks which were kept in school libraries for use. These textbooks from government were supplied free of charge and are meant to be in the library. Though, students could borrow them depending on discretion of individual school libraries. Those whose parents could afford to buy textbooks still do and those who had phones could browse for further information needs. Those who could not afford to buy resulted to the library. These books and the ones donated by the Old Students' Association (OSA) and the Parents Teachers Association (PTA) are available in the school library. According to SP#15," students are usually encouraged to go to the school library to access those textbooks for their information needs. The school library is properly put in place in such a way that the books are arranged in groups of school subjects so that students can easily locate their needs. Also, the seats and tables are arranged such that each of the students can concentrate on their private reading. Equally, there is a 'school librarian' and language teacher (whom they commonly referred to as 'teacher librarian), to control the affairs of the students". However, these "teacher librarian' in most schools did not usually sit in the library as they had their tables and chairs located in staff general office with their counterparts.

Respondents SP#8 said: "students were always given assignments that required creative thinking on regular basis, this usually tasked them to do further study beyond what they were being taught in class. Since students have personal interest in knowing beyond the prescribed textbooks. SP#9; SP#18 and SP#26 said something along the lines. SP#16 said: "actually, we follow syllabus and there is scheme of work to be followed. Within the school system, we are not outside the syllabus, so, it is parents who are a little bit literate that will encourage their children to go beyond the syllabus, but for us we are following the real syllabus. We are having different textbooks in the library, the school is having all most all these reasonable authors. Most of them (students) browse through their handsets". The teachers and school authority always request from students to answer questions from any textbook they studied which are not in their disposal". "Students were encouraged since their teachers usually allow them to read other textbooks from the school library along with those supplied to the school by the state government" (respondent SP#11). However, a particular respondent (SP#12) had a divergent opinion on this issue. He rhetorically asked:

> "how do you expect a student who does not have the recommended textbook or could not afford to buy a textbook to read beyond the prescribed textbooks.

His response to the question: "No, most students don't even have the prescribed textbooks. So the idea of reading beyond their textbooks is unrealistic. Until the school library is well stocked with current books and internet facilities, it may be difficult for one to say students should read beyond prescribed textbooks".

Advocacy on using information resources beyond textbooks

On the issue of advocacy, using information resources beyond textbooks, the respondents mentioned different ways by which they ensure science teachers advocate using information resources beyond textbooks. Respondents SP#1 and SP#2 had this to say: by motivating, encouraging and telling science teachers that the various ways of seeking information resources beyond textbooks could improve their teaching skills. SP#15and SP#2 encourage science teachers to use internet services for more research, or improvise using locally made materials for effective teaching of the topic and organising quiz competitions and literary debates. However, none of these schools had internet access as at the time of visit.

In reacting to the question, SP#3 said: "teachers in the state were regularly sent for seminars and workshops for training and retraining. Science teachers are encouraged to make use of other resources such as charts on each subject, and other teaching aids for science teachers supplied by the State Government". According to SP#4, "there is net room (computer laboratory) in the school which is fully equipped in term of electronics. Science teachers usually go there (computer lab) to browse for information and facts on various topics they want to teach the students. They even use to take the students there to see for themselves". SP#23 said: "students are given project work to do at home which might require them going on internet, charts and excursion so as to get the work done". However, when respondents mentioned internet at home, they referred to individual/parent's phones or Cyber Cafés (business centres). Teachers are encouraged to go online to source for recent information and develop on their subject areas so as to be on the same level with their counterparts in advanced countries (SP#22; SP#23; SP#24). It is worthy to know that when the respondents mentioned internet at home, they referred to individual/parent's phones or cyber Café (this is business centre, which is lacking in rural areas).

Information technology is an integral part of school curriculum, students have been made aware of the internet as a veritable tool of research material and knowledge. Therefore, teachers are encouraged to frequently use the internet, and design some specific questions for the purpose of internet research for students. For this purpose, teachers were supplied laptops and iPads and they were being monitored to be sure they use them as teaching aids in showing the students some concepts/terminologies that are technical in nature. Interacting with some computer teachers in schools, in house training was once organized for teachers on how to use computer to prepare lesson notes, result sheet, etc. The reason why the training had not been regularly organized was that government has not been encouraging them in term of providing logistics. In addition, teachers are mandated to give assignments and practical work to students on a regular basis so as to make use of other sources different from their recommended textbooks, this is a deliberate policy (SP#9; SP#10). Disappointingly, the researcher observed during the visitation to the schools that, there was no internet services in the majority of schools, though, a principal (SP#22) claimed the subscription was just due for renewal some months ago and they were waiting for the government to renew it for the school.

State of libraries in schools

In a bid to find out the state of school libraries, a question was put to the school principals: are libraries in schools adequately equipped in term of **resources** and **qualified personnel? Yes/No.** If **No**, then what are you doing to guarantee that the school libraries are well equipped both in term of **resources and qualified personnel** to serve science teachers and science students for greater curriculum implementation?

In reacting to the question, most of the respondents (SP#1; SP#3; SP#6; SP#7; SP#10; SP#11; SP#12; SP#13; SP#15; SP#16; SP#18; SP#21; SP#22; SP#23; SP#25 SP#26; SP#27) were not happy about the state of their school libraries as they described them to be in state of disrepair. The respondents, however, highlighted various steps they have taken to ensure their school libraries are well equipped to better the lot of both teachers and students in their curriculum implementation. For instance, SP#1 said: "I had informed the government of our needs to acquire more relevant textbooks in the library for teachers and students use".

However, SP#17 said: "my library is fairly equipped in terms of resources, while unqualified personnel are the ones still managing the library. Though, a letter had been written to the Ministry of Education requesting for qualified librarians so as to man the affairs of library in the school". The issue of unqualified personnel managing school libraries was attributed to the state's financial predicament. This must have contributed to the alternative ways of sourcing for fund. For example, SP#21 stated that: "my school has a small room for the library which is not adequate. The school, with the aid of the Old Students Association (OSA), is working on getting a better library for the school". SP#3 stated: "we appealed to the state government, Parents Teachers Association (PTA) as well as OSA of the school to help organise appeal for fund for development of the library".

Furthermore, it seemed some schools had resigned themselves to not getting qualified personnel for their school libraries as they made do with whoever that is posted to them. They send their unqualified library staff for training on how to manage the library. In some schools, one of the principals (SP#22) expressed his plight in clear term by saying "it is government that used to employ the librarians to the schools, the schools on its own supports the librarians from the government with English teacher.

Employment of fulltime qualified school librarians

A fulltime, qualified librarian is one of the attributes/hallmarks of a good, standard library. Consequently, a question on how to ensure that fulltime qualified librarians are the ones managing school libraries was put the school principals. In responding to this question, most of the respondents stated that they had little or nothing to do with employing qualified librarians to manage their libraries as the onus of employing the school librarians rested on the state government, and that they only make use of who is posted to school libraries. SP#3 lamented that: "government always employs Senior School Certificate Examination (SSCE) holders to manage school libraries in the state". SP#11 said: "schools have no power than to accept whosoever that is posted to us" since it is government that employs and posts library staff to the schools, though their (librarians) activities are being monitored (SP#21). This was confirmed by the researcher during the visit to school libraries that almost all the staff managing school libraries were not qualified as the majority of them (percentage) do not possess any qualification in the field of librarianship.

Library study period

Before any school can talk of adopting an inquiry-based approach there must be time or a period created for students in the school timetable to use the library. Based on this, a question was put to respondents: does your school have a library study period? If it does, how often do classes visit the school library? If it does not, what are the plans to ensure that students use the library? Almost half of the school principals (SP#3; SP#4; SP#5; SP#7; SP#9; SP#12; SP#13; SP#20; SP#21; SP#22; SP#24; SP#25) said they had no library study period, but the principals said students were being encouraged to use the library during lunch break, free periods or weekends since some schools are full boarding schools. The encouragement giving by many of the principals implies they recognised the significance of their school libraries and librarians in curriculum implementation, which is in concordance with Shannon's (2009) study.

However, there were only five boarding schools (SCHL#5; SCHL#6; SCHL#13; SCHL#24 and SCHL#27) among the selected samples but it was only one school (SCHL#24) operating as full boarding. It should be noted that Ekiti State had five full boarding schools. Further, it was observed by the researcher that the school timetable hardly had more than a free period due to many subjects being offered by the students. Even those schools which had library study periods, the small size of the school libraries was identified as a constraint to using the library. For instance, SP#25 said that his library could not contain a class of 40 students at a time (not to talk of average class of 80 and above). Instead of asking students to visit the library, they were advised to stay back and read in their classes during the library periods. This ill advice by the principal could be attributed to the belief that students' performance usually revolves around only teaching and learning in class (Oberg, 2006). However, for any effective teaching and learning to take place, there should be access to a well-equipped library that could assist teachers in presenting their lessons. Librarians should always initiate collaboration with teachers as this is one of the ways principals could be convinced about the significance of school library programme to science curriculum implementation (Church, 2010).

State of science and computer laboratories in schools

Research has revealed that science and computer laboratories are one of the predictors of Science curriculum implementation in schools. In view of this, a question was put to respondents: are science and computer laboratories in your school adequately equipped to serve science teachers and students for curriculum implementation? If No, then what is the school doing to ensure that the laboratories in schools are well equipped? If yes, describe the state of the science and computer laboratories in your school.

The majority of the principals except (SP#11; SP#12; SP#13; SP#15; SP#16; SP#19; SP#21; SP#23; SP#24; SP#25; SP#26 and SP#27) claimed that their science and computer laboratories were either well equipped or fairly equipped described the state of their respective laboratories. SP#6 said: "our computer laboratory was equipped by MTN to accommodate modern equipment for optimal performance", while respondent (SP#20) described the computer laboratory as well equipped but decried the condition of science laboratories in his school. SP#22 said: "I am satisfied with the state of science and computer laboratories in my school, as government supplies computer and science equipment to the school through State Education Programme Investment Project (SEPIP), a World Bank Project".

However, some respondents described the state of laboratories in their schools as poor and their environment not conducive to teaching and learning (SP#15). SP#12 said: "our laboratories were not well equipped but government is now intensifying effort to equip science laboratories, while there were appreciable efforts in providing items like projectors, laptops for the school, no computer laboratory building to house these items for effective use".

Further to the inadequacies, SP#19 explained how they were trying to involve the PTA and OSA to assist in equipping the science and computer laboratories. Although, he added that government was trying to bridge this gap as it had supplied the school with some science apparatus. Similarly, SP#24 said: "the OSA is equally trying to see what it could do to refurbish the science laboratory's dilapidated buildings, and supply more computers to better the education standard".

General comments

Respondents were asked to freely comment on any area they think the interview had not covered. SP#2 said Information Technologies (ITs) such as satellites and rockets should have been included as part of ICT facilities in the study. SP#3 said that how to generate funds to equip a school library, science and computer laboratories in order to facilitate teaching and learning process should have been included. SP#6 said that in this generation, an e-library is all that schools needed for holistic and overall development of the system. This is not yet put in place by government. SP#8 hammered on about more periods on the school timetable for science subjects' practical work. However, the researcher observed in the school timetable that virtually all schools had not more than two periods of 45 minutes each per week on their timetable for science subjects' practical work.

5.5.2.3. FINDINGS FROM THE INTERVIEWS WITH THE AREA EDUCATION OFFICERS

Introduction

In addition to the 19 principals interviewed, three area education officers (AEOs), director of State Library Board, director of the Teaching Service Commission (TESCOM) and the Permanent Secretary (PS), Ministry of Education, Science & Technology were also interviewed individually. The findings of the four groups, principals, AEOs, director of State Library Board, director of the TESCOM and the PS, will be reported on separately. These interviews took place both in rural and urban areas where the researcher had to travel distances to conduct the interviews. The data collected from the area education officers (AEO) were equally helpful and assisted in clarifying some questions in the study. The decision to interview the area education officers was based on the fact that they are the ones in charge of affairs of all the schools in each local government. They report directly to the Ministry of Education, Science & Technology. The researcher contacted each of the AEOs during the dispatching of the interview guide in the respective local government. The three AEOs were to be interviewed but unfortunately one was unable to grant the face to face interview as he travelled for official assignment outside the state when the researcher got to his office. Though, he supplied his answers in written form with the aid of interview guide earlier dispatched to him. In the end, two of the three AEOs were interviewed, one is responsible for schools in a rural area (AEO#1) and the other for schools in an urban area (AEO#2). Their names are coded with AEO#1, AEO#2 and AEO#3 respectively to protect their anonymity.

The researcher in the course of the interview referred and equally drew the attention of AEOs to the current Nigerian 2007 Curriculum, where there is no provision for a mode of assessment that requires students to read beyond textbooks. It is recognised worldwide that knowledge societies require citizens to be able to access and utilise various sources of information resources (in any format, e.g. physical or digital) to make well informed decisions, weigh evidence, solve problems, or generate new knowledge. Just like the interviews with school principals, each individual interview did not take more than 30 minutes. The interviews were recorded with permission and the recordings transcribed. The interview questions (see Appendix 6) revolve around: seeking information resources beyond textbooks; advocacy on using information resources beyond textbooks; state of school libraries in the state in terms of resources and personnel; employment of fulltime qualified school librarians; library study period and state of science and computer laboratories in schools.

Seeking information resources beyond textbooks

On a question for stakeholders on how they ensure students read beyond textbooks, AEO#1; said: "teachers were advised to always give assignments that require students to note and observe some things in the environment, with this they may be curious to research more on every issue by going online for further information on any assignments given to them". Besides, teachers were requested to conduct a 'principal's test', a test usually conducted by first week of each term. In fielding the question, AEO#2 said:

> I always tell teachers to encourage their students by making them to know the importance and essence of reading beyond textbooks. Also, by providing access to

> other materials different from their prescribed textbooks. So, if you want them to read beyond textbooks, the teachers can give them assignment. They (students) will want to read and find answer to those questions, and even the teachers, after given the assignment, they should mark and sanction any students that did not comply or do the assignment, by coming to school the following day, the students will ensure that they do their assignments. Another thing is that they (students) can engage in group activities because group activities can bring out ideas. Also, the teachers used to give their students holiday assignment instead of them playing. In the first week of resumption, they will engage them in principal or commissioner test as it is being called in the schools (the first test in each term). So, with these, you know the students will have to read wide before the resumption. Another thing is that we have some that can browse, they use their phones to do their assignments.

One respondent (AEO#3) said it is regularly recommended to the Ministry of Education, Ado-Ekiti, that every student in all public schools be provided laptops to enable them to google, send and receive information online". With this, students would be able to browse and read ahead and beyond their textbooks. However, the researcher observed that there was no functioning internet facility in any of the schools at the time of visitation. This prompted a further probe on how students were expected to go online for information needs for their assignments. Though, researcher was earlier made to understand that schools were expected to use modems with individual laptops to browse. In addition, students were also expected to access information online via their personal phones or parents' phones as the case may be. It is presumptuous for public schools to expect parents/students to purchase their own data for accessing the internet. In Nigeria, many parents who are either poor or low earning put their children in public schools, while the affluent put theirs in private schools, which they believe are better equipped for teaching and learning.

Advocacy on using information resources beyond textbooks

Teachers are the major stakeholders when it comes to advocacy on using information resources beyond textbooks. It is on this note that the researcher intended to know how the AEOs have been motivating and encouraging teachers to advocate for information beyond textbooks. There are different ways in which to encourage and motivate teachers ranging from querying the existing assumptions a result of technological advancement, recommending teachers for seminars, workshops and conferences. All three AEOs made their point that:

> by observing what goes on in their (schools) environment so as to query the existing laws and assumptions that are obsolete as a result of technological advancement" (AEO#1). "By providing required materials and incentives that will further motivate and encourage them (science teachers).

Further, the respondent AEO#2 said: "by recommending teachers for workshops and ask them for improvisation of materials as teaching aid where necessary". Also, Ministry of Education, Science & Technology has been advised to supply all science teachers with laptops/computers with internet facilities so as to meet up with technological advancement of downloading vital information and updating themselves in their areas of specialisation (AEO#3).

State of school libraries

It is understandable at any level of secondary school education that when you request students to read beyond their recommended textbooks the first place that readily comes to mind is the school library. Therefore, it is on this assumption that the researcher tried to find out from AEOs the state of school libraries in term of resources and qualified personnel in their respective local governments. Some of their responses were in tandem with that of school principals. For instance, AEO#1 stated:

> equipping school libraries in terms of resources and qualified personnel is beyond my capacity as AEO, I only make recommendations to higher authorities anytime there is opportunity to do so. I write report to the Ministry of Education based on our assessment, observation and feedback received from school principals.

The school libraries cannot be said to be well equipped in term of resources, however, the library staff in my jurisdiction have been recommended for training so as to be able to carry out effective service delivery that would aid/improve teachers' curriculum implementation and students' academic performance (AEO#2). There are new subjects/topics in the syllabus which many library books do not conform with. Therefore, government is being informed about the deplorable condition of school libraries and recommendations are being made for more current and relevant resources and qualified personnel (AEO#3).

Employment of fulltime qualified school librarians

Fulltime qualified librarians have been proven to be one of the yardsticks in measuring the standard of any school library. Having visited schools, the researcher discovered that the majority of those managing the libraries were not qualified as they did not have any qualification in the field of Library and Information Science. Armed with this information, the researcher planned to find out from AEOs their role in ensuring that fulltime qualified staff are the ones managing the libraries. Fielding the question, AEO#1 said that school principals have been requested to write through to her office the Permanent Secretary, Ministry of Education, Science & Technology on the need to employ qualified librarians to manage their libraries, while two AEOs stated that it is only the Ministry of Education that could employ qualified school librarians to manage the school libraries. AEOs could only recommend to the Ministry of Education to employ qualified school librarians into school libraries across the local governments (AEO#2 and AEO#3). It can be deduced from this that the onus of employing staff rests squarely on the Ministry of Education, Science & Technology.

Library study period

Just like a question for education stakeholders on the plan to ensure that schools create time for students to use library, a similar question put to the principals about a library study period was put to the AEOs. Some of the respondents said school principals have been instructed to use their discretion to create a library study period and ensure their students use the library during their free period (AEO#1; AEO#2), while AEO#3 said: 'it has been recommended to Ministry of Education to re arrange the time table in a way to accommodate library study period.

5.5.2.4. FINDINGS FROM THE INTERVIEWS WITH THE DIRECTOR OF STATE LIBRARY BOARD

The data collected from the director assisted in answering more specifically research question one: What is the status of secondary school libraries in Ekiti State? The interview with the director of State Library Board equally helped in providing insight into how the libraries in schools were being managed both in term of resources and personnel.

Introduction

The director of the State Library Board was interviewed because of the oversight role function the board plays in school library activities and training of library staff. Interview sessions were held with the Director, State Library Board as a follow up to the previously filled interview questions. This was to further seek clarification to any form of evasive answers supplied in the interview answers. The interview was recorded with permission on a personal android phone. The interview was transcribed. The types of questions posed related to school library resources, qualifications of school library personnel, management of school libraries, and the library study period.

State of school libraries

From the response of the Director, it seemed this unique oversight role has not been well discharged. For instance, when asked the question about the condition of school libraries in the state, she replied that the condition of school libraries was appalling and said: "the onus of employment and equipping the library rests with the state government, the State Library Board only monitors regularly to guarantee that all libraries in schools are well managed'. This is done by the provision of regular training to the staff employed to manage the libraries. Probing further on how to ensure that qualified personnel are the ones managing the school libraries, the Director said they had recommended to state government to have a special salary scale, just like medical personnel, for school librarians. This will motivate them to stay and work in schools, since librarians in the state are rare species, the few would prefer to work in tertiary institutions where they would be well remunerated.

Employment of fulltime qualified school librarians

When asked how she ensures that fulltime qualified librarians are the ones managing school libraries, the Director of the State Library Board said: "despite the fact that the onus of employment rests with the state government, the State Library Board still organises training for staff managing the school libraries in the state so as to be able to carry out effective service implementation". Therefore, the implication is that until the government freely and completely involves the State Library Board in all affairs (ranging from selection, acquisition and recruitment of personnel) of the school library, little or nothing could be achieved by the Board.

Library study period

It was observed during the researcher's visitation to schools that some of the schools do not have a "library study period". The Director of State Library Board was asked her plan to ensure that schools create time for students to use the library. She responded that:

> there is standing instruction that all schools in the state should create library study period on their timetables. However, since library is not a teaching course, some schools make use of this library study period to meet up with other subjects, which we are not happy about. The State Library Board is making a move to ensure that all schools who are using library study period for other subjects comply with the standing instruction.

5.5.2.5. FINDINGS FROM THE INTERVIEWS WITH THE DIRECTOR OF TEACHING SERVICE COMMISSION

The knowledge society requires that citizens should be able to access and utilise various sources of information (both physical and digital format) to be able make informed decisions, weigh evidence, solve problems, or generate new knowledge. There are some crucial extrinsic factors that contribute to achieving inquiry-based learning. Factors such as: state of school libraries and state of library resources; presence of fulltime qualified school librarians in schools; creation of library study period and state of science and computer laboratories in schools. Similar to the interviews conducted with other respondents, the researcher had interview session with the director of TESCOM who deals with employment and promotion, posts, the welfare of teachers, library staff and other non-teaching staff in secondary schools.

Seeking information resources beyond textbooks

In the course of the interview the researcher drew the attention of Director of PR&S TESCOM to the current Nigerian 2007 Curriculum, where there is no provision for the mode of assessment that requires students to read any other texts but the recommended ones. Based on this, a question on how students are being encouraged to seek information resources beyond their recommended texts was put to the Director of PR&S TESCOM. Here is his response:

> assessment of students is not limited to written or oral test, most times projects are undertaken. These projects when given are directed at specific issues and on specific location. This would compel the students to carry out research going into reading through different literatures and findings on related projects.

Probing further if there is anything that could done to incorporate into the curriculum any form of assessment that could make students to seek a variety of information resources. Director of PR&S TESCOM explained that the curriculum is being designed at national level, apart from recommendations, there is little or nothing anybody could do other than to key in to it.

However, there are marking schemes (see Appendix 34 for the four science subjects) designed by these exam bodies (e.g. WAEC, NECO, etc.) that every science teacher is expected to follow or use when assessing students on any of these science subjects.

Advocacy on using information resources beyond textbooks

Teachers in schools are the ones who directly deal with students during the course of teaching and learning. In this case, they need to advocate for using a wide variety of information sources. It is in this view the researcher asked the Director of PR&S TESCOM, being the one coordinating the activities of teachers in the state, the ways in which he has been encouraging and motivating teachers to use various information sources. In responding, the Director of PR&S TESCOM said that:

> all teachers (science teachers inclusive) were supplied laptops, and Government is planning to introduce e-library in 12 public schools that would serve as models pending the time e-library will be generalised in all schools. All students in senior classes were supplied laptops free of charge by the state government".

However, supplying laptops to teachers and students without internet facilities may still not guarantee the inquiry-based learning in schools. The researcher later followed up to enquire about the 12 pilot schools that would serve as a model for others. What about 12 pilot schools you said earlier would serve as a model for others?

Response:

> That is one thing about projects, when there is change in government, there would be a sort of hindrance on the continuity of such project. By that time, the plan was to use 12 schools as model and they were selected in such a way that cut across 6 federal constituencies in the state. Two were picked from each constituencies. I am sure these model schools had internet facilities but not sure whether there was internet connectivity for people to use their handsets, laptops. Though, students too were encouraged to buy data on their "tablet' to browse because we had even instructed the teachers to give them assignments that would challenge them enough so as to make

them to browse for the information on the internet. There were internet facilities in few schools but subscription may be the problem and schools seemed not to be ready for subscription.

Asking if it is not the government's responsibility to subscribe for schools. The PR&S TESCOM Director explained:

> No, government cannot be subscribing, the cost will be enormous for government. When schools subscribe which I believe is not much they will able to exercise a sort of control on the usage of the internet, probably they will have a particular period of the day which users will be allowed to make use of the facilities but if it is government subscribing it could be open 24 hours a day, seven days a week.
>
> Financially, is there provision for schools to subscribe? Yes, there were many sources such could be financed. For example, every school is given what is called "school improvement grants". Though, it is not designed for internet subscription. For secondary school, it is seven hundred thousand naira (₦700,000.00) about ($2,000.00) annually, which is aside from school grant for administrative purposes. This particular grant is from "World Bank Assisted Project". Here they are required to draw their plan for the year, tell the government through the Ministry of Education what they intend to use money for that would bring improvement to the school, such improvement that could easily being linked with student performance. So, when you bring the plan, if it is approved they give you your ₦700,000.00. So, any school that has facilities for internet what we expect is to put it in their plan the subscription kind of a thing so from time to time they would have sufficient money to subscribe. Even though they have not said the money is for internet subscription. Some schools buy projects like generators from it, some use the money to get part-time teachers. It depends on their priorities. Under SEPIP arrangement, we bought modems for them so that they could buy data on it. Though, that is at minimal scale. So, there is hardly any school without HP laptops with modems but on the larger scale where they can connect to desktops for all the students and teachers, which is Herculean task.

Further clarification was sought on the way they encourage and motivate teachers in advocating for using information resources beyond recommended textbooks. PR&S TESCOM Director responded:

For teachers, school could come to their aid. Before teachers could ask students to browse on internet for information, they themselves must have gone there to know the kind of information that is available and you are expecting the students to give out to you. In this way, subject teachers could be assisted in schools to pay for their subscription. We have PTA levy that parents pay for their children. This money is being controlled by schools and parents jointly. If the principal is able to convince the PTA management or executive members that a certain part of the money will be used for subscription for teachers so that they will have access to the internet, they can oblige. This is a way of motivating and encouraging teachers.

State of school libraries

Any library that is expected to discharge its responsibility of selecting, acquiring, processing and disseminating "the right information to the right users at the right time" must be equipped with current resources and fulltime qualified personnel. This has been advocated by several scholars (Small, Snyder & Parker, 2009; Lance and Hofschire, 2012; Kachel, 2013 and Gretes, 2013) across the world. In the light of this, the views of the Director of PR&S TESCOM were sought about the state of school libraries in term of resources and personnel. The Director of PR&S TESCOM decried the poor condition of school libraries in the state but were quick to say that the present administration has been trying to turn things around for the better. Here is his statement:

> most staff serving in the libraries are not actually those who read the Library Studies in higher institutions. They are merely library assistants. However, with the upgrading of the libraries (already being envisaged) the respective personnel would equally be reviewed and upgraded to conform with e-library. That is the next level being envisaged.

Employment of fulltime qualified school librarians

One of the expected roles to be offered by school librarian is intellectual, physical and digital access to library resources in all formats – print, non-print, electronic, computer hardware platforms, operating systems, storage devices, computer network resources, electronic databases, and e-books (AASL, 2016) for use (reading, study, research, consultation, etc.) by not only students and teachers but the entire school community (Williams & Coles, 2007). Libraries and qualified librarians have assisted teachers in identifying invaluable library resources through collaboration with meaningful goals, such as: lesson development and curriculum planning. This form of collaboration has helped in integrating research-based content into teaching practices, which has resulted in high test scores, as seen in several studies across the United States as well as European countries such as the UK and Netherlands (New York Comprehensive Center, 2011; Nielen & Bus, 2015; William, Wavell & Morrison, 2013). In terms of fulltime qualified librarians to manage the school libraries, the Director of PR&S TESCOM said:

> presently, most of the libraries are being managed by library assistants but these library assistants are being encouraged to embark on further studies (Library Studies).
>
> Those interested were granted study-leave with pay and on completion of their studies, they would not only be reabsorbed but granted conversion (upgrading) approval.

Library study period

The researcher observed during his visitation to schools, that some schools did not have “library study period” reflected on their timetables. This called for posing the question to the Director of PR&S TESCOM to know his plan to ensure that schools create time for students to use library. Here is his response:

> it is a fact that specific periods were not allotted for library study period in some schools but there is still a standing instruction that all free periods up to 4 periods of 45 minutes each in a week are to be spent for private reading in the school libraries.

State of science and computer laboratories in schools

Science and computer laboratories play a crucial role in the science curriculum implementation. It is in this regard that the researcher wanted to find out the condition of science and computer laboratories in schools. A question was put to the Director of PR&S TESCOM in this respect. This is his comment:

> both science and computer laboratories are from time to time equipped directly or indirectly by the state government. Large chunk of the yearly School Improvement Grant (SIG), ₦700,000.00 is being set aside for each school for procurement of science equipment. Aside from this, government goes to direct purchase of science equipment which is distributed on a yearly basis to all public schools in the state. Science teachers also undergo training on a regular basis.

Indeed, as observed by the researcher at the schools visited, a large number of science apparatuses (both consumable and non-consumable) were just supplied to most of the schools by the State Government with the aid of SEPIP, a World Bank Project. However, with the problem of space, some schools have resorted to a multipurpose (three in one) laboratory to be able to accommodate these apparatuses.

General comments

The director of PR&S TESCOM was asked to freely comment on any area he felt the interview had not covered. The director mentioned other areas government encourages and motivates teachers to include: the training of science teachers; exam coordination by teachers; granting of scholarships to encourage science students; study leave with pay for teachers and library staff to encourage further studies and payment of 20% of basic salary as core subject allowance on a monthly basis. These are what government is doing to encourage not only science teachers but other teachers as well.

5.5.2.6. FINDINGS FROM THE INTERVIEWS WITH THE PERMANENT SECRETARY

The Permanent Secretary was interviewed because she is the overall head of the Ministry of Education, Science & Technology, the ministry that oversees any activity concerning education in the state. The data collected from the Permanent Secretary covered broad topics such as: information resources in schools; advocacy on using various information sources; state of school libraries in the state in term of resources and personnel; employment of fulltime qualified school librarians; the library study period and state of science and computer laboratories in schools. After dispatching the interview guide to the Permanent Secretary (PS) around February, 2018, the researcher later interviewed her around June, 2018. Approval was granted for the recording of the face-to-face interview.

Seeking information resources beyond textbooks

The interview enquired about how students are being encouraged to read and consult a wide variety of information sources not only their textbooks for their science subjects. The Permanent Secretary succinctly said:

> we put their (students) recommended textbooks in the school libraries. Many students do not have these textbooks, so they have to compulsorily use the library. Though, some may copy from their friends, which is too bad, as we do not have control over this.

On seeking further clarification on the issues of seeking information resources beyond textbooks, knowing fully well that none of the school computer labs visited had Wi-Fi/ internet for both teachers and students to use. The researcher was informed by the PS that:

> the Ministry of Education just had meeting yesterday (29/01/2019) to deliberate on the proposals submitted by some contractors on getting schools in the state with Wi-Fi/ internet. She said before the end of the term hopefully there would be Wi-Fi/ internet in all schools in the state.

The plan to ensure that all schools in the state have Wi-Fi/internet is still in the pipeline. As it is, individual teachers and students look for ways of getting information online, either through their personal phones or parents' phones as the case may be.

Advocacy on using information resources beyond textbooks

Inquiry-based learning (IBL) is one in which student actively engages with diverse and often conflicting sources of information and ideas, to build new understandings, and to develop personal viewpoints and perspectives. The power of the inquiry-based approach to teaching and learning science is its potential to increase intellectual engagement and foster deep understanding through the development of a hands-on, minds-on and research-based disposition towards teaching and learning science in a country which seeks to build a knowledge-based society. To find out the ways in which science teachers are being encouraged and motivated in advocating using information resources beyond textbooks, the PS's plans were sought. The PS said that:

> schools were enrolled for science quiz and inventions competitions stately, nationally and internationally. Therefore, winners are encouraged with handsome prizes, such as scholarships, monetary prizes, laptops, travels, etc. Also, recognition from State Governor and government is a big deal to motivate teachers in encouraging students to read from other sources of information.

According to PS, some of national competitions for science students are; *Cowbellpedia* and *Mathematics & Science Olympiad*. The PS invited the director of STEM to shed more light on the competitions students usually go for. According to him: *Cowbellpedia* competition is centred on competition on mathematics, while *Mathematics & Science Olympiad* is competition on mathematics, physics, chemistry and biology. Asking why the Ekiti students have not been participating in international competitions, the director of STEM said that they have been participating. He said: "for instance, I was the one that led Ekiti students to

Oldham International Debate that held in April, 2017 in Singapore". The researcher then specifically asked why Ekiti students have not being participating in international assessments such as Trends in International Mathematics and Science Study (TIMMS). The director succinctly responded: "they have not been receiving invitation for that".

On seeking further clarification on the issues of seeking information resources beyond textbooks, knowing fully well that none of the school computer labs visited had Wi-Fi/ internet for both teachers and students to use. I was informed by the PS that the Ministry of Education just had meeting yesterday (29/01/2019) to deliberate on the proposals submitted by some contractors on getting schools in the state with Wi-Fi/internet as earlier mentioned.

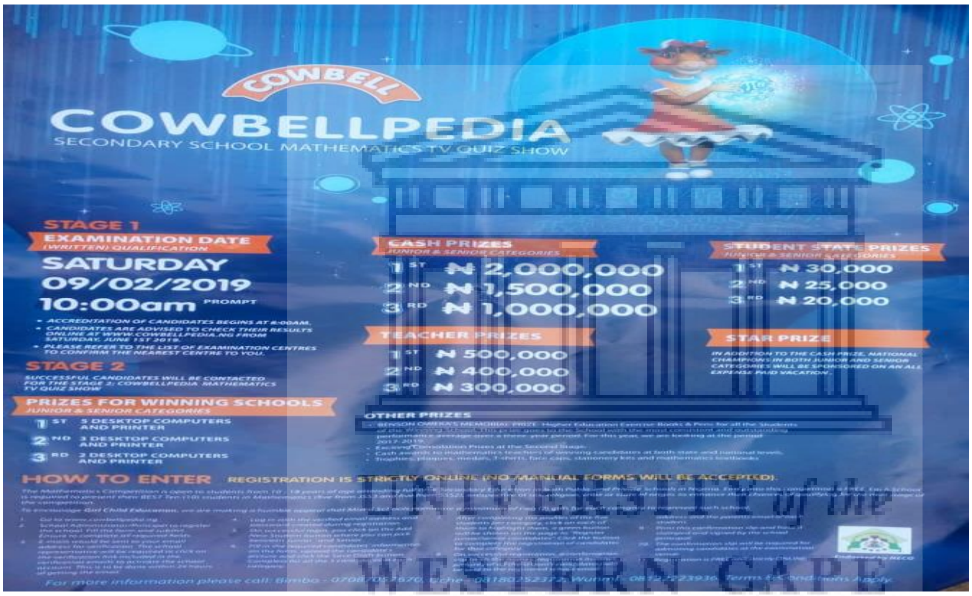


Figure 5.17: Poster of one of the national science competitions in Nigeria

Source: https://www.lasuinfo.com/2018/01/cowbellpedia-mathematics-competition-guidelines.html

State of school libraries

This section enquires about the state of libraries in term of resources and qualified personnel. The PS agreed that most school libraries in the state were not well equipped in term of resources and qualified personnel but pointed out that government has been trying to equip school libraries with current resources. She said:

> they (trained librarians) were 'rare species' in the state. They were not many and the few available ones would not want to work in school libraries. However, the state

government is trying to ensure that there are designated libraries in some schools. These designated libraries would serve as a model for other schools to emulate.

This is in line with the statement of director of TESCOM that stated: “with the upgrading of the libraries (already being envisaged) the respective personnel would equally be reviewed and upgraded to conform with an e-library. This is the next level being envisaged.

In the course of the interview, the PS made it clear that the state of libraries in term of resources and personnel was mediocre. Several studies found that the library, that is being managed by fulltime qualified librarians, impacts positively on students’ performance. It is on this note that the researcher tried to find out from the PS her plans to ensure that libraries in the state are being managed by fulltime qualified librarians. In reaction to the question, the PS regrettably said: “it is almost impossible to achieve this because: first; they (qualified librarians) would not apply to work in secondary schools, second; economic predicament forestalls the employment of few available ones into the library”.

Library study period

During the visitation of researcher to schools, it was observed that most of the schools did not have a “library study period”. Based on this, enquiries were made from the PS about her plans to ensure that schools create time for students to use the library. It seems a daunting task to achieve the inclusion of the ‘library study period’ in the timetable of all the schools in the state. There are many subjects to be taken by students in the senior classes as outlined in the current 2007 Curriculum. The PS responded:

> while I was the Director of Library Services, the Ministry of Education issued a standing instruction on this but with the 2007 National Education Curriculum (designed by Nigerian Educational Research and Development Council) with so many subjects (46 or there about) the time has been crowded out, but we would look in to how library study period in all schools in the state could be achieved.

State of science and computer laboratories in schools

The presence of functional computer and science laboratories in schools has been regarded as one of the predictors of science curriculum implementation. The PS revealed that the State, with the assistance of SEPIP, had 12 pilot schools using laptops. She added that all schools will hopefully participate as from later in the year 2018. However, up till January 2019 when the researcher went back for further clarification on some issues, this laudable plan had not been achieved. The reason, according to the PS, was due to change of government.

5.5.2.7. CONCLUSION

Twenty-seven schools were selected for this study, eight of these schools were 'single schools' (4 boys only and 4 girls only), while the rest were mixed. Five education stakeholders and 19 school principals who were male dominated were interviewed face to face. Majority of school principals had bachelor of education (BED) in their various disciplines, while only two of education stakeholders had PhD degree, one with master degree, while the rest had BSc/BED. In addition, majority of the principals had worked between 30 to 34 years, while most of education stakeholders had worked for more than thirty years and the rest had worked between 21-30 years.

Most of school principals and education stakeholders played active role in encouraging their students to read and consult other information sources beyond their textbooks for their information needs. However, school principals who deplored the state of the school libraries as abysmal, listed some steps taken to ensure the libraries were well equipped both in term of information resources and fulltime qualified personnel. Each library was staffed with one Library Assistant who was being supervised by a Teacher (commonly, English teacher) as majority of these staff had no qualifications in librarianship. None of the library actually processed (catalogued and classified) its resources, though the resources were arranged on the shelves according to the subject's disciplines for easy retrieval. Information resources in all the libraries were majorly textbooks as some libraries did not have appreciable number of text on physics. Many of the school libraries did not have lending policies on the number of resources/books to lend out at a time as individual library applied its discretion on this. Averagely, there is presence of science and computer laboratories in all the schools. Shockingly, some schools were still operating '3 in 1 (multipurpose) laboratory.

Lastly, there seemed to be a paradigm shift in schools as computer laboratories in some schools were being complemented or replaced with Computer Resource Centre called MRC, a project sponsored by *Multichoice*, South Africa as teaching aid for both the teachers and students.

5.6. GENERAL CONCLUSION FOR CHAPTER FIVE

The findings gathered through questionnaires for school librarians, science teachers and science students were first presented in this chapter, followed by the findings from interviews of 27 school principals who were male dominated and six education stakeholders and observation/documentary analysis in the twenty-seven sample schools. Eight of these schools were ‘single schools’ (4 boys only and 4 girls only), while the rest were (mixed) co-ed.
Majority of the school librarians had B.Sc. /HND in other disciplines followed by those who did not possess more that Senior School Certificate Examination (SSCE), while no respondents had Bachelor’s degree in Library and Information studies (B.L.I.S.). Besides, majority of the school librarians had working experience between 10-14 years. However, the educational qualifications of majority of science teachers was B.Sc., while those with HND and PGDE were less than 4%, while majority of school principals had bachelor of education (BED) in their various disciplines, and two of education stakeholders had PhD degree, one with master degree, while three had BSc/BED. In addition, majority of the principals had worked between 30 and 34 years, while most of education stakeholders had worked for more than 30 years and the rest had worked between 21-30 years. Majority of the teachers taught all the classes (SSS1 to 3). Female students were in majority. Most of the schools were in urban areas as 10 only schools had library study period in the timetable. Majority (32%) of the school were established between the years 1980 – 1989.

In conclusion, the major library resources for teaching science curriculum contents were textbooks, as no library had computer for either staff or student use. Obsoleteness of materials, lack of adequate space, etc. were found to be major factors hindering effective use of resources in libraries for science curriculum implementation. The advocacy of using other information resources beyond recommended textbooks has not yielded much as majority of teachers were still adopting teacher-centred approach as method of teaching. Besides, majority of school librarians were not knowledgeable of science, most especially physics and chemistry. However, there seemed to be a paradigm shift in schools as computer laboratories in some schools were being complemented or replaced with computer resource centre called MRC, as teaching and learning aid for both the teachers and students.

CHAPTER SIX

DISCUSSION AND INTERPRETATION OF FINDINGS

6.1. INTRODUCTION

The research findings of the study were presented in the preceding chapter and these findings need to be thoroughly discussed and interpreted. Discussion of findings in any research is vital because the usefulness and utility of research findings lie in the proper interpretation of results. Discussion of the findings as defined by Daniel and Aroma (2011), is the "task of drawing inferences from data that was collected after an analytical and/or experimental study". Daniel and Aroma conclude that the only way by which a researcher can expose relations and processes that underscore the findings is through the discussion of the findings. Meanwhile, Leedy and Ormrod (2005, p. 276) opine that "it is important to discuss findings by focusing on the research objectives, research questions, literature reviewed and theories to give a clear implication for policy, theory and practice". Constructivism and inquiry-based learning form the theoretical framework for this investigation. The research questions to be answered using the lens of constructivism and inquiry-based learning are:

1. What is the status of public school libraries in Ekiti State, Nigeria?
   a. What are the qualifications and experiences of school librarians?
   b. What are the available library resources for science curricula implementation?
   c. How adequate are the available science library resources in terms of quantity and quality?
2. To what extent does the quality of library resources influence science curriculum implementation?
3. Do the science teachers advocate using information resources beyond textbooks?

6.2. BACKGROUND INFORMATION OF EDUCATORS

Background information of the educators involves personal characteristics such as age, gender, designation, school affiliation, year of experience and the level of education. All these personal characteristics assist a researcher in framing strategies for the target population (Brink, Van der Walt, & Van Rensburg, 2012).

Location (urban or rural) of schools

Findings confirmed that the majority (63%) of schools are located in urban areas whereas 37% of schools are in rural areas. Since Nigeria's rural-urban population ratio is 52:48 (World Population Review, 2019), ordinarily, one expected schools in rural areas to be more than that of urban areas. However, the rapidly growing population of inhabitants in Ekiti State urban areas could be attributed to why they had many schools in the areas. For instance, the rapid population growth in urban areas informed the reason the present administration in Ekiti State recently established four additional schools, which were all located in Ado-Ekiti, the state capital to decongest the public schools in the capital city in view of its growing population (Nejo, 2019).

Location of the library within the school

The majority of respondents indicated that their libraries were in separate/purpose-built buildings. Contrarily, the researcher's observation visits confirmed very few schools (SCHL#4, SCHL#5, SCHL#14 and SCHL#27) had separate/purpose-built buildings for a library, as the majority of schools either used classrooms not occupied by students or buildings attached with either staffrooms or laboratories. The reason respondents regarded any room/classroom stocked with books as a separate/purpose-built library could be attributed to the fact that sometimes the Nigerian school library is usurped and repurposed as a classroom, staff room or where staff hold meetings (Ajegbomogun & Salaam, 2011). Lack of requisite knowledge of a standard school library by most of the respondents, and even the staff managing the library who were expected to advocate library services and raise awareness on its role also indicates misconceptions of a purpose-built school library. This is confirmed in studies conducted by Dike (2012) and Lawal-Solarin (2016) on school libraries in Nigeria, where they revealed that Nigerian school libraries were faced with challenges of inadequate and unqualified library staff. This present study's findings are consistent with Adebamowo's (2011) study on the use of school library resources in Ogun State, Nigeria which revealed that less than 17% of schools surveyed had a separate/purpose-built buildings for a library.

Educational qualifications and work experience of the educators

The vast majority of science teachers had a BSc degree, and have been teaching for 11-20 years, while the majority of school principals held a B.Ed degree and have been teaching for more than 30 years. The results confirmed that the majority of science teachers were not adequately qualified for their teaching responsibilities as they possessed only a BSc degree without a PGDE as recommended by TRCN. See details in Chapter two, under section 2.8: *teaching and learning methods in Nigeria*. The registrar of TRCN recently gave December 31, 2019 as the deadline to remove unqualified teachers from the system (Babalola, 2019). "Qualified teachers are 'dual professionals' possessing both subject expertise and pedagogical expertise" (Teachers Registration Council of Nigeria, 2019).

Subject, number of students and level of class of respondents

Class size is one of the major factors in implementing constructivist approaches to teaching. As stated by Tam (2000), one of the basic characteristics of constructivist learning environment to be considered when implementing constructivist approaches to teaching is groups of small numbers of students (small class size). According to Mathis (2016, pp. 1-7), "the smaller the class, the better the student outcomes". Mathis, however, recommended class sizes of between 15 and 18. It is extremely difficult to teach via the inquiry approach if the student class size is over 18.

Average number of students in class

In this study, an average class size is determined by dividing the total numbers of students taught by the number of classes.

Table 6.1: Average number of students in class

	Average number of students in class		
Subjects	SSS1	SSS2	SSS3
Mathematics	87	59	66
Chemistry	64	53	41
Physics	62	50	41
Biology	37	45	40

The average class sizes for all the subjects were large. See Table 6.1 for details. The average class size in this present study ranges from mostly 37 to 87 or more students, which could make constructivist approaches to teaching unconducive and it would be difficult for teachers to vary methodology that could improve the student outcomes (Mathis (2016, pp. 1-7). The large class size could prevent teachers from adopting constructivist approaches to teaching. Therefore, they would be left with little or no option other than to depend on lecturing in their classrooms, with little or no time dedicated to inquiry-based learning which constructivist approaches are all about.

Subjects taken by students

The majority of the students (87.9%) were taking all four science subjects (physics, chemistry, biology and mathematics). This implies that majority of the students had an interest in all the science subjects, which is one of the major variables predicting students' performance in science subjects.

Gender

The majority (51.7%) of the science students were female, while 48.3% were male. This result aligns with current national and global trends. Though, the percentage of students' enrolment in science and technology based courses in Nigerian Universities indicates that females occupy the lower proportion in all the disciplines, in terms of general development, there is a definite increase in the number of girls enrolled in science and technology based courses from 15.1% in 1998/1999 to 31.4% in 2001/2002 (Nigeria. Federal Office of Statistics, 2003 as cited in Ekine & Abay, n.d.). The percentage of female teaching staff in Nigerian polytechnics (tertiary institutions with mostly science and technology courses) rose from 20.64% to 20.94% between 2013 to 2015 (Nigeria. National Bureau of Statistics, 2018, p. 23). Globally, science has long remained male-dominated, however a new report says females are catching up.

6.3. WHAT IS THE STATUS OF PUBLIC SCHOOL LIBRARIES?

The research question one sought to find out the status of public school libraries in Ekiti State, Nigeria. The following factors were used to determine the status of public school libraries: qualifications and experience of school librarians; and availability of library resources for science curricula implementation. All these are discussed in this section.

Qualifications and experience of school librarians

In the current study, no respondent had a Bachelor's degree in Library and Information Science (B.L.I.S.), while less than half of the respondents (44.4%) had other qualifications such as a BSc or HND in other disciplines to occupy the position of school librarian in secondary schools. Ten (37%) did not possess more than a Senior School Certificate Examination (SSCE). The researcher observed during visitation to schools that each library was staffed with one staff member (responsible for running the library) who was being supervised by a teacher (commonly, English language teacher) and none of these staff had qualifications in librarianship, although they claimed they had practical knowledge about how to organise and manage school libraries.

Different studies across African countries have identified poor staffing practices of recruiting unqualified personnel as one of the major problems facing school libraries. For instance, a study conducted by Shonhe (2019) on the challenges school libraries face in developing countries reviewed the literature in several developing countries such as: Ghana, Sri Lanka, Nigeria; Malawi; and South Africa. Nearly all the studies reviewed decried poor staffing as the problem of school libraries. Equally revealed in the study was the challenges such as irrelevant library collections, uncatalogued and poorly organised books, which were as a result of inadequate and/or unqualified staff in the library. According to Malanga (2017), poor staffing leads to a lack of information literacy among students, and equally results in inadequate marketing of library services and awareness of its role. The IFLA School Library Guidelines state that the role of the school library as "to facilitate teaching and learning. Therefore, the services and activities of the school library should be under the direction of fulltime professional staff with the same level of education as the classroom teacher" (IFLA and Institutions, 2015, p. 6).

From the present study it can be inferred that the majority of school librarians in Ekiti State possessed other types of qualifications but not librarianship to occupy the position of school librarians. Surprisingly, 52% of these school librarians claimed to be certified (see Figure 5.2). Considering their qualifications, the majority of respondents who claimed to be certified have wrongly assumed that working in the library for years had qualified them to be certified librarians. However, for a librarian to be certified in Nigeria, he/she must have a minimum qualification of first or postgraduate degree in the field of Library and Information Science or its equivalents as determined by council (LRCN, n. d.). A fulltime qualified librarian is part of what schools need in order for their students to be successful in academic. For example, in more than 60 studies carried out in 19 states in the USA and a Canadian province, it was revealed that students with access to well-supported school libraries with a full-time qualified librarian scored higher on reading assessments regardless of their socio-economic statuses (Gretes, 2013).

However, qualified librarians with adequate qualifications have been found to improve student academic performance (Haycock, 2011) In the same way, AASL (2016) affirms that no matter how well designed a school library might be its success depends on the quality of the librarian in charge of managing the library programme. Further, the AASL framework posits that all students, teachers and administrators should have access to a school library that is being managed by at least a qualified fulltime professional librarian. Findings further revealed in the current study that some of the school librarians had BSc degrees, with majority (70%) of them had more than 10 years' work experience. Ordinarily, this number of years should have afforded them the opportunity of attending several in-house trainings, workshops and conferences that will equip them in rendering effective service implementation to teachers and students in their various schools. However, with government lukewarm attitude towards library development in Nigeria (Gbadamosi, 2011), it would be difficult for all of these to come to a reality. Besides, the apathy among qualified librarians to work in school library, coupled with high level of unemployment in Nigeria (Kazeem, 2016), it is not surprising to see people with BSc degrees taking up a lower job that is not commensurate with their qualifications just to make ends meet. However, the advocacy for standard school libraries that could engage both teachers and students with diverse and conflicting sources of information (inquiry-based learning) in addition to information handling skills as well as constructive dispositions towards information utilisation beyond periphery requires the responsibility of full-time qualified school librarian (Kuhlthau, 2004).

Availability of library resources for science curricula implementation

From table 5.5 in the preceding chapter, it is observable that approximately 96% of the school librarians reported availability of different textbooks in their school libraries, 77.8% reported availability of dictionaries in the school libraries while other resources like newspapers and magazine cuttings were reported by all respondents as not available. Similarly, 95.1% of science teachers revealed textbooks as the only available library resources that support implementation of science curriculum. In addition, table 5.41 revealed that 98.3% of students were aware of textbooks in their school libraries followed by 80.8% who were aware of dictionaries. Most of the other library resources apart from dictionaries were rated below 50% which calls into question their availability. To a large extent, implementation of the science curriculum and academic performance depends on the availability of library resources (Books – fiction and non-fiction, newspapers/magazines, reference, journals, television, projector, head phones, view screen, video player/recorder, toys, picture books, puzzles and games (Nigeria Universal Basic Education Commission, 2010, p. 13) as well as other information resources using digital technology). Technologies (Isiye, 2015) facilitate round the clock access to the school library both in and outside the school environment. This persuaded the government of Nigeria to recommend the establishment of libraries in all schools (Nigeria National Policy on Education, 2013).

Teachers have not been giving assignment/projects that require the use of non Non fiction science, yet about 42% of students claimed that non Non fiction science were relevant. The researcher observed that there were few non Non fiction science in the school libraries. Going by the low level of availability of other resources (as stated by librarians (table 5.5), teachers (table 5.22), students (table 5.41) and confirmed by the researcher's observations) in the libraries, one may rightly conclude that almost half of the students did not actually know what non Non fiction science were. Less than half of the students (47.1%) said they did not have internet facilities in their libraries, while the majority of librarians' (79,6%) and teachers' (85.2%) maintained that there were no internet facilities in their libraries. The researcher's observation confirmed that there was no library with functional internet as at the time of visitation. Students would not have had easy access to online information for their assignments/projects. In addition, the majority of librarians (88.9), teachers (87.4%) and students (52.5%) mentioned that their libraries did not have television. This was equally confirmed by the researcher's observation. However, this is telling for science subjects because there are so many documentaries and quiz shows (e.g. *Cowbellpedia, Work It Out and Take A Step*) on different TV channels such as NTA, AIT and *Africa Magic* on DSTV that could make science come alive.

The researcher observed during the school visits that all the libraries in the three local government areas had mostly textbooks on science subjects. In many of the schools, textbooks no longer related to the current science curriculum (2007 Curriculum) were still kept on the shelves. This could be attributed to lack of weeding of library resources which could only be properly done by qualified library personnel, which were lacking in schools (Lawal-Solarin, 2016). This is not in line with the IFLA School Library Guidelines that recommend school library resources to be continually updated so as to guarantee that there would always be new resources available for learners to select from (IFLA and Institutions, 2015). Conclusively, it can be deduced that the authority in charge of the acquisition of school library resources in Ekiti State placed a higher premium on the acquisition of textbooks than any other type of library resource, which may be as a result of lack of funds, lack of acquisition policy or unawareness of other resources. There are many other materials that facilitate the learning process than textbooks. They include 3D objects, science board games, models, charts and ICT software (South Africa, Department of Basic Education, 2012, p. 37). These materials among others are what required in the application of inquiry-based learning and teaching approach. The teaching and learning approach that is pertinent to secondary school education of 21st century which is expected to move along with advancement and evolving landscape in ICTs suitable to achieve NV20: 2020.

Adequacy of the available science library resources in terms of quantity and quality

Results from table 5.6, show that more than 81% of respondents (school librarians) rated the level of provision of library resources to be adequate for implementation of science curriculum. It is worrisome to observe that librarians were not critical about their libraries. This may not be unconnected with the fact that virtually all the librarians in the schools were not qualified (table 5.2) and may not know what constitutes an ideal school library. The majority of the science teachers (as shown in Table 5.25 and Table 5.26) indicated the available library resources (mostly textbooks) to be adequate in term of quality and quantity respectively. It was disturbing to note that most of other library resources (apart from textbooks) such as: DVD-ROMs, CD-ROMs, online newspapers and magazines, TV, video games, internet facilities and e-books were either inadequate or unavailable. The majority of the science teachers still surprisingly rated their libraries that consisted chiefly of textbooks as good. This is a result of most of students, teachers and the so called “librarians” not have clear knowledge of resources ideal library should have. Besides, Ekiti State has only one functional public library (Ekiti State Library Board), which is grossly inadequate to cater for people of the state, its resources were inadequate and nothing special as it has not been seriously funded since its creation in 1996 (Zaid, 2011, p. 170). The state of the Ekiti public library may have influenced the perception of respondents being satisfied with their school libraries.

According to constructivism and inquiry-based learning, the principal theory of this study as well as information (guided) inquiry, adequate resources in the school library is an important component for teaching and learning (Callison & Preddy, 2006). School librarians are expected to “provide the platform for developing information literacy, which includes a collection of well-organized materials within the school, internet resources, community resources in public libraries, and contacts to different subject experts” (Kuhlthau, Maniotes & Caspari, 2007, p. 17). Therefore, the school library is expected to be set up to expedite action on implementation of educational policy goals by providing suitable (adequate) resources through careful selection, acquisition and processing of the information resources and making both printed and non-printed media resources available for the school community use, particularly students (Afolabi & Elaturoti, 2016). As the Canadian Education Resource Acquisition Consortium (2008, p. 7) pointed out;

> the resources support the learning outcomes of the curriculum, (Integrated Resourced Packages) assist students in making connections between what they learn in school and its practical application in their lives; [should] be developmentally and age appropriate; support integration across other curricula and promote hands-on activities and an applied approach to learning (p. 7).

Table 5.40 shows that more than 78% of science students evaluated the quality of their library resources to be good, while few (20.4%) rated the quality as either fairly or not good. Similarly, in term of quantity, majority (70%) of respondents evaluated their library resources to be good, and only a few (4.2%) evaluated it as not good. The researcher confirmed from the accession registers of school libraries that the only resources that support the science curriculum were in print format (mostly textbooks). However, the school libraries in the state cannot be said to be adequate since most of their resources are mainly textbooks, and some libraries still held on to obsolete textbooks which are not in line with the 2007 Curriculum. Considering library resources in more developed countries such as the United States (American Library Association (ALA), 2010, p. 4) and a few developing countries like South Africa (South Africa, Department of Basic Education, 2012, p. 37), textbooks are no longer viewed as library resource but a classroom necessity; every student is expected to have a textbook for each subject they are taught (UNESCO Science Education, n. d.), in addition to having access to library resources in multiple formats to support reading for information and lifelong learning (ALA, 2010, p. 4).

It was also discovered during the researcher’s visitation to schools that no library staff processed new acquisitions and there was no acquisition policy which could help to avoid waste and regulate the resources to enable libraries to have adequate and quality books linked to the school curriculum. Even the lofty idea of NERDC *Teachers' Aid*, a digital library of curriculum based teaching resources expected to provide web-based access to a database of teaching resources where the teacher can search for, locate, download, and comment on resources to aid the teaching and learning process has neither been subscribed to by Ekiti State Ministry of Education, Science & Technology nor any of the 27 schools visited by the researcher not to talk of individual teachers. According to the Nigerian Educational Research and Development Council (2014-2017), the senior secondary education curriculum implementation may not be possible without adequate textbooks and other instructional materials such as; books, journals and other information resources using digital technology, It is a difficult task for teachers and students to work without adequate (textbooks) resources (Okoye & Ogunleye, 2015).

The majority of participants in this current study indicated textbooks as the major resource for science curriculum implementation. This suggests that they still see textbooks as part of library resources. However, textbooks in advanced countries is no longer library resources but a classroom necessity, because there are other library resources that facilitate learning than textbooks. Research question two unravels in more depth the extent to which the quality of library resources influence curriculum implementation.

6.4.TO WHAT EXTENT DOES THE QUALITY OF LIBRARY RESOURCES INFLUENCE SCIENCE CURRICULUM IMPLEMENTATION?

The influence of library resources on science curriculum implementation is discussed in this section. Less than half (44.4%) of the school librarians attested to library resources, textbooks in particular, being influential in science curriculum implementation, while a substantial number of them rated library resources as either having minimal (37%) or no influence (18.5%) at all. All other resources they rated as either having a low influence, no influence or not available. Science teachers (61%) were more positive about the influence of library resources on their teaching of science subjects. Science students (80%) had the highest rating amongst respondents for library resources to be significantly influencing their academic performance. It is understandable for students to rate textbooks high because without a textbook they cannot succeed. However, unlike China, Mexico and Caribbean, Nigerian government had not been providing free textbooks for senior secondary schools (Adebayo, 2018). This could be attributed to the economic downturn that has seriously bedevilled the country for some years (Adeniran & Sidiq, 2018). Then, how students have easy access to the teaching and learning resources in the face of inadequate library with no internet connectivity is a major concern. Role of school library is shifting away from audio-visual towards multimedia and ICTs, and is expected to provide a “hub” for learning both within and beyond the physical space (Burke, 2015; Harper, 2016; Harvey, 2001; Howell & O’Donnell, 2017).

Based on respondents’ level of understanding of school library, the main resource they expected to see in a library is textbooks, then it makes sense that they rated the library resources highly. Unlike advanced countries that textbook is no longer a library resources but classroom necessity. However, teachers with training in information literacy skills and the techniques of effective inquiry-based learning are required to challenge and engage students with the various sources of information available to them; and to question, select, analyse and synthesise until they are able to discern paths to new understandings and knowledge construction (Barrett, 2010, p. 13), which is required of 21st century secondary school education expected to lay a solid educational foundation for producing quality manpower to achieve NV20:2020. Teaching to the textbook and exams does not prepare students for independent and lifelong learning. They may pass the exams and enter university but often students who have learned by rote fall by the way side in university which challenges critical thinking and expects independent learning.

The issue of transforming a school library into a collaborative, technology-enabled, physical and virtual spaces where students work on their own and with others to construct knowledge and actively use, evaluate, co-create, and share information (Howell & O’Donnell, 2017), which is gaining ground in most developed countries such as Canada, and even few African countries like South Africa need to be embraced by Nigerian school libraries since it enhances individuals or groups of learners to engage in project work/assignments, information literacy and inquiry, analysis, collaboration and curriculum integration, research, and a variety of creative activities that involve the use of digital tools, devices, 3D printers, robotics, craft and software and hardware supplies (Burke, 2015; Howell & O’Donnell, 2017). These are the elements of constructivism and inquiry-based learning which is the theoretical framework of this study.

6.5. DO SCIENCE TEACHERS ADVOCATE USING INFORMATION RESOURCES BEYOND TEXTBOOKS?

In getting evidence for this question, several methods were employed, such as finding out the teaching styles adopted by teachers, the nature of projects/assignments given by teachers (assignment topics), sources of information and access points for the sources, scaffolding, types of presentations and form of assessment guidelines and rubrics given to students by teachers.

Teaching style

In the first questionnaire administered to teachers, the majority of them indicated they used student centred approaches in teaching, which was contrary to researcher's observation during the administration of questionnaires in schools where teaching was passive and knowledge was being passed from teacher to students, which is contrary to the constructivist approach to learning (Kuhlthau, 1993, 2004, 2008; 2010: Kuhlthau, Heinström & Todd, 2008). This prompted researcher to embark on a follow up questionnaire where detail explanation/definitions of each teaching method were supplied so as to accurately guide the teachers to know which teaching method they adopted. In the follow up questionnaire, the majority of teachers indicated that they used a teacher centred approach. This implies that teachers in this current study did not have clear knowledge of different teaching styles, which made them overstating the approaches adopted for teaching. This is confirmed in a comparative study of science teachers' reports of their classroom practices with their pedagogical practices in Rivers State, Nigeria by Kalu-Uche, Alamina and Ovute (2015), where they found out that the science teachers utilised several transmission and constructivist inclined approaches in classroom instruction and that there were significant differences in science teachers' reports of their classroom practices and their observed practices.

However, a teacher centred approach may not seriously propel students to seek information resources beyond textbooks as there would not be opportunity to engage students with diverse and conflicting sources of information. Through an inquiry-based method, students develop competencies through a process of inquiry and discovery. Students would collaborate to create new knowledge while also learning how to think critically and creatively, and how to make discoveries—through inquiry, reflection, exploration, experimentation, and trial and error (Friesen & Scott, 2013, p. 2). Similarly, Ikitde and Edet's (2013) study on the influence of learning styles (active/reflective, sensing/intuitive, visual/verbal, and sequential/ global) and teaching strategies (guided inquiry, demonstration and lecture) on students' achievement in biology, revealed that there is a significant effect on academic achievement of biology students taught with guided-inquiry. In an era of focus on learner centred approaches, the 21st century school library should be playing a pivotal role. Therefore, the inquiry based learning as a teaching methodology, should be an integral part of school systems since students taught with ILB develop ability to think critically and creatively which result in positive academic performance (Montiel-Overall & Grimes, 2013; Omenyo, 2016).

Teaching and learning in the 21st century has gone beyond the traditional (teacher centred) approach in which an instructor (teacher) assumes both the directive and authoritative roles, but rather interacts and negotiates with students to demystify the dynamism that goes with learning and knowledge acquisition, by "applying their existing knowledge and real-world experience, learning to hypothesize, testing their theories, and ultimately drawing conclusions from their findings" (Bada, 2015, pp. 66-67). Among the several frameworks developed to address education in the 21st century place more emphasis on the process of learning and the development of the skills, attributes, and competencies such as: critical thinking, inquiry, and problem-solving; active learning; literacy and numeracy; innovation, creativity, and entrepreneurship; collaboration; and metacognition (learning to learn, self-directed learning) (Howell & O'Donnell, 2017; Zinn, 2012). In the same vein, the constructivist approach to learning encourages and enhances activity and participation, which ultimately lead to better students' academic performance (Maxwell, Lambeth & Cox, 2015; Omenyo, 2016; Overall & Grimes, 2013; Todd, Kuhlthau & Heinström, 2005).

The nature of assignments given by teachers (assignment topics)

The majority (72.8 %) of teachers in this study claimed that they were giving students assignments/projects that challenged students to use information resources other than textbooks. Librarians' (Table 5.10) and students' (Table 5.37) responses corroborate the teachers' responses being given assignments/projects that take students beyond consulting textbooks. This is surprising, that librarians who managed libraries that consisted mainly textbooks with no functional internet connectivity could indicate that teachers were giving assignment/projects that take students beyond consulting textbooks.

Besides, there were different and divergent responses from school principals on the issues of giving students assignment/projects that would take them beyond consulting the textbooks. Some (SP#5; SP#10; SP#19) said "science teachers were encouraged to give students assignments that are not in detail in their textbooks and ask them to go beyond their textbooks. Even the school principals seemed not to have clear understanding of assignment/projects that are line of constructivism and inquiry based learning as some only encouraged students to make use of laboratory equipment without making reference to school libraries. This could be attributed to school principals' limited and inaccurate understanding of the importance of school libraries in curriculum implementation (Hartzell, 2002), and lack of science and information literacy skills. For instance, respondents SP#3 said:

> the schools encourage students to make use of laboratory equipment and attend science exhibitions.

However, science and information literacy enhance curriculum implemtation skills such as; resource-based, problem-solving, problem-based learning and evidence-based, which require students to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity (Holbrook & Rannikmae, 2009; Lupton, 2004). In advanced countries such as the US, these skills have been strongly stressed by STEM as a way to promote critical thinking in developing science literacy (National Council Research, 1996; National Science Foundation, 2012). In Nigeria, information literacy is yet to be embedded into school library programmes, this may not be unconnected with the fact that majority of school libraries are being manned by unqualified staff.

The final examinations (e.g. WAEC and NECO) that solely centred on curriculum that is only examination centred, which does not place more emphasis on development of student's abilities and creative potentials through training and practices is not helping matters as to engage the students with assignment/projects that would take them beyond the recommended textbooks. This is confirmed in the word of a principal (SP#16) who said:

> actually, we follow syllabus and there is scheme of work to be followed. Within the school system, we are not outside the syllabus, so, it is parents who are a little bit literate that will encourage their children to go beyond the syllabus, but for us we are following the real syllabus.

Inadequate infrastructure in school is another impediment preventing teachers from actually giving students assignments/projects that would take them beyond textbooks. For instance, a school principal (SP#12) rhetorically asked:

> how do you expect a student who does not have the recommended textbook or could not afford to buy a textbook to read beyond the prescribed textbooks. Until the school library is well stocked with current books and internet facilities, it may be difficult for one to say students should read beyond prescribed textbooks.

However, researcher's observation could not confirm any serious assignment that required students to consult other sources of information different from textbooks apart from science practical expected of students to offer as part of requirements for final examination and this practical works can still be solved by students using their recommended textbooks.

From the assignments/projects given by teachers one can easily deduce that teachers have not been giving students projects/assignments other than the ones students could still use the recommended textbooks for (mostly published by *Africana First Publishers PLC and West African Books Publishers Ltd*). For example, in mathematics, students were expected to know about e*xperimental probability.* This can be found in *Essential mathematics for senior secondary school 2* by Oluwasanmi (2013), published by *West African Books Publishers Ltd* (see Figure 6.1, Figure 6.2, Figure 6.3 and Figure 6.4). Also, in biology where students were expected to make insect net and quadrant (ecological instrument) could equally be found in *Modern biology for senior secondary school* by Ramaligan (2013), published by *Africana First Publishers, PLC* (see Figure 6.5 to Figure 6.6). Similarly, in chemistry where students were expected to know how to *separate salt from water* (crystallization) could be found in *New school chemistry for senior secondary school* by Ababio (2016), published by *Africana First Publishers, PLC* (see Figure 6.7). Likewise, in physics, where teacher required students to draw gold leaf electroscope could be found in *New school physics for senior secondary school* by Anyakoha (2013), published by *Africana First Publishers, PLC* (see Figure 6.8).

Note that probabilities greater than 1 or less than 0 do **not** exist.

Random: The word random means without aim or chance in an unbiased way. For example, if there are 15 boys and 20 girls in a class, if we select a student at random, then each student in the class has an equal chance of being selected.

Event: An *event* is something that happens. For example, tossing a coin or throwing a dice is an event. The set of possible outcomes is called a ***sample space***.

Outcome: An *outcome* is the result of an event. For example if you toss a coin, you will either get ***a Head*** or ***a Tail***. This means there are **2 *possible outcomes***. When the outcome is the ***required result***, then we say it is ***successful*** or ***favourable.***
Hence the probability that an event will happen is written as:

$$\textbf{Probability} = \frac{\textbf{Number of successful outcomes}}{\textbf{Total number of possible outcomes}}$$

17.2 Experimental Probability

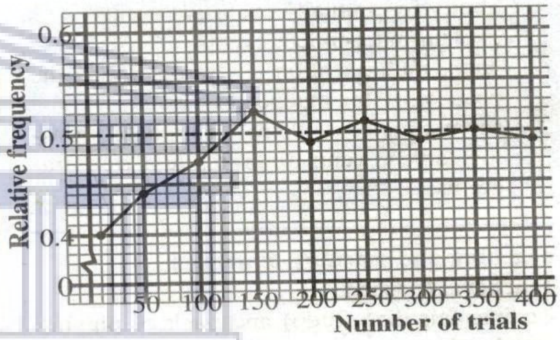
Sometimes we may need to find the probability of an event by carrying out an experiment or survey. This is called ***experimental probability***. For example tossing a coin is an ***experiment*** and each of the throw carried out is called a ***trial***.

Activity

(a) Toss a ₦1 coin (or any coin) 10 times and record how many heads you got.
(b) Toss the coin more times so that altogether you obtain 50 times and record the number of heads in the table.
(c) Now record your results after every 50 trials .
(d) calculate the relative frequency like the one shown in the table below.

No of trials	No of successful trials	Relative frequency
10	4	$\frac{4}{10} = 0.40$
50	22	$\frac{22}{50} = 0.44$
100	47	$\frac{47}{100} = 0.47$
150	78	$\frac{78}{150} = 0.52$
200	98	$\frac{98}{200} = 0.49$
250	128	$\frac{128}{250} = 0.51$
300	148	$\frac{148}{300} = 0.49$
350	174	$\frac{174}{350} = 0.50$
400	196	$\frac{196}{400} = 0.49$

(e) draw a line graph to illustrate the results like the one shown below.



Notice that in this graph the results appear erratic after a few trials but they settle down around 0.49. Therefore, the probability of throwing a head may be given as 0.49.

Note that it is essential to carry out sufficient trials or experiments to show that the results settle down to a steady value.
Since the values of experimental probability are estimated, we can write the probability as:

$$\textbf{Estimated probability} = \frac{\textbf{number of successful trials}}{\textbf{total number of trials}}$$

$$\therefore\ P(H) = \frac{\text{number of throwing a head}}{\text{total number of trials}} = 0.49$$

Figure 6.1: Mathematics: Experimental probability

Where $P(H)$ means probability of throwing a head.

Experimental probability is sometimes called ***relative frequency,*** so the above formula may also be given as.

$$\textbf{Relative probability} = \frac{\textbf{frequency of the event}}{\textbf{total number of trials}}$$

For example, the relative frequency of throwing a head when the number of trials is 100 is 0.47 as shown in the table.

We can use relative frequency to estimate '*the expectation of an event*' (i.e. how often we expect an event to happen).

Expectation of an event
= relative frequency × number of trials.

Example 17.1

In an experiment, a dice is thrown 500 times. The table below shows the outcome:

Score	1	2	3	4	5	6
Frequency	84	81	88	85	80	82

(a) Find the relative frequency of getting
(i) a 5 (ii) a multiple of 3.

(b) (i) Find the relative frequency of getting a 3.
(ii) How many times would you expect to get a 3 if the dice is thrown a total number of 2000 times?

<u>**Note:**</u> Although the singular of dice is die, in this book dice is used as singular as well as plural.

Solution

(a)(i) Relative frequency of getting a 5 $= \frac{80}{500}$
$= \mathbf{\frac{4}{25}}$

(ii) Throwing a multiple of 3, i.e. 3, 6.
$\therefore$ Frequency of the event = 88 + 82 = 170
$\therefore$ Relative frequency $= \frac{170}{500} = \mathbf{\frac{17}{50}}$

(b)(i) Relative frequency of getting a 3 $= \frac{88}{500}$
$= \mathbf{0.176}$

(ii) Expected number of 3 = 0.176 × 2000
= **352**

Example 17.2 **[Past WAEC Question]**

A bag contains red, black and green identical balls. A ball is picked and replaced. The table below shows the result of 100 trials. Find the experimental probability of picking a green ball.

Colour of ball	Red	Black	Green
Number of occurences	54	30	16

Solution

Number of trials = 100

Number of successful trials (i.e. picking a green ball) = 16.

Experimental probability of picking a green ball is

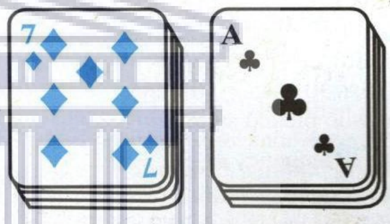
Experimental probability $= \frac{16}{100} = \mathbf{\frac{4}{25}}$

A park of playing cards

A standard park of 52 cards has 4 suits and each one contains 13 cards. Each suit has 13 Diamonds, 13 Clubs, 13 Hearts and 13 Spades.

Diamond Club Heart Spade

$\therefore$ Total = 13 + 13 + 13 + 13 = 52.



7 of Diamonds **A of Clubs**

There are 26 red cards and 26 black cards. The *Diamonds* and the *Hearts* are both ***red*** while the *Club* and the *Spade* are ***black***.

The cards in each suit are the same.

For example,

Diamond = {A, 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K}.

Thus, we have 4 of each type (i.e. 4 × 13 = 52).

Where A = Ace, J = Jack, Q = Queen and K = King.

Out of these cards there are 12 ***picture cards***, namely; 4 Kings, 4 Queens and 4 Jacks.

Example 17.3

Using the above fact, find the probability of picking a picture card in a pack of standard playing cards.

Figure 6.2: Mathematics: Experimental probability (Continued)

same time, there are four possible outcomes: (H, H), (H, T), (T, H) and (T, T)]

7 Throw a dice 36 times and tabulate your results as follows:

Score	1	2	3	4	5	6
Frequency						

Use your table to determine the probability
(a) of throwing a two **(b)** at least a four.
(c) a prime number **(d)** a factor of 6

8 **(a)** Put 4 green and 6 black counters in a bag.
(b) Pick a counter at random and record the colour in a table.
(c) Put the counter back in the bag and shake the bag.
(d) Repeat the experiments 100 times.
(e) Calculate the relative frequency of getting a green counter after every 10 trials.
(f) Draw a graph showing the number of trials on horizontal axis and the value of green counter ÷ number of trials on vertical axis.
(g) Make a comment about the graph.

9 A manufacturer makes generators. It is observed that out of every 50 made, 4 are usually faulty. If a business man buys 200 generators, what is the probability that he buys a faulty one?

10 A ball is taken from a bag and then replaced. The relative frequency of getting a red ball is 0.6. If the bag contains 15 balls, how many of them are not red?

11 A card is selected from a well shuffled standard pack of 52 cards. Replace the card and repeat the experiment 100 times. Record your results in a table like the one below.

Outcomes	Club	Diamond	Heart	Spade
Frequency				

Use your table to find the probability of getting
(a) a diamond **(b)** a heart **(c)** a club

12 In an experiment, a girl threw a drawing pin and recorded whether it landed either point up or point down. She threw the pin 500 times and it landed point up 350 times.

(a) Find the relative frequency of the pin landing point up.
(b) How many times would she expect the pin to land point up if she had thrown the pin 2000 times?

13 **(a)** Roll two dice together and then add the two scores. Copy and complete the table below.

1st Dice						
6						
5						
4						
3						
2						
1						
	1	2	3	4	5	6
	2nd Dice					

(b) Find the total possible scores.
(c) Can you say the results are equally likely outcomes?
(d) Use your table to find the probability of getting a total score of:
(i) 10 **(ii)** 1 **(iii)** 16
(iv) 12 **(v)** less than 6.

14 The table below shows the speed of cars in km/h passing a road within a given time.

Speed	51-60	61-70	71-80
No of cars	15	80	5

If the national speed limit on this road is 61-70 km/h, what is the probability that the next vehicle drive
(a) below the speed limit?
(b) above the speed limit?

17.3 Theoretical Probability

We have already considered that probability can be found by carrying out experiments. However, it must be emphasized that the probability found by experiments are **not exact.** If the same experiment is repeated or performed by another person, the result may also be different from the first one. Probability can also be estimated by using ***historical data***. This involves looking at data collected over a long period of time and

Figure 6.3: Mathematics: Experimental probability (Continued)

Solution

There are 12 picture cards, so the number of successful or favourable outcomes = 12.

Total number of possible outcomes = 52.

$P(\text{picture card}) = \frac{12}{52} = \frac{3}{13}$

Example 17.4

From each class in a certain school, 10 students were selected at random. They were asked their favourite sports and gave the following answers.

Football	80
Swimming	35
Wrestling	30
Tennis	45
Boxing	10

(a) Find the relative frequency of chosen a student at random whose favourite sport is swimming.

(b) If there are 800 students in the school, how many students would you expect to choose swimming as their favourite sport?

Solution

(a) Total number of students involved

$80 + 35 + 30 + 45 + 10 = 200$

Those who picked swimming = 35

$\therefore$ Relative frequency $= \frac{35}{200} = 0.175$

(b) Expected number of those whose favourite sport is swimming $= 0.175 \times 800 = 140.$

Exercise 17.1

1 A student threw a dice and records the number of sixes he obtained as shown in the table below.

Number of throws	Number of sixes
50	6
100	14
150	20
200	34
250	41
300	50
350	56
400	61
450	74
500	84

(a) Calculate the experimental probability of getting a six at each stage of the experiment.

(b) Draw the graph of the relative frequency for this data. What do you observe?

(c) If the dice is thrown 2750 times, how many sixes would the student expect to get?

2 Look for 10 identical balls and number them 1 to 10 and then put them in a bag. Take a ball each time and record the number on the ball. Replace the ball and shake the bag. Then repeat the experiment 50 times and tabulate your results as follows:

Score	1	2	3	4	5	6	7	8	9	10
Frequency										

Ask a friend to repeat the same experiment as you have done and compare your results. What do you notice?

3 Make a dice of your own. You may use a cardboard paper. If after many trials the relative frequency of throwing a six is 0.85, can you say the die is fair?

4 A five sided dice numbered 1, 2, 3, 4, 5 is thrown 400 times. The results are as follows:

Score	1	2	3	4	5
Frequency	70	75	80	95	80

(a) What is the relative frequency of scoring

(i) an even number

(ii) a prime number?

(b) If the dice is thrown 1500 times, how many times would you expect to score a prime number?

5 The probability that a promiscuous person carries HIV virus in a certain country is 8%. In a survey, if 250 people are promiscuous, how many of them are expected to carry HIV virus?

6 Toss two coins at the same time. Record your results in a table. Find the experimental probability of getting

(a) two heads **(b)** two tails

(c) a tail and a head **(c)** a head and a tail

[(Hint: When two coins are tossed at the

Figure 6.4: Mathematics: Experimental probability (Continued)

Conducting Population Studies

We cannot possibly carry out population studies on a whole habitat. Instead, we pick at random several small areas of the habitat and carry out the necessary investigations. This method of studying the populations in a habitat is known as *sampling*.

To conduct population studies we carry out the following procedures:

- choose the habitat to be studied;
- select the sampling method to be used;
- collect, count and record the different types of organisms present;
- identify the different organisms (use a key where necessary); and
- repeat the population studies at intervals.

Techniques

Collection of Specimens

The method of collection of specimens depends on the habitat being studied and the type of specimens to be collected. Each specimen should be put into a clearly labelled container that states the name of the collector, date, time, location and the name (identified) or code number (unidentified) of the specimen. Records of other details should be entered in a note book.

Since the aim of the collection is for study, organisms which can be studied in the habitat should not be collected. Usually, only organisms found in habitats which are difficult for study, e.g. water and soil, are collected.

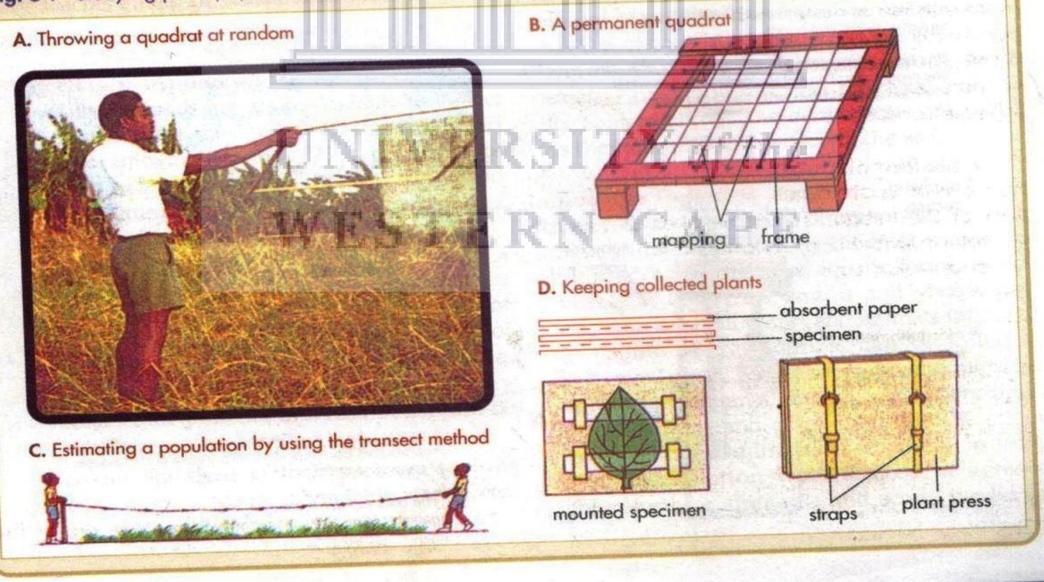
Collection of Plants

Plants in a small area are easy to count and their distribution is recorded on a map or scale diagram of the area. For larger areas, *quadrats* or *transects* are used for counting.

Quadrat sampling A quadrat is a rectangular or square frame made from thick wire. The quadrat is thrown at random several times and, on each landing, the area covered by it is observed. The type of species and their number within the quadrat are recorded. The average number of times each species appears is calculated and the most frequent or dominant species is then determined. (See fig. 5–7A and B.)

Some quadrats are specially made to mark off an area for the study of seasonal variations of plants. They are sturdier, larger and permanent and can thus serve their purpose through the seasons. These quadrats often have a mapping grid attached so that the flora within it can be mapped at regular intervals.

Fig. 5-7 Studying plant populations



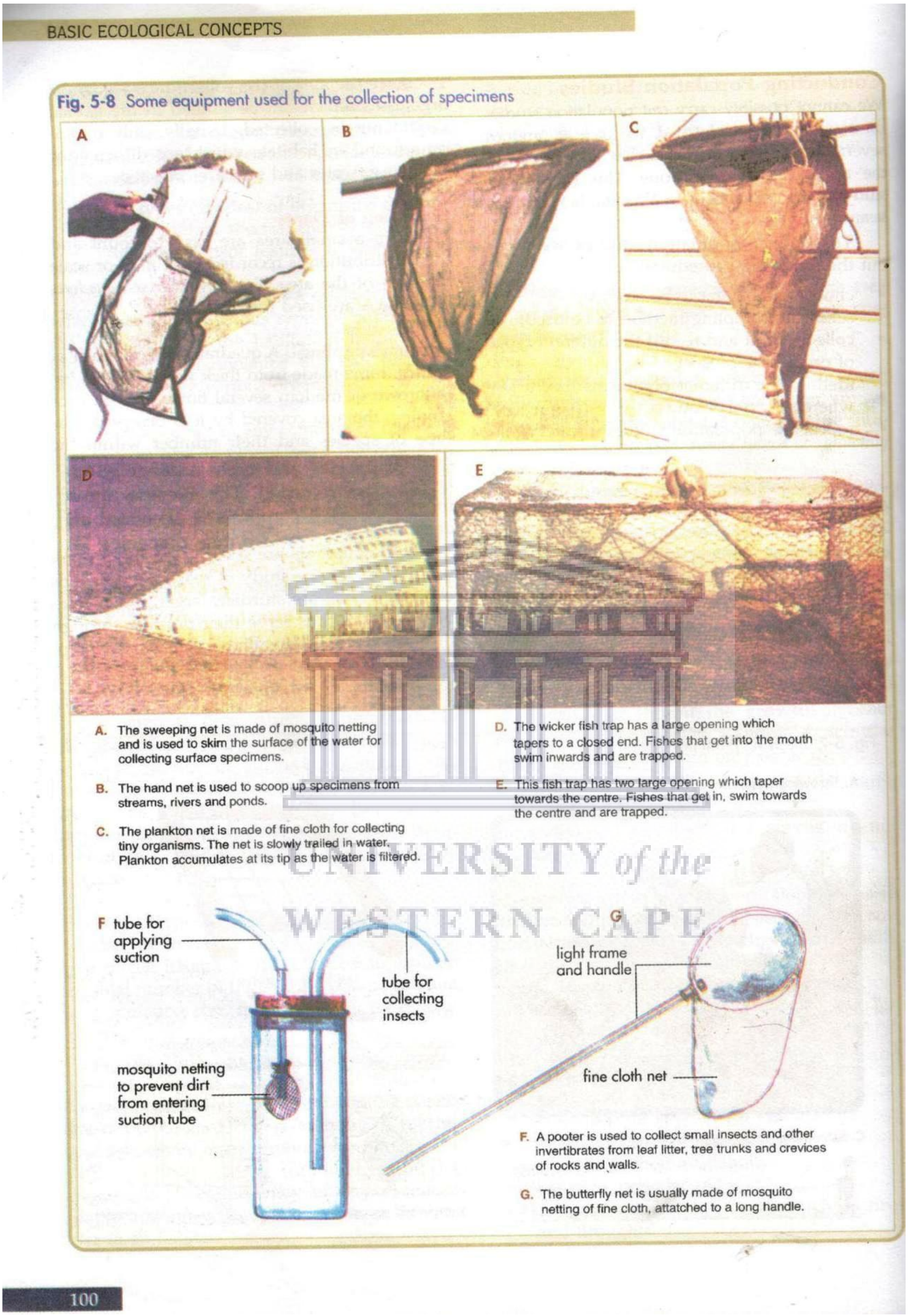


Fig. 5-8 Some equipment used for the collection of specimens

A. The sweeping net is made of mosquito netting and is used to skim the surface of the water for collecting surface specimens.

B. The hand net is used to scoop up specimens from streams, rivers and ponds.

C. The plankton net is made of fine cloth for collecting tiny organisms. The net is slowly trailed in water. Plankton accumulates at its tip as the water is filtered.

D. The wicker fish trap has a large opening which tapers to a closed end. Fishes that get into the mouth swim inwards and are trapped.

E. This fish trap has two large opening which taper towards the centre. Fishes that get in, swim towards the centre and are trapped.

F. A pooter is used to collect small insects and other invertibrates from leaf litter, tree trunks and crevices of rocks and walls.

G. The butterfly net is usually made of mosquito netting of fine cloth, attached to a long handle.

Figure 6.5: Biology: Making of insect net and quadrant

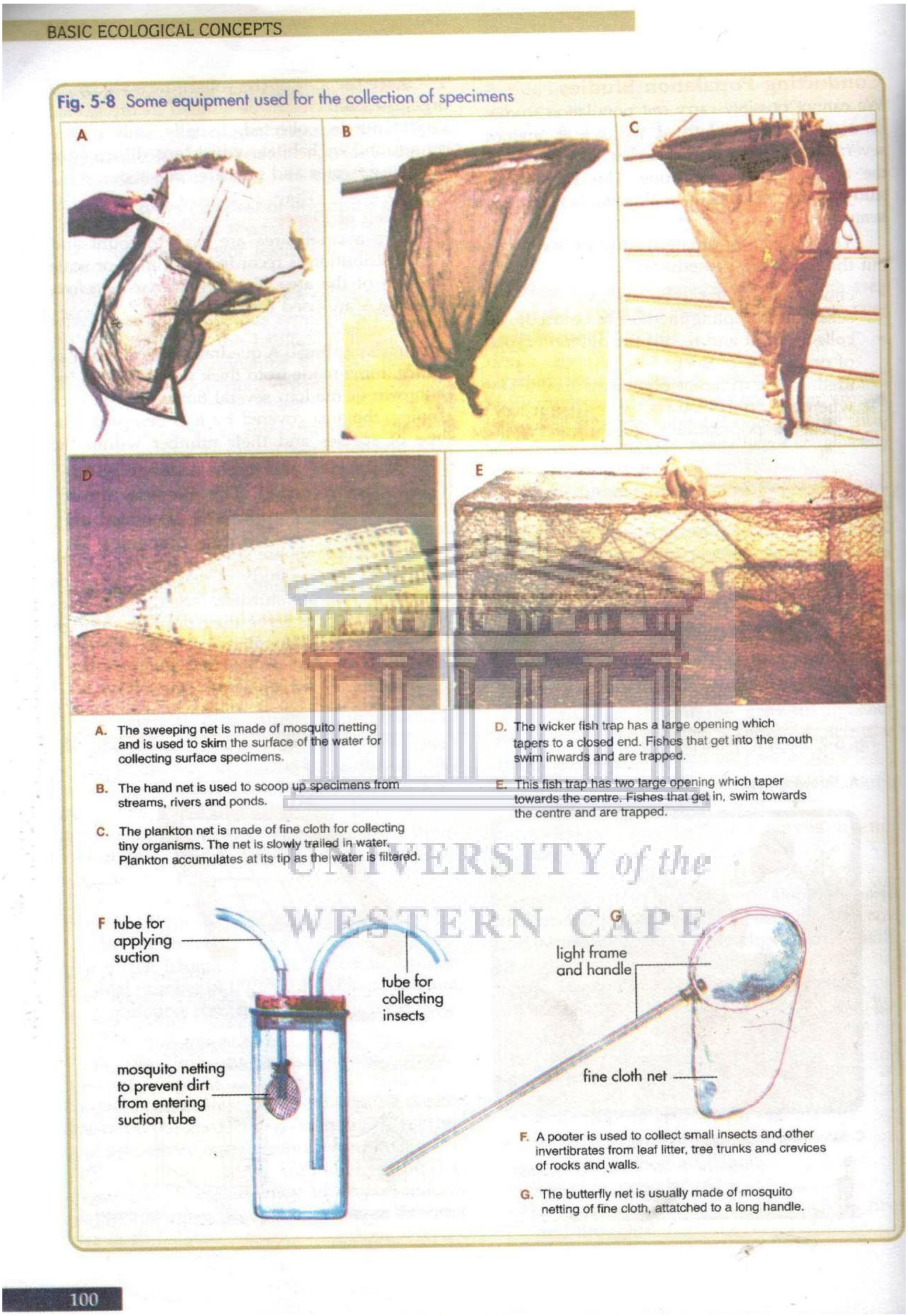


Figure 6.6: Biology: Making of insect net and quadrant (Continued)

Making salt from sea-water by evaporation

Evaporation to dryness

Evaporation can be used to recover a solid solute from a solution. In this process, the solvent is usually sacrificed.

solution → solute + solvent

A water-bath or a sand-bath is used to bring about a steady rate of evaporation. The solute required is left behind in the dish while the solvent escapes into the air as vapour. This method is not suitable for salts easily destroyed by heating.

Evaporation is used in salt-making industries. Along the western coast of Africa, sea-water is pumped into trenches and allowed to evaporate under the heat of the sun. The salt is left behind when all the water dries up.

Crystallization

Crystallization is used to separate salts, which decompose easily on heating, from their solutions. The salt crystals obtained in this way are pure, and usually contain water of crystallization, for example,

- copper(II) tetraoxosulphate(VI)-pentahydrate,
- copper(II) trioxonitrate(V)-trihydrate,
- iron(II) tetraoxosulphate(VI)-heptahydrate.

The salt solution is first heated to evaporate some of the solvent. The solution becomes saturated. When the saturated solution is cooled, crystals of the solute begin to form. To induce crystal formation,

- crystals of the same salt are added into the solution to serve as seeds; or
- inside of the vessel containing the solution is scratched.

Crystallization is used in industries where purity of the product is important as in the manufacture of drugs and in sugar production.

Fractional crystallization

Fractional crystallization is used to separate two or more solid solutes which are present in the same solution in roughly equal amounts. The solubilities of different solutes in the given solvent must differ at different temperatures. During the cooling process, at a particular temperature, crystals of the relevant solute will come out of solution, leaving behind the others which are still within their limits of solubility.

Precipitation

A difference in the solubility of a solid in two different miscible liquids is used to precipitate the solid when it is dissolved in one of them. Iron(II) tetraoxosulphate (VI), for example, is soluble in water but not in ethanol. If ethanol (which is miscible with water) is added to a solution of iron(II) tetraoxosulphate(VI) in water, the iron(II) tetraoxosulphate(VI) will be precipitated out of the solution and can then be separated by filtration.

Distillation

Distillation is used to recover a solvent from a solution. It is also used for separation of miscible liquids with widely unduly far apart boiling points. Here themometer is used. The solution is heated in a flask to vaporize the solvent. The vapour passes along a *condenser* which is cooled by circulating water in its outer jacket. This recondenses the vapour into a liquid, called the *distillate*, which is then collected in a receiver. The solute and other impurities are left behind in the distillation flask.

Fig. 2.8 Distillation of water

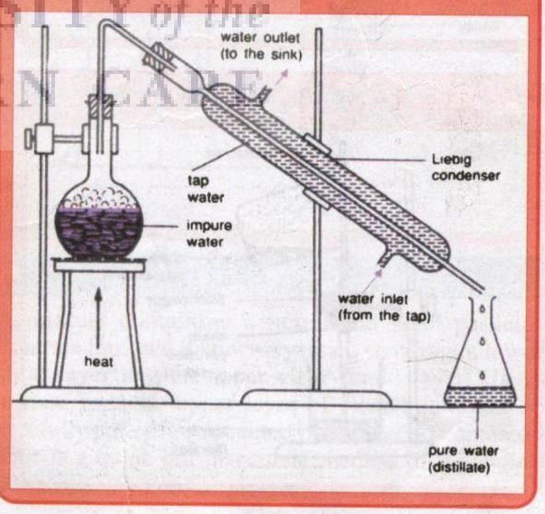
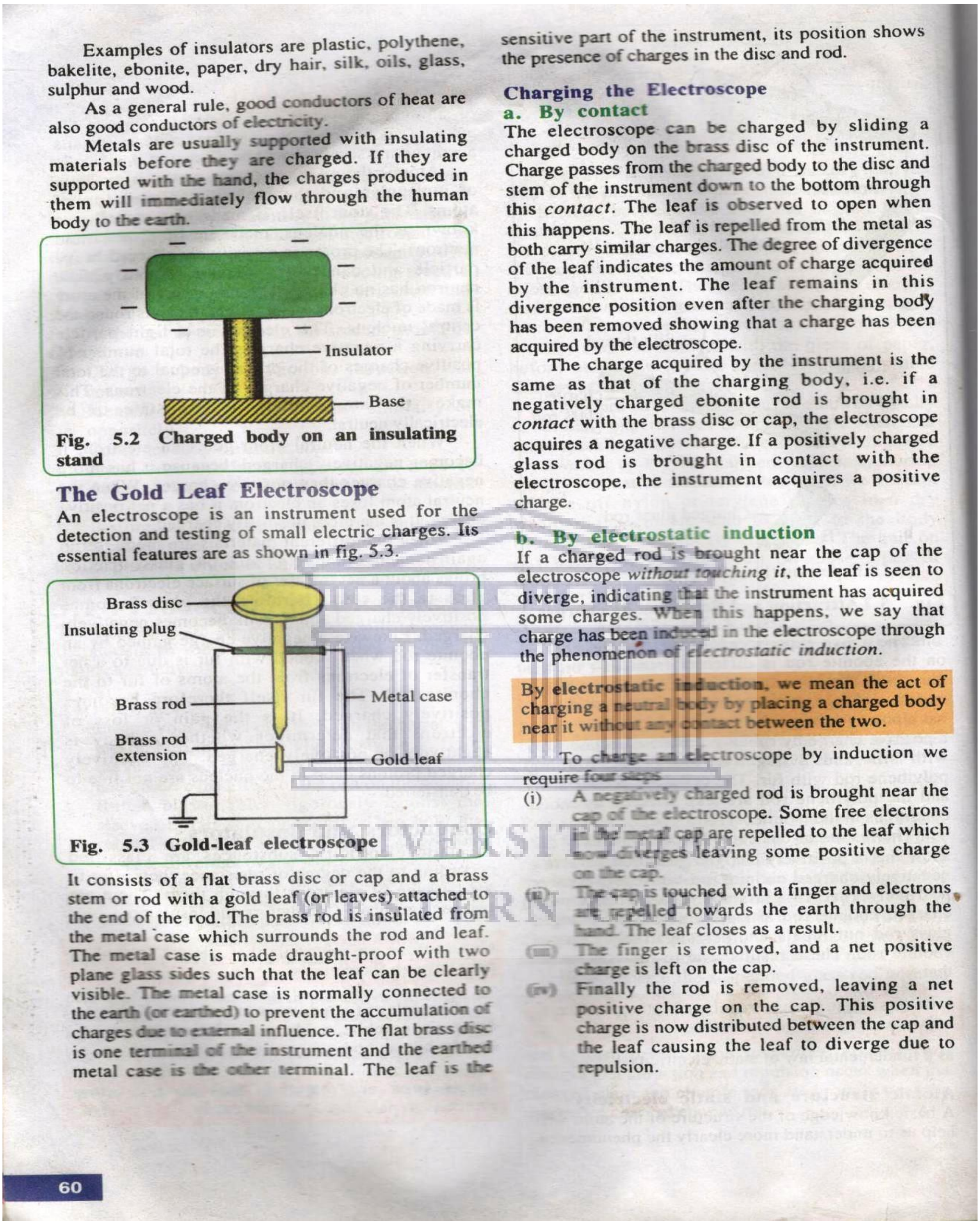


Figure 6.7: Chemistry: Separation of salt from water (Crystallization)



Examples of insulators are plastic, polythene, bakelite, ebonite, paper, dry hair, silk, oils, glass, sulphur and wood.

As a general rule, good conductors of heat are also good conductors of electricity.

Metals are usually supported with insulating materials before they are charged. If they are supported with the hand, the charges produced in them will immediately flow through the human body to the earth.

Fig. 5.2 Charged body on an insulating stand

The Gold Leaf Electroscope

An electroscope is an instrument used for the detection and testing of small electric charges. Its essential features are as shown in fig. 5.3.

Fig. 5.3 Gold-leaf electroscope

It consists of a flat brass disc or cap and a brass stem or rod with a gold leaf (or leaves) attached to the end of the rod. The brass rod is insulated from the metal case which surrounds the rod and leaf. The metal case is made draught-proof with two plane glass sides such that the leaf can be clearly visible. The metal case is normally connected to the earth (or earthed) to prevent the accumulation of charges due to external influence. The flat brass disc is one terminal of the instrument and the earthed metal case is the other terminal. The leaf is the sensitive part of the instrument, its position shows the presence of charges in the disc and rod.

Charging the Electroscope

a. By contact

The electroscope can be charged by sliding a charged body on the brass disc of the instrument. Charge passes from the charged body to the disc and stem of the instrument down to the bottom through this *contact*. The leaf is observed to open when this happens. The leaf is repelled from the metal as both carry similar charges. The degree of divergence of the leaf indicates the amount of charge acquired by the instrument. The leaf remains in this divergence position even after the charging body has been removed showing that a charge has been acquired by the electroscope.

The charge acquired by the instrument is the same as that of the charging body, i.e. if a negatively charged ebonite rod is brought in *contact* with the brass disc or cap, the electroscope acquires a negative charge. If a positively charged glass rod is brought in contact with the electroscope, the instrument acquires a positive charge.

b. By electrostatic induction

If a charged rod is brought near the cap of the electroscope *without touching it*, the leaf is seen to diverge, indicating that the instrument has acquired some charges. When this happens, we say that charge has been induced in the electroscope through the phenomenon of *electrostatic induction.*

By electrostatic induction, we mean the act of charging a neutral body by placing a charged body near it without any contact between the two.

To charge an electroscope by induction we require four steps.

(i) A negatively charged rod is brought near the cap of the electroscope. Some free electrons in the metal cap are repelled to the leaf which now diverges leaving some positive charge on the cap.

(ii) The cap is touched with a finger and electrons are repelled towards the earth through the hand. The leaf closes as a result.

(iii) The finger is removed, and a net positive charge is left on the cap.

(iv) Finally the rod is removed, leaving a net positive charge on the cap. This positive charge is now distributed between the cap and the leaf causing the leaf to diverge due to repulsion.

60

Figure 6.8: Physics: Drawing of gold leaf electroscope

It could be concluded that the nature of assignments given to students did not challenge them to use other sources of information different from their textbooks. This could perhaps be as a result of lack of time to apply inquiry-based science or inexperience on the part of the teacher as revealed in a study on teachers and librarians collaborating on inquiry-based science instruction conducted by Overall and Grimes (2013), where they revealed that considerable time and experience are required to prepare teachers and librarians to collaborate on instruction, and lack of experience with inquiry-based science, particularly in schools with a culture of teacher centred approach.

Similarly, in a study to assess teaching and evaluation methods used in Nigeria, Moyinoluwa (2014) revealed that many schools poorly implemented procedures like concept-mapping, individual projects, group works/assignments and guided discovery. Constructivist learning is particularly valuable when it involves complex skills, such as problem solving or critical thinking skills (Tam, 2000), since the power of an inquiry-based approach to teaching and learning of science rests in its potential to improve students' intellectual engagement and fosters deep understanding to be able to put into practice what they have learned (Hutchings, 2007). By applying an inquiry-based learning approach in teaching, the knowledge base of learners is enriched and expanded as their social and communication skills are improved (Bada, 2015). Constructivism and inquiry-based learning serves as a conceptual approach to information literacy which is necessary in teaching and learning science, as it takes into account the affective and cognitive elements associated with metacognition of information seeking (Kuhlthau, 2008 p.71).

Considering the various reasons stated by teachers for not giving students assignments/projects that require the use of a variety of information sources, one could easily conclude that teachers were following the 2007 Curriculum which does not specify such assignments as the curriculum is designed mainly to pass examinations (such as WAEC, NECO, JAMB and Unified promotion examination for SS II, an exam compulsorily to be passed by any student in Ekiti State before writing WAEC or NECO). As pointed out by Alade (2011, p. 331), the Nigerian curriculum is examination centred, as such, no positive impact can be made on the curriculum that emphasises theoretical knowledge, rather than emphasising the development of inherent abilities and creative potentials in students through training and practices. The reasons Nigerian graduates are presently faced with challenges in the 21st century work environment is that they require information handling skills to solve problems which the curriculum lacks (Alade, 2011).

Sources of information and access points for the sources

This section discussed various sources of information teachers expected their students to use for the assignments. As revealed from findings in the preceding chapter where teachers were requested to mention information sources they would like their students to consult for assignments/projects (questions 18 to 20 in the questionnaire).

There are several sources of information expected of students to consult. Some of them revolves around the internet (the most common tool), Google, library; ICT laboratory/centre; science laboratory; videos, tele tutors; microscope; coin and dice toss in doing *probability* (in mathematics) and playing a board game; audio visual materials**;** their environment; textbooks; fieldtrip; excursion; chart and object; compiled past questions and answers (series); locally made materials and natural plants. See Chapter five, under section: *sources and where to find/access information teachers would like students to use for assignments/projects (questions 18 to 20)*" for details. Constructivism requires consulting a wide variety of materials, which may include raw data, primary sources, and interactive materials and equally encourages students to use them (Bada, 2015).

However, while teachers expected students to consult the internet, there was no functioning internet facility in any of the schools studied. Besides, no library had any computer for either staff or students to use. How students were expected to go online for their information needs was sought further. In the word of respondents (Director of TESCOM and SP#19), teachers in schools without internet connectivity were expected to use modems with their laptops to browse, and students were expected to access information online via their personal/parents' phones as the case may be. This demonstrates that the principal was not aware of the role library play in curriculum implementation (Overall & Grimes, 2013).

The teachers faced obstacles in advocating the utilisation of information resources other than recommended textbooks. They stated that their roles were hindered by the curriculum which is content driven and examination centred. They also decried the poor internet access and small size of the library which could hardly accommodate the whole class at once (as revealed in the chapter five, under section: "*school type and state of libraries in schools*"). The responsibilities of AEOs towards addressing these issues were just that of 'adviser', as no concrete measures could be put in place to improve the abysmal condition of schools other than recommendations to the Ministry of Education, Science & Technology. See chapter five under section 5.5.2.6.: *findings from the interviews with the director of Teaching Service Commission.*

In a school with no free textbooks (Adebayo, 2018) and no internet facility, coupled with the library consists mainly of textbooks and staffed with unqualified personnel, how teachers expect students to access a variety of information resources is a cause for concern. Even the Ekiti State public library cannot serve as a role model.

Scaffolding

Less than 50% of teachers selected each way of scaffolding (see Table 5.21) such as: locating and accessing information; providing students with examples of the end product (for example, a template for a poster); assisting students with brainstorming and mind mapping their project; work a similar example on the chalkboard; and giving students hints on how to go about their assignment/project. This implies that teachers were ambivalent towards projects/assignments that are in line with constructivism and inquiry-based learning. Through the researcher's interaction with students and teachers, the only time students received major assistance from teachers was during the practical classes where teachers assisted and guided in setting up the apparatus in the laboratory. This suggests that most of the teachers have been conducting science practical exercises with students as the only project expected of them.

Scaffolding the assignment enables students to tackle the assignments at specific timelines under supervision of a teacher as this will encourage students to be actively involved in the exploration of the content, issues, and questions surrounding a curricula area or concept, which gradually lead towards independent learning (Lane, 2007; Todd, Kuhlthau & Heinström, 2005). In order to promote student learning, it is necessary to create constructivist learning environments that directly expose the learner to the material being studied. Science process skills should be developed where students could ask questions; research; construct hypotheses and experiment to see if the system is working; and then analyse data and draw conclusions; if the system is not working, troubleshooting the procedure is employed, and the results are communicated as the new data will become another background research for future projects (Callison, 2015).

Types of presentations

Only less than half (45.6%) of teachers encouraged performance or demonstration as a way for students to present assignments. This was followed by a debate with pros and cons (two side – for or against) with less than 20% choosing other formats such as: simulate a talk show with a host and speakers; creating a board game with questions and answers; creating a word puzzle; video; collage and quiz representation and competitions within the class (see Figure 5.8). Teachers were asked to provide the researcher examples of the assignment instructions given to students so that the researcher could ascertain, for example, which information resources teachers were directing student to and the presentation formats for these assignments. However, going by the natures/examples of assignment teachers stated under Section; "*Description of assignments/projects that require students to use information resources other than textbooks (question 17)",* it can be concluded that teachers have not been exposed to other teaching and learning methods (such as – inquiry based approaches). This perhaps could be attributed to the nature of library resources (which are mostly textbooks) and science curriculum expectations that did not encourage information-based projects/assignments. In terms of teaching science education to foster the active learning, which requires interaction with a wide variety of resources for information-based assignments, information inquiry (guided-inquiry) (Kuhlthau, 2008) has served as conceptual approach to teaching science. The model assists students to explore in depth their thoughts and ideas before coming up with their own understanding of a topic. Active learning, (Zinn, 2012, p. 9), "involves a process not limited to the textbook and teacher's ideas, the proverbial chalk-and-talk approach. Active learning requires interaction with a wide variety of resources (print or digital) for information-based assignments". The ability to access and use resources (beyond the textbook) means that learners should have a thorough understanding and knowledge of diverse sources of information in addition to information handling skills as well as positive dispositions towards information seeking (Kuhlthau, 2004).

***Form of* assessment guidelines and rubrics**

Nearly all 99 (96.1%) respondents provided rubric or guidelines on how marks would be awarded when giving assignments/projects to students. However, the majority 69 (69.7%) of respondents provided a marking scheme (guide) designed by examination bodies such as WAEC and NECO which is only meant to pass the exam, while 41 (42.3%) provided self-designed marking schemes (rubric or guideline) for students. Even those who provided a self-designed marking scheme, adapted that of WAEC and NECO. The reason for sticking to the approved WAEC and NECO examples could be attributed to the 2007 curriculum which is content driven and exam oriented (Alade, 2011) and which only requires teachers in secondary schools to prepare students to pass the promotion exam and the exams conducted by WAEC and NECO. The total marks in percentage allocated for practical exercises range between 30% to 40% (see Appendix 35), which tallies equally with that of the WAEC/NECO marking scheme. This suggests that teachers were not giving assignments/projects that required students to collect, organise, analyse and critically evaluate information and communicate effectively with multiple formats of representation but only considered science practical work which is mostly laboratory work as a major project. This could be attributed to principals' perception that the advancement of learners usually revolves around teaching and learning in class (Oberg, 2006). However, this attitude does not take into consideration that for any effective teaching and learning to take place, library resources that could assist teachers to present their lessons must be provided. It is only the trained person who can rightly recommend teachers the relevant information resources for effective presentation of their lessons

These marking (guides) schemes do not have a common ground with the information inquiry model in terms of the cognitive aspect of learning, where learners are expected to construct/generate knowledge for themselves through interaction with media and libraries (Bada, 2015; Bhattacharjee, 2015). Very few teachers considered peer assessment (students mark each other's work) or collaborative assessment involving other professionals in their discipline or the librarian in the marking (Table 5.20). Taking a critical look at Appendix 35 supplied by teachers as assessment guidelines and rubrics, it can be concluded that students are not being prepared for independent and lifelong-learning but just to pass exams, as Appendix 35 has only marking schemes for examinations conducted by WAEC and NECO and not in any way rubrics.

Though, the emphasis on student-centred learning and inquiry/discovery learning in Appendix 35 may not be unconnected with lack of clear understanding of different teaching methods as pointed out by Kalu-Uche, Alamina and Ovute (2015), where teachers could not accurately described the teaching methods they adopted. The Nigeria curriculum lacks provision for inquiry based learning required for 21st century of teaching and learning science, as its major concern seems to be about passing external examinations (WAEC, NECO, JAMB), which is not in tandem with constructivism. For example, going by the physics curriculum introductory statement that reads; "*unfortunately, teaching and learning of physics has been fraught with challenges which prevent many students from passing well in external examinations"*. Unlike South African curriculum (see Appendix 36) that clearly states various methods of assessment which include tests, examinations, practical, projects, presentation, demonstration and performance as well as time allocation and how marks will be awarded for assignments/projects, the Nigerian 2007 Curriculum does not make provision for any project like assignment and, therefore, the awarding of marks for assignments is not clearly stated in the curriculum. This could be the reason teachers were not giving assignments that seriously required student to consult other sources of information apart from textbooks; as they would not want to go outside the curriculum. The responsibility of reviewing the curriculum rests solely on the Federal government. When the attention of the education stakeholders was drawn to this lacuna (lack of formats of assessment that could require students to seek information resources anywhere) in the curriculum, it seemed they were helpless as they could not do anything on their part. For instance, one of them (Director of PR&S TESCOM) simply responded:

> the curriculum is being designed at national level, apart from recommendation, there is little or nothing anybody could do other than to key in to it.

Constructivism is about creativity where teachers are expected to lay strong emphasis on: giving students assignment/project that require them to actively construct meaning for themselves and with others by questioning, observing, classifying, generalizing, verifying, thinking critically and solving problems; multiple formats of representation of assignment; collaboration and exchange of ideas and flexible guidelines/rubrics that suit secondary school education of 21st century which is expected to move along with advancement and evolving landscape in ICT.

6.6. CONCLUSION

This chapter discussed and interpreted the findings from the quantitative and qualitative research underpinned by the constructivism and inquiry-based learning as the main theoretical lens. Research questions, review of existing literature and theoretical framework underpinning the study served as a guide to the discussion of the findings. The adoption of mixed methods approach has paid off as it had made it possible to answer the research questions of this study by weaving together the findings from the quantitative and qualitative research. This chapter also discussed the broad topic of school libraries and teachers' method of teaching science education in Nigeria.

Conclusively, the major resources in school libraries for the implementation of a science curriculum were textbooks, as none of the school libraries studied had computers for either staff or students to use. Obsoleteness of library resources and inconvenient opening hours were the major hindrances to effective utilisation of library resources. The advocacy of using other information resources beyond recommended textbooks has not yielded much as a majority of teachers were still adopting teacher-centred approaches as a method of teaching.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 INTRODUCTION

The purpose of the conclusion chapter in a doctoral thesis is to offer major elements of the knowledge resulting from the research, urgencies for future work from the study and contributions to existing literature (Sampson, 2017). This chapter, therefore, discusses the level by which the research problem has been successfully addressed and answered. The chapter offers a summation of the entire study and this includes an examination of the study's distinct value to growing knowledge in the field of school librarianship and science education.

In this chapter, an overview of the research problem is presented first, followed by the summary of the research findings as related to the research problem against the background and framework of prior research. The last sections present the study's contribution to the body of knowledge, the implications of the research for theory, practice, policy and recommendations of the study as well as suggestions for further research.

7.2. SUMMARY OF THE RESEARCH PROBLEM

Provided in Chapter one is the statement of the research problem which was to investigate the role of School libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools. Chapter one, sections 1.1.1 to 1.1.4 clarifies and establishes further the premise on which the research problem is based and which is briefly described below.

The role of the school library in curriculum implementation is recognized by the Government (NNPE, 2004, p. 52). The government plan to embrace science for skills improvement to realise NV 20:2020, is a national effort required for developing and growing the Nigerian economy into one of the 20 largest principal economies by the year 2020 (Economic Transformation Blueprint, 2009). If science is important to Nigeria's economic growth, it is worthwhile to examine to what extent school libraries make a contribution to the success of science education. Twenty-seven selected secondary schools in Ekiti state, Nigeria were the case of this study.

7.3. SUMMARY OF THE RESEARCH FINDINGS

The findings for each research objective/question are summarized from Chapter six. The three broad research objectives are:

i. To know the status of school libraries in public senior secondary schools in Ekiti State, Nigeria.
ii. To determine the extent to which the quality of library resources influence the implementation of the science curriculum.
iii. To find out if science teachers advocate using information resources beyond textbooks.

Status of public school libraries

The first research question sought to find out the status of public school libraries. None of the so called “school librarians” had a Bachelor’s degree in Library and Information Science (B.L.I.S.), while the majority of them had other qualifications such as a BSc. or HND in other disciplines to occupy the position of school librarian in secondary schools The majority of them had more than 10 years’ work experience. Ordinarily, this number of years should have afforded them the opportunity to attend several in-house training sessions, workshops and conferences that would equip them to render an effective service to teachers and students in their various schools. However, with government’s lukewarm attitude towards library development in Nigeria, it would be difficult for all of these to be realised. Besides, the apathy among qualified librarians to work in school library, coupled with high levels of unemployment in Nigeria, it is not surprising to see people with BSc degrees taking up lower paying jobs, that are not commensurate with their qualifications, just to make ends meet. The advocacy for standard school libraries that could engage both teachers and students requires a full-time qualified school librarian who should take the lead.

There was no school library with functional internet connectivity in the state. Besides, the majority of the school libraries did not have television, which could make science come alive as there are many science documentaries and quiz shows on different television channels. Many of the schools still kept obsolete textbooks on the shelves that were no longer related to the current science curriculum.

More than 81% of school librarians rated the level of provision of textbooks to be adequate for implementing the science curriculum. The majority of science teachers indicated the available library resources (mostly textbooks) to be adequate in term of quality and quantity respectively. Other library resources such as: DVD-ROMs, CD-ROMs, online newspapers and magazines, TV, video games, internet facilities and e-books were either inadequate or unavailable.

More than 70% of the students evaluated the quality and quantity of their library resources (mainly textbooks) to be good. The researcher observed from accession registers of school libraries that, apart from textbooks, no other resources were available to support the science curriculum implementation. Besides, no library staff processed new acquisitions and there was no acquisition policy which could help to avoid waste and regulate the resources to enable libraries to have an adequate quality and quantity of resources linked to the school curriculum. Even the lofty idea of NERDC *Teachers' Aid* has been neither subscribed to by the Ekiti State Ministry of Education, Science & Technology nor any of the 27 schools visited by the researcher.

Influence of library resources on curriculum implementation

Less than half (44.4 %) of the school librarians stated that their library resources, which were mainly textbooks, had influence on science curriculum implementation, while 90.3% of teachers attested to textbooks as the only library resource that had a positive influence on their teaching and learning science in schools. Other resources were either inadequate or not available**..**

Science teachers' advocacy on using information resources beyond textbooks

Several methods were employed in obtaining evidence for this research objective/question, such as finding out the teaching approaches adopted by teachers, the nature of projects/assignments given by teachers (assignment topics), sources of information and access points for the sources, scaffolding, types of presentations and form of assessment guidelines and rubrics given to students by teachers.

A few teachers used constructivist methods, while the majority adopted a teacher centred approach. Most (72.8 %) teachers claimed they were giving students assignments/projects that challenged them to use information resources other than textbooks. Librarians' and students' responses corroborate the teachers' responses about being given assignments/projects that take students beyond consulting textbooks.

However, many of the assignments/projects given by teachers could be solved with the recommended textbooks (mostly published by *Africana First Publishers PLC and West African Books Publishers Ltd*). This could be attributed to a curriculum that is examination centred, which does not place more emphasis on the development of student's abilities and creative potentials that would take them beyond the recommended textbooks.

The average class size in this study is 87. Only 50% of teachers scaffolded student learning by, for example, providing students with examples of a project end product (such as, a template for a poster); assisting students with brainstorming and mind mapping their project; or giving students hints on how to go about their assignment/project. Similarly, less than half (45.6%) the teachers encouraged performances, demonstrations or debates as ways of presenting assignments. Even fewer (less than 20%) chose alternative, creative formats such as simulating talk shows; creating board games; creating word puzzles; videos; or collages.

A majority (96.1%) of teachers did not have constructivist inclined assessment guidelines or rubrics as they only used marking schemes (guides) designed by examination bodies such as WAEC/NECO (or adapted one).

7.4. LIMITATIONS OF THE STUDY

As this study investigated the role school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools, a few limitations were experienced. The greatest limitation of this study was the assumption that school library resources in Nigeria was that defined by IFLA (2015). It was a surprise after a decade (Olajide & Ariwodola, 2009) to find out that IFLA's ideas were still not the standard in Nigerian schools. For example, in First World countries, textbooks are viewed mainly as classroom resources unlike in Nigeria where students are required to buy their own textbooks. Students are not given free textbooks, instead the state sends copies of textbooks to be housed in the school libraries. Still, the study shows that a school library with mostly textbooks had an influence on science curriculum implementation. The reason for this influence could be attributed to the nature of Nigerian curriculum that is exam centred, which does not actually prepare student for independent and lifelong learning required for achieving the vision of the 21st century.

The researcher requested copies of assignments and projects teachers claimed to be giving students. In spite of assurances to respondents that their anonymity and confidentiality would remain intact, no teacher readily provided copies of such assignments.

7.5. CONCLUSIONS

This section presents the conclusions of the study which are based on the findings of each research question/objective of the study, as follows: status of school libraries; influence of library resources on curriculum implementation and extent of science teachers advocacy on using information resources beyond textbooks.

7.5.1 STATUS OF SCHOOL LIBRARIES

The majority of the library staff did not have a school librarian qualification. The majority of library resources were inadequate as textbooks were the predominant resource that supported science curriculum implementation. However, there are many materials that facilitate the learning process other than textbooks. To implement inquiry-based learning and teaching approaches a variety of learning resources (not only textbooks) are required including access to internet resources. To achieve NV20:2020, secondary school science education should embrace more learner-centred, inquiry-based approaches to develop critical thinking young adults.

7.5.2. INFLUENCE OF LIBRARY RESOURCES ON THE IMPLEMENTATION OF THE SCIENCE CURRICULUM

The most available resource in the library that supported curricula implementation was textbooks, followed by dictionaries. The authority in charge of the acquisition of school library resources in Ekiti State placed a higher premium on the acquisition of textbooks than any other type of library resource, which could be attributed to curriculum content that is exam oriented, lack of funds on the part of government to acquire all formats of resource, or government's awareness that students could not afford to buy textbooks for themselves. Though students may pass the examinations and enter university, it should be noted that students who have learned by rote often fall by the way side in university and even in the world of work which challenges critical thinking and expects independent learning.

7.5.3. SCIENCE TEACHERS' ADVOCACY ON USING INFORMATION RESOURCES BEYOND TEXTBOOKS

The majority of science teachers claimed they were regularly giving students assignments that required them to access and use other information resources, not only textbooks. However, these assignments could still be completed using the recommended textbooks. It can be concluded that teachers did not really set assignments that challenged students enough to warrant using other sources of information.

It can therefore be concluded that teachers have a limitation in effectively engaging students with assignments/projects that require them to consult other sources of information apart from textbooks. Teachers' roles were hindered by their inadequate knowledge of various teachings styles, the content and examination centred curriculum and inadequate library resources.

Teachers did not display a clear understanding of different teaching approaches. They used teacher-centred approaches. The assignments many of the teachers were giving to students could be solved with only their textbooks. In view of this, it can be concluded that teachers were not advocating using information resources beyond textbooks. If students could find solution to their assignments/projects in the their textbooks they would hardly be compelled to use other sources of information.

In this study, the average class size is 87, and the majority of teachers used a teacher centred approach. It can, therefore, be concluded that class sizes could make constructivist approaches to teaching challenging and unconducive for teachers to change methodology. They appeared to have little or no option other than to depend on teaching in their various classrooms, with little or no time for inquiry-based learning, a constructivist approach.

Conclusively, a majority of the teachers were ill-prepared to embrace inquiry-based learning because of inadequate library resources, a lack of a professional teaching qualification, large class sizes and the 2007 curriculum that is content driven and examination centred.

7.6. CONTRIBUTIONS OF THE STUDY TO THE BODY OF KNOWLEDGE IN RELATION TO THE RESEARCH PROBLEM

The fundamental question of this research was to investigate the role of School libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools. The study was confined to Ekiti State among school librarians, science teachers, science students and other major stakeholders in education associated with provision, management and utilization of library resources for science curricula implementation, forming a purposive sample. Triangulation is necessary as it offers the opportunity to explore various parts of a phenomenon (Mason, 2002), which is neeede in proffering answers to different research questions with different methods relating one source of information with another to enrich the quality of information. Since the combination of qualitative and quantitative approaches provides a more comprehensive understanding of research problems than either approach alone (Creswell, 2014). The revealing insights offered by the triangulation of qualitative and quantitative research methods may apply to secondary schools in other states in Nigeria. This study confirms previous, local research by (Afolabi & Elatruroti, 2016; Atanda & Jaiyeoba, 2011; Ayanlola, 2014; Olaojo, 2013; Owate & Iroha, 2013), that a school library is one of the most important and viable educational vehicles/means for national development. Observation visits, questionnaires for all categories of respondents and analysis of accession registers unravelled the factors behind the difficulty in applying inquiry-based approach for teaching and learning science subjects in the selected secondary schools in Ekiti State. Lack of qualified library personnel, inadequate library resources, lack of a professional teaching qualification, inappropriate teaching methods and large class sizes were the major factors responsible for this difficulty in applying inquiry-based approach for teaching and learning science subjects in the secondary schools.

A mixed methods approach was employed in this study to investigate the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria. Although, empirical studies have been conducted on the impact of school libraries on academic performance in Nigeria (Afolabi & Elatruroti, 2016; Atanda & Jaiyeoba, 2011; Ayanlola, 2014; Olaojo, 2013; Owate & Iroha, 2013), the current study distinctively explored the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools underpinned by a theory of constructivism. In this study, the existing literature on the subject matter investigated demonstrates that no comprehensive study grounded in constructivism has been undertaken. This research, therefore, filled a research gap in the context of the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools. In addition, the study serves as an addition to existing works on the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Nigerian setting.

7.6.1. IMPLICATIONS OF THE RESEARCH FOR THEORY, PRACTICE AND POLICY

This study has implications for theories in the school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools. In this section, the contributions of this current study in term of: theory; practice and policy are discussed:

Theory

Theoretically, this study is worthwhile in providing a platform for school principals, teachers and education stakeholders as well as curriculum developers in Nigeria to engage in and determine appropriate pedagogical methods of implementing inquiry-based learning. This is imperative given that government has adopted science in actualising its economic growth and the opportunity science offers by productively positioning the country in the wake of Fourth Industrial Revolution (Industry 4.0). Besides, secondary school education serves as the foundation to equip students to effectively live in the digital age of science and technology and for more knowledge in tertiary institutions and world of work. In addition, this study would empower school librarians and teachers in Nigeria to reconsider library orientation and traditional approaches to teaching and instead lay more emphasis on constructivist approaches. Though, it is possible for students to pass the exams and enter university by mainly consulting textbooks, students who have learned by memorisation (which could be achieved by mainly consulting textbooks) often fall by the way side in university and even in the world of work which challenges critical thinking and expects independent learning required for actualisation of the NV 20: 2020. For example, it is possible to find a graduate of chemistry who may not be able carry out a simple separating technique (crystallization) required to separate salt from their solutions This is as a result of learning by rote.

Policy

With regard to policy, this study is anticipated to bring about wide debate and conversation among policy makers (such as curriculum developers and education stakeholders which include librarians, teachers, school principals, AEOs and the Directors of State Library Board and TESCOM on how they can come together to: develop an acquisition policy that would encourage the acquisition of all formats of information resources for school libraries; train school librarians and ensure compliance with smaller class sizes to enable effective implementation of the curriculum that revolves around constructivism and student-centred learning. A lack of qualified library personnel and adequate resources are major problems for school library development, which hinder librarian-teacher collaboration that could make science curriculum implementation and guided inquiry effective.

Practice

In term of practice, the study contributes by exposing the actual state of school libraries and how they influenced science curriculum implementation in Ekiti State, Nigeria. The study found that the majority of the staff managing school libraries were not qualified and most library resources available for curriculum implementation were textbooks. The majority of teachers were still using a teacher centred approach in teaching. The nature of the assignments were limiting and teachers need to be informed about how to set assignments that are challenging.

The findings of this study may be useful to professional bodies such as the TRCN, LRCN and NLA, particularly Nigerian School Library Association (NSLA) section on formulating policies that will: encourage adoption of inquiry-based approach in teaching and learning, guide acquisition of library resources in a variety of formats, and advocate for the education of professional school librarians.

7.6.2. ORIGINALITY OF THE STUDY

Originality is a major criterion for assessing and evaluating PhD thesis. As stated by the Academic Skills Unit (2010, p. 2), “there are many criteria by which originality of the research could be determined”. Among the criteria as stated by (Academic Skills Unit, 2010, p. 2) are:

- demonstrating originality by testing someone else’s idea; carrying out empirical work that has not been done before
- using a different methodological approach to address a problem

- repeating research in other contexts, for example, a different state or country; applying existing ideas to new areas of study
- and adding to knowledge in a way that has not been previously done before (p. 2)

Since there has been no comprehensive empirical study employing a mixed methods approach conducted on the role of the school library in supporting an inquiry-based approach for teaching and learning science subjects in secondary schools in Ekiti State, Nigeria, this current study uniquely explores this research gap.

7.7. RECOMMENDATIONS OF THE STUDY

In this section, the recommendations offered are aligned with the research findings and conclusions on the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria. Based on the findings of this study, the following recommendations are made:

7.7.1. STATUS OF PUBLIC SCHOOL LIBRARIES

Recommendation 1: It is recommended that in subsequent employment, Ekiti State Government should employ library staff with at least a first degree in Library and Information Science to manage school libraries, and equally encourage and motivate the present library staff to further their studies in the field of Library and Information Science to be able to render effective service implementation. Also, Ministry of Education should work hand in hand with NERDC in updating the Curriculum in a way that allows ample time for students to use library and consult other sources of information so as to create room for inquiry based learning.

Recommendation 2: An acquisition policy should be jointly formulated by the State Library Board and State Ministry of Education, Science & Technology and school librarians to cater for the acquisition of all forms of information resources such as electronic and non-electronic resources which could encourage self-directed learning in schools. In addition, Ekiti State Government should expedite action on the provision of internet connectivity in all schools in the state so that both teachers and students will have free access to information on the internet for greater independent learning and knowledge creation.

7.7.2. INFLUENCE OF LIBRARY RESOURCES ON CURRICULUM IMPLEMENTATION

Recommendation 3: The authority in charge of the acquisition of library resources should look beyond acquiring just textbooks for the library. The acquisition of resources such as 3D objects, robotics, craft, science board games, models, charts and ICT software enliven teaching and learning, and go a long way in supporting the adoption of a guided inquiry approach in schools, or at least enable independent and lifelong learning needed to achieve Nigeria Vision 20:2020.

7.7.3. SCIENCE TEACHERS' ADVOCACY ON USING INFORMATION RESOURCES BEYOND TEXTBOOKS

Recommendation 4: It is recommended that all concerned stakeholders (Ministry of Education, Science & Technology, school principals, AEOs) should continue advocating for the use of a variety of information resources by requesting teachers to give students more challenging assignments/projects that will require them to consult information more widely (going beyond textbooks). The government should provide an enabling environment that will encourage the adoption of more constructivist learning approaches in schools. Such environment should include a well-equipped library managed by qualified personnel, smaller class sizes, teachers with adequate teaching qualifications and a compulsory library study period in all schools.

Unless these burning issues are addressed as it relates to Ekiti State secondary schools and other secondary schools in the Federation, NV 20: 2020 may remain but a mirage.

7.8. SUGGESTIONS FOR FURTHER RESEARCH

The research findings of this study and gaps from the literature, suggest that further research should consider investigating the following areas:

1. Initially, the study sought to find out if school librarians were knowledgeable of science subjects. This would have made the study too cumbersome. A study to know the librarian's knowledge of science could help in areas of collaboration with teachers in curriculum implementation. This study, therefore, recommends that empirical research be conducted to know librarians' knowledge of science.
2. Since Nigeria is made up of 36 states and the study was limited to only Ekiti State, it is suggested that similar research be conducted nationwide to make the results more

generalizable and also take into consideration various areas of differences in which secondary schools exist.

3. Finally, this study only considered public secondary schools in Ekiti State. Therefore, a comparative study of both public and private schools in Ekiti State will provide more insights to teaching approaches, curriculum implementation and academic performance in both categories of secondary schools in the state.

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LIST OF APPENDICES

Appendix 1: Interview Schedule with school principals and other education stakeholders

Date	Interviewee
13th June, 2018	SP#1, SP#7 and SP#8
14th June, 2018	SP#10, SP#11, SP#12, SP#13 and SP#16
19th June, 2018	SP#3, SP#5 and SP#6
20th June, 2018	SP#14 and SP#18
21st June, 2018	SP#15, SP#17, SP#19, SP#20 and SP#22
22nd June, 2018	SP#25
11th June, 2018	AEO#1
14th June, 2018	AEO#2
11th June, 2018	Director of State Library Board
11th June, 2018 and 19th February, 2019	Permanent secretary, Ministry of Education, Science & Technology
13th June, 2018 and 20th February, 2019	Director of Teaching Service Commission

Appendix 2: Questionnaire for school librarian

DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE,
FACULTY OF ARTS,
UNIVERSITY OF THE WESTERN CAPE,
SOUTH AFRICA

Dear Respondent,

My name is Olabode Olajide, a PhD student in Library and Information Science at the University of the Western Cape. I am conducting a study on THE ROLE OF SCHOOL LIBRARIES IN SUPPORTING AN INQUIRY BASED APPROACH FOR TEACHING AND LEARNING SCIENCE SUBJECTS IN SENIOR SECONDARY SCHOOLS IN EKITI STATE, NIGERIA". This study is in partial fulfilment of the conditions of Doctor of Philosophy in the department of Library and Information Science, University of the Western Cape, South Africa.

Therefore, I humbly request you to spare your valuable time for filling up the questionnaire. Your co-operation in providing data will be highly appreciated. The information supplied by you will be used for my research work only. You will be anonymous and all answers will be kept confidential.

In case you have any questions and wish to have a detailed account of this study please contact me at bordey2016@gmail.com; tel: 08036250056 or my supervisor Prof. Sandy Zinn at the University of the Western Cape at szinn@uwc.ac.za ; tel: +2721 9592349.

• Your participation is voluntary and you are free to withdraw at any time without giving any reason.

If you agree to take part in the above mentioned study, please fill in the questionnaire and return to me.

Thank you.

SECTION A: GENERAL INFORMATION

Please indicate your responses in the appropriate box ( ) against the answer of your choice and complete what you consider fit for the ones that involve writing.

1. What is the name of your school?

____

2. Date of establishment

____

3. Local Government Area/Town

____

4. Where is your school located?

   Mark only one oval.

   ◯ Urban
   ◯ Rural

5. What is your gender?

____

6. What is your age bracket?

Mark only one oval.

- 20-30
- 31-40
- 41-50
- 51-60
- 60 and above

7. Are you a certified full time librarian?

Mark only one oval.

- Yes
- No

8. What is your highest qualification?

Mark only one oval.

- SSCE
- Diploma in librarianship
- B.L.I.S.
- Masters
- PhD
- Other (please specify)

9. How many years have you occupied the position of school librarian?

Mark only one oval.

- 1-10
- 11-20
- 21=20
- 31 and above

SECTION B: AVAILABILITY OF SCHOOL LIBRARY AND ITS RESOURCES IN THE SCHOOL

10. Does your school have a library?

Mark only one oval.

- Yes
- No

11. If No to the question above, how have you been advocating using resources beyond textbooks?

____

____

____

____

____

12. If your school has a library, where is it located?

Mark only one oval.

- ◯ Book boxes
- ◯ Classroom(s)
- ◯ Principal's office
- ◯ Separate/purpose-built building
- ◯ Store house/room
- ◯ Cupboard

13. Does your school have "library study hour"?

Mark only one oval.

- ◯ Yes
- ◯ No

14. If No to the above question, please state how you encourage students to use the library_______________

____

____

15. What types of school library resources do you have in your school library that support implementation of the science curriculum?

Check all that apply.

- ☐ Textbooks
- ☐ Nonfiction science books
- ☐ Reference books
- ☐ Encyclopaedias
- ☐ Dictionaries
- ☐ Magazines
- ☐ Newspapers
- ☐ Journals
- ☐ Yearbooks
- ☐ Internet facilities

- [ ] CD-ROM/DVD-ROM
- [ ] Computer games
- [ ] Documentaries
- [ ] Charts & Pictorials
- [ ] Pictures
- [ ] Wall charts
- [ ] Flip charts
- [ ] Real objects/samples
- [ ] Television
- [ ] Microscopic slides
- [ ] Article topics collection (e.g. newspapers and magazine cuttings)

16. How does school library availability impact teaching and learning of science subjects in your school?

Mark only one oval.

- Very positively
- Positively
- Neutral
- No impact

17. Assess your school's level of provision of school library and its resources
Mark only one oval.

- Very adequate
- Adequate
- Not adequate

SECTION C: INFLUENCE OF SCHOOL LIBRARY ON THE SCIENCE SUBJECTS

18. In your overall assessment of the teachers, how would you describe the influence of availability of school library and its resource on the implementation of science subject curriculum in your school?

Mark only one oval.

- Maximum influence
- Minimum influence
- No influence

19. How have the following school library resources influenced teaching of science subjects in your school?

Mark only one oval per row.

	Very high influence	High influence	Low influence	No influence
Textbooks				
Nonfiction science books				
Reference books				
Encyclopedias				
Dictionaries				
Magazines				
Newspapers				
Journals				
Yearbooks				
Internet facilities				
CD-ROM/DVD-ROM				
Computer games				
Documentaries				
Charts & Pictorials				
Pictures				
Wall charts				
Flip charts				
Real objects/samples				
Television				
Microscopic slides				
Article topics collection (e.g. newspapers and magazine cuttings)				

20. How knowledgeable are you in science subjects?

Mark only one oval per row.

	Very knowledgeable,	Knowledgeable,	Not knowledgeable
Physics			
Chemistry			
Biology			
Mathematics			

SECTION D: USE OF SCHOOL LIBRARY BY TEACHERS

21. Do science teachers require students to use the library for science assignments/projects? *Mark only one oval.*

- Yes
- No

22. If your answer to the above question is YES, provide some of the assignment topics/ questions students have to investigate using library resources.

23. How regularly do science teachers use these library resources for the implementation of their subject content?

Mark only one oval per row.

	Very regularly	Regularly	Fairly regularly	Not regularly
Textbooks				
Nonfiction science books				
Reference books				
Encyclopaedias				
Dictionaries				
Magazines				
Newspapers				
Journals				
Yearbooks				
Internet facilities				
CD-ROM/DVD-ROM				
Computer games				
Documentaries				
Charts & Pictorials				
Pictures				
Wall charts				
Flip charts				
Real objects/samples				
Television				
Microscopic slides				
Article topics collection (e.g. newspapers and magazine cuttings)				

24. Tick activities science teachers normally use school library resources for:
Check all that apply.

- [ ] Prepare lesson note
- [ ] As instructional materials in classes
- [ ] Draw up examination questions/continuous assessment
- [ ] Don’t use them at all

25. Advance reasons why science teachers do not use the library
Check all that apply.

- [ ] It is located in a noisy environment
- [ ] Lack of adequate space
- [ ] Their personal collection is richer than the library’s
- [ ] Obsolete materials
- [ ] Opening hours not convenient
- [ ] Frustration in locating materials

SECTION E: SUPPORT RENDERED AS THE SCHOOL LIBRARIAN

26. The assistance I render to science teachers through the provision of the following resources of information have effectively influenced the curricula implementation of their subjects

Mark only one oval per row.

	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
Textbooks					
Nonfiction science books					
Reference books					
Encyclopedias					
Dictionaries					
Magazines					
Newspapers					
Journals					
Yearbooks					
Internet facilities					
CD-ROM/DVD-ROM					
Computer games					
Documentaries					
Charts & Pictorials					
Pictures					
Wall charts					
Flip charts					
Real objects/samples					
Television					
Microscopic slides					
Article topics collection (e.g. newspapers and magazine cuttings)					

SECTION F: EVALUATION OF LIBRARY USE COMPETENCY SKILLS

27. How competent (knowledge and skills) are teachers in using the school library?
Mark only one oval.

- Very competent
- Fairly competent
- Not competent
- I don't know

28. Which of the following library and information skills have you taught students to help them learn science?

Check all that apply.

- [ ] Study skills
- [ ] Finding skills
- [ ] Science literacy skills

THANK YOU FOR YOUR TIME AND CONTRIBUTION

Appendix 3: Questionnaire for science teacher

DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE,
FACULTY OF ARTS,
UNIVERSITY OF THE WESTERN CAPE,
SOUTH AFRICA

Dear Respondent,

My name is Olabode Olajide, a PhD student in "Library and Information Science at the University of the Western Cape. I am conducting a study on "THE ROLE OF SCHOOL LIBRARIES IN SUPPORTING AN INQUIRY BASED APPROACH FOR TEACHING AND LEARNING SCIENCE SUBJECTS IN SENIOR SECONDARY SCHOOLS IN EKITI STATE, NIGERIA". This study is in partial fulfilment of the conditions of Doctor of Philosophy in the Department of Library and Information Science, University of the Western Cape, South Africa.

Therefore, I humbly request you to spare your valuable time for filling up the questionnaire. Your co-operation in providing data will be highly appreciated. The information supplied by you will be used for my research work only. You will be anonymous and all answers will be kept confidential.

In case you have any questions and wish to have a detailed account of this study please contact me at: bordey2016@gmail.com; tel: +2348036250056 or my supervisor Prof Sandy Zinn at the University of the Western Cape at: szinn@uwc.ac.za ; tel: +2721 9592349.

Your participation is voluntary and you are free to withdraw at any time without giving any reason.

If you agree to take part in the above mentioned study, please fill in the questionnaire and return to me.

Thank you.

SECTION A: GENERAL INFORMATION

Please indicate your responses in the appropriate box **(√)** against the answer of your choice and complete what you consider fit for the ones that involve writing.

1. What is the name of your school?..

2. Local Government Area/Town……………………………………………………………………

3. Where is your school located?
   - Rural area
   - Urban area

4. Date of establishment of the school…………………………

5. How many years have you been teaching science subject(s)?

6. What is your highest qualification? *Mark only one oval.*
   - Diploma
   - N.C.E.
   - BSc
   - Masters
   - PhD
   - Other (Please give details) ____

7. What is the total population of **ALL students** in your school……………………

8. Which science subject/s do you teach?

- [ ] Physics
- [ ] Chemistry
- [ ] Biology
- [ ] Mathematics

9. Please provide the number of science students you teach in **SSS1**, **SSS2**, **SSS3**.
Your answers should provide details for each subject and each level. For example: SSS1 Physics 45; Chemistry 45. SSS2 Mathematics 76, etc.
………………………………………..
………………………………………..
………………………………………..
……………………………………….

SECTION B: AVAILABILITY OF SCHOOL LIBRARY AND ITS RESOURCES IN THE SCHOOL

10. Does your school have a library?

Mark only one oval.

- Yes
- No

11. If no to the above question, then, how have you been advocating using resources beyond textbooks?

12. If you have a library in your school, where is it located?

Mark only one oval

- Book boxes
- Classroom(s)
- Principal's office
- Separate/Purpose built building
- Store house/room
- Cupboard
- Other (Please specify) ____

13. To what extent does school library availability influence teaching and learning of science subjects in your school?

Mark only one oval.

- Very positively
- Positively

- Neutral
- No influence

SECTION C: TEACHING APPROACH

14. Please select below the teaching approach that best describe your teaching:

[ ] <u>Teacher-centred approach:</u>

- The teacher is the highest authority, the expert.
- The teacher talks and students listen.
- The teachers use direct instruction and students learn through listening and watching the teacher.
- The teacher is in control of the classroom. The teacher directs all classroom activities.
- Teachers choose what students will learn, how the students will learn, and how the students will be assessed on their learning
- Assessment is usually tests and exams.
- Students work on their own and seldom in groups.
- The teacher provides students with all the information they need to learn and to acquire a certain set of knowledge along with basic skills and abilities.
- Learning is through repetition, and learning is a quantifiable outcome.

[ ] <u>Student centred approach:</u>

- Teachers and students share the classroom space equally.
- Students are not passive receivers of information and ideas from the teacher.
- There is equal interaction between teachers and students.
- Group work is encouraged and students learn to collaborate and communicate with one another.
- Students learn to direct their own learning, ask questions, and complete tasks independently.
- Focuses on skills and practices for life-long learning and independent problem-solving.
- Emphasizes the understanding that students construct their own meaning from new information and add it to prior experience
- Students choose what they will learn, how they will learn, and how they will assess their own learning

[ ] <u>(Guided) Inquiry-based learning:</u>

- The teacher acts as a facilitator of the learning process.
- There is equal emphasis on the *process* as on the content of learning
- Prior knowledge is established and new knowledge built on
- Form of active learning that starts by posing questions, problems or scenarios—rather than simply presenting established facts or portraying a smooth path to knowledge.
- Learning is done in a social context, from each other and even outsiders
- Students voices lend weight.
- Inquirers identify and research issues and questions to develop their knowledge or solutions.
- Inquiry-based learning includes problem-based learning, and is used in projects, as well as research.
- Reflecting on learning and depth of thought are valued
- Assessment is varied and there is equal regard for the process and the end product of learning

SECTION D: NATURE OF ASSIGNMENTS/PROJECT YOU GIVE TO STUDENTS THAT REQUIRE THEM TO USE INFORMATION RESOURCES OTHER THAN TEXTBOOKS

15. As a science teacher, do you give students assignments/projects that require them to use information resources other than textbooks? Circle your choice: Yes or No

16. If you answered NO to question 15, provide a reason why you do <u>not</u> set science assignments or projects
....
....

17. If you answered **Yes** to question 15, provide a detailed description of the assignments/projects you give to students that require them to use information resources other than textbooks? If you have copies of assignment/project instruction, you may attach them to this questionnaire. Your anonymity and confidentiality will remain intact.
....
....
....
....
....

18. Which sources of information **<u>would you like</u>** students to use for these assignments/projects?
……
……
……………………………..

19. **<u>Where</u>** do you expect students to access/find these information sources?
……
……
…………

20. From your experience as a teacher, which sources of information have your students been **using most of the time** for these assignments/projects?
……
……
……………………

21. Other than writing a report or essay, what other forms of presentation are students encouraged to use to present their assignments/projects? *Check all that apply.*
Check all that apply.

- [ ] Present a slide show (e.g. power point presentation)
- [ ] Conduct a performance or demonstration
- [ ] Have a debate with pros and cons (two sides – for or against)
- [ ] Create a Crossword puzzle
- [ ] Create a board game with questions and answers
- [ ] Create a video
- [ ] Simulate a talk show with a host and speakers
- [ ] Create a collage
- [ ] Design a model
- [ ] Any other, please specify……………………………………………………………………….........................

SECTION E: ASSESSMENT OF ASSIGNMENTS/PROJECTS

22. Do you provide a rubric or guideline on how marks will be awarded when giving out assignments/projects to students? Circle your choice: **Yes** or **No**

What kind of marking guide do you give students when setting assignments/projects?

- [ ] Marking (scheme) guide designed by exam bodies like WAEC, NECO, etc.
- [ ] Self-designed marking scheme
- [ ] Others, please specify………………………………………………………………………………………

.

23. Do the marks for these assignments/projects count towards the student's promotion? YES/ NO. If YES, what percentage of the final mark comes from assignments/projects? ………………………………………………

24. How do you assess the students' assignments/projects?

- ☐ Using peer assessment (students mark each other's work)
- ☐ Authentic assessment (involving people in real life setting e.g. a nurse, biologist, physicist)
- ☐ Collaborative assessment (involving other professionals in your discipline or the librarian in the marking)
- ☐ Assessment by subject teacher alone
- ☐ Other, please specify………………………………………………………………………………………….

SECTION F: SCAFFOLDING OF THE ASSIGNMENT

25. Do you support students at different stages (planning, during and end) of a project?

Tick all that apply

- ☐ I do not provide support because students should be able to do the project independently
- ☐ I assist students with brainstorming and mind mapping their project
- ☐ I assist students in locating and accessing information
- ☐ I provide students with examples of the end product (for example, a template for a poster)
- ☐ Other, please specify other kinds of support to students ………………………………………………………………………………………………….

26. How much time do you generally give students for assignments/projects?

- ☐ Few days
- ☐ A week
- ☐ Two weeks
- ☐ More than two weeks

SECTION G: AWARENESS OF RESOURCES THAT SUPPORT IMPLEMENTATION OF SCIENCE CURRICULUM IN THE LIBRARY

27. What types of library resources are you aware of in your school library that support implementation of science curriculum? *Check all that apply.*

- ☐ Textbooks
- ☐ Nonfiction science books
- ☐ Reference books
- ☐ Encyclopaedias
- ☐ Dictionaries
- ☐ Magazines
- ☐ Newspapers
- ☐ Journals
- ☐ Yearbooks
- ☐ Internet facilities

- [ ] CD-ROM/DVD-ROM
- [ ] Computer games
- [ ] Documentaries
- [ ] Charts & Pictorials
- [ ] Pictures
- [ ] Wall charts
- [ ] Flip charts
- [ ] Real objects/samples
- [ ] Television
- [ ] Microscopic slides
- [ ] Article topics collection (e.g. newspapers and magazine cuttings)

SECTION H: RELEVANCE AND ADEQUACY OF SCHOOL LIBRARY RESOURCES TO SCIENCE SUBJECTS

28. School library resources are relevant to the teaching of science subject(s) in my school. *Mark only one oval per row.*

	Strongly Agree	Agree	Neutral	Strongly disagree	Disagree
Textbooks					
Nonfiction science books					
Reference books					
Encyclopaedias					
Dictionaries					
Magazines					
Newspapers					
Journals					
Yearbooks					
Internet facilities					
CD-ROM/DVD-ROM					
Computer games					
Documentaries					
Charts & Pictorials					
Pictures					
Wall charts					
Flip charts					
Real objects/samples					
Television					
Microscopic slides					
Article topics collection (e.g. newspapers and magazine cuttings)					

29. What do you normally use school library resources for?
Check all that apply.

- [ ] Prepare lesson notes
- [ ] As instructional materials in classes

- [ ] Draw up examination questions/continuous assessment
- [ ] For setting assignments or projects
- [ ] For creating reading/reference lists for students

30. Rate in term of QUALITY, the adequacy of the school library resources utilization on the implementation of your subject's learning instructions in your school:

Mark only one oval per row.

	Very adequate	Adequate,	Fairly adequate,	Not adequate
Textbooks	⬭	⬭	⬭	⬭
Nonfiction science books	⬭	⬭	⬭	⬭
Reference books	⬭	⬭	⬭	⬭
Encyclopaedias	⬭	⬭	⬭	⬭
Dictionaries	⬭	⬭	⬭	⬭
Magazines	⬭	⬭	⬭	⬭
Newspapers	⬭	⬭	⬭	⬭
Journals	⬭	⬭	⬭	⬭
Yearbooks	⬭	⬭	⬭	⬭
Internet facilities	⬭	⬭	⬭	⬭
CD-ROM/DVD-ROM	⬭	⬭	⬭	⬭
Computer games	⬭	⬭	⬭	⬭
Documentaries	⬭	⬭	⬭	⬭
Charts & Pictorials	⬭	⬭	⬭	⬭
Pictures	⬭	⬭	⬭	⬭
Wall charts	⬭	⬭	⬭	⬭
Flip charts	⬭	⬭	⬭	⬭
Real objects/samples	⬭	⬭	⬭	⬭
Television	⬭	⬭	⬭	⬭
Microscopic slides	⬭	⬭	⬭	⬭
Article topics collection (e.g. newspapers and magazine cuttings)	⬭	⬭	⬭	⬭

31. Rate in term of QUANTITY, the adequacy of the school library resources utilization on the implementation of your subject's learning instructions in your school. *Mark only one oval per row.*

	Very adequate,	Adequate,	Fairly adequate,	Not adequate
Textbooks				
Nonfiction science books				
Reference books				
Encyclopaedias				
Dictionaries				
Magazines				
Newspapers				
Journals				
Yearbooks				
Internet facilities				
CD-ROM/DVD-ROM				
Computer games				
Documentaries				
Charts & Pictorials				
Pictures				
Wall charts				
Flip charts				
Real objects/samples				
Television				
Microscopic slides				
Article topics collection (e.g. newspapers and magazine cuttings)				

32. In a follow up to questions 31 and 32, rate generally the adequacy of the school library resources utilization on the implementation of your subject's learning instructions in your school.

- Very adequate
- Fairly adequate
- Adequate
- Not adequate

33. If you have not been using the library regularly for curriculum implementation, why?

Check all that apply.

- [ ] It is located in a noisy environment
- [ ] Lack of adequate space
- [ ] My personal collection is richer than the library's
- [ ] Obsolete materials
- [ ] Opening hours not convenient
- [ ] User frustration in locating materials
- [ ] My textbook is enough

SECTION I: INFLUENCE OF SCHOOL LIBRARY ON SCIENCE

34. The quality of the following school library resources influences my subject implementation.

Mark only one oval per row.

	Regularly	Occasionally	Never
Textbooks	⬭	⬭	⬭
Nonfiction science books	⬭	⬭	⬭
Reference books	⬭	⬭	⬭
Encyclopaedias	⬭	⬭	⬭
Dictionaries	⬭	⬭	⬭
Magazines	⬭	⬭	⬭
Newspapers	⬭	⬭	⬭
Journals	⬭	⬭	⬭
Yearbooks	⬭	⬭	⬭
Internet facilities	⬭	⬭	⬭
CD-ROM/DVD-ROM	⬭	⬭	⬭
Computer games	⬭	⬭	⬭
Documentaries	⬭	⬭	⬭
Charts & Pictorials	⬭	⬭	⬭
Pictures	⬭	⬭	⬭
Wall charts	⬭	⬭	⬭
Flip charts	⬭	⬭	⬭
Real objects/samples	⬭	⬭	⬭
Television	⬭	⬭	⬭
Microscopic slides	⬭	⬭	⬭
Article topics collection (e.g. newspapers and magazine cuttings)	⬭	⬭	⬭

35. Rate your school librarian's knowledge of science *Mark only one oval.*

- ⬭ Good
- ⬭ Average
- ⬭ Fair
- ⬭ Poor

36. In your own opinion, what degree of influence does the availability of a school library have on science curriculum implementation?

Mark only one oval.

- ⬭ Maximum influence
- ⬭ Minimum influence
- ⬭ No influence

SECTION J: ADEQUACY OF THE SCIENCE AND COMPUTER LABORATORIES

37. How adequate are the science laboratories in your school? *Mark only one oval per row.*

	Adequate	Not adequate	Not available
Physics laboratory	⬭	⬭	⬭
Chemistry laboratory	⬭	⬭	⬭
Biology laboratory	⬭	⬭	⬭

38. The computer laboratory is used for science teaching and learning in your school *Mark only one oval.*

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- Not available

39. Please, feel free to make general comments on any area of this study this questionnaire has not covered?

THANK YOU FOR YOUR TIME AND CONTRIBUTION

Powered by Google Forms

Appendix 4: Questionnaire for student

DEPARTMENT OF LIBRARY AND INFORMATION SCIENCE,
FACULTY OF ARTS,
UNIVERSITY OF THE WESTERN CAPE,
SOUTH AFRICA

Dear Respondent,

My name is Olabode Olajide, a PhD student in Library and Information Science at the University of the Western Cape. I am conducting a study on THE ROLE OF SCHOOL LIBRARIES IN SUPPORTING AN INQUIRY BASED APPROACH FOR TEACHING AND LEARNING SCIENCE SUBJECTS IN SENIOR SECONDARY SCHOOLS IN EKITI STATE, NIGERIA". This study is in partial fulfillment of the conditions of Doctor of Philosophy in the department of Library and Information Science, University of the Western Cape, South Africa.

Therefore, I humbly request you to spare your valuable time for filling up the questionnaire. Your co-operation in providing data will be highly appreciated. The information supplied by you will be used for my research work only. You will be anonymous and all answers will be kept confidential.

In case you have any questions and wish to have a detailed account of this study please contact me at bordey2016@gmail.com; tel: 08036250056 or my supervisor Prof. Sandy Zinn at the University of the Western Cape at szinn@uwc.ac.za; tel: +2721 9592349.

• Your participation is voluntary and you are free to withdraw at any time without giving any reason.

If you agree to take part in the above mentioned study, please fill in the questionnaire and return to me.

Thank you.

SECTION A: GENERAL INFORMATION

Please indicate your responses in the appropriate box ( ) against the answer of your choice and complete what you consider fit for the ones that involve writing.

1. What is the name of your school?

2. Where is your school located? *Mark only one oval.*

- Urban
- Rural

3. What is your gender?

4. Indicate subjects you take from the following:
   Check all that apply.

- [ ] Physics
- [ ] Chemistry
- [ ] Biology
- [ ] Mathematics

SECTION B: AVAILABILITY, ACCESSIBILITY, UTILISATION AND ADEQUACY OF LIBRARIAN'S SUPPORT

5. Does your school have a library? if your answer is no, then answer only question 7 and stop *Mark only one oval.*

- Yes
- No

6. If no to the above question, where do you find materials to study and do your assignments?

7. If you have a school library, where is it located?
   Mark only one oval.

- Book boxes
- Classroom(s)
- Principal's office
- Separate/purpose-built building
- Store house/room
- Cupboard

8. How often do you use the library? *Mark only one oval.*

- Daily
- Once in a week
- Once in a month
- Occasionally
- Others (Please explain)

9. How often do your science teachers set assignments that require access to information resources beyond the textbooks?

Mark only one oval.

- Very regularly
- Regularly
- Fairly regularly
- Not regularly

10. How regularly do you enjoy the services rendered by the school librarian? *Mark only one oval.*

- Very regularly
- Regularly
- Fairly regularly
- Not regularly
- Not at all

11. Evaluate your school library in line with the following criteria *Mark only one oval per row.*

	Very good	Good	Fairly good	Not good	Don't know
Quality of personnel					
Quality of service					
Quality of resources					
Quantity of resources					
Administration of school library					
Attitude of the school librarian					

12. What types of library resources are you aware of in your school library that support your academic performance in science subjects?

Check all that apply.

- ☐ Textbooks
- ☐ Nonfiction science books
- ☐ Reference books
- ☐ Encyclopedias
- ☐ Dictionaries
- ☐ Magazines
- ☐ Newspapers
- ☐ Journals
- ☐ Yearbooks
- ☐ Internet facilities
- ☐ CD-ROM/DVD-ROM
- ☐ Computer games
- ☐ Documentaries
- ☐ Charts & Pictorials
- ☐ Pictures
- ☐ Wall charts
- ☐ Flip charts
- ☐ Real objects/samples
- ☐ Television
- ☐ Microscopic slides
- ☐ Article topics collection (e.g. newspapers and magazine cuttings)

13. How relevant are these library resources to your science subjects?
Mark only one oval per row.

	Very relevant	Relevant	Fairly relevant	Not relevant
Textbooks				
Nonfiction science books				
Reference books				
Encyclopaedias				
Dictionaries				
Magazines				
Newspapers				
Journals				
Yearbooks				
Internet facilities				
CD-ROM/DVD-ROM				
Computer games				
Documentaries				
Charts & Pictorials				
Pictures				
Wall charts				
Flip charts				
Real objects/samples				
Television				
Microscopic slides				
Article topics collection (e.g. newspapers and magazine cuttings)				

14. Does the school library influence your academic performance in science subjects? *Mark only one oval.*

- Very significant influence
- significant influence
- Fairly significant influence
- No significant influence

SECTION C: EVALUATION OF LIBRARY USE COMPETENCY SKILLS

15. How competent are you in using the library?
Mark only one oval.

- Very competent
- Competent
- Fairly competent
- Not competent

16. Through the school library, you have been able to acquire the following relevant skills needed for learning science subjects:

Mark only one oval per row.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Study skills	⬭	⬭	⬭	⬭	⬭
Finding skills	⬭	⬭	⬭	⬭	⬭
Science literacy skills	⬭	⬭	⬭	⬭	⬭

SECTION D: ADEQUACY OF THE SCIENCE AND COMPUTER LABORATORIES

17. How adequate are the science laboratories in your school?

Mark only one oval per row.

	Very adequate	Adequate	Not adequate
Physics laboratory	⬭	⬭	⬭
Chemistry laboratory	⬭	⬭	⬭
Biology laboratory	⬭	⬭	⬭

18. The computer laboratory is used for science teaching and learning in your school *Mark only one oval.*

⬭ Strongly agree

⬭ Agree

⬭ Neutral

⬭ Disagree

⬭ Strongly disagree

THANK YOU FOR YOUR TIME AND CONTRIBUTION

Appendix 5: Interview guide for school principal

- Please, what is/are your qualifications? ………………………………………
- What is your year of experience? …………………………………
- Are students encouraged to read and consult texts beyond their textbook for their science subjects? If the answer is yes, please explain how it is encouraged. If the answer is no, please give reasons.
- In what way do you ensure that science teachers advocate using information resources beyond textbooks?
- Is library in your school adequately equipped in term of **resources** and **qualified personnel? Yes/No.** If **No**, then what are you doing to ensure that the school libraries are well equipped both in term of **resources and qualified personnel** to serve science teachers and science students for greater curriculum implementation academic performance?
- How do you ensure that **fulltime qualified librarians** are the ones managing your school library?
- Does your school have **a library study period?** If it does, how often do classes visit the school library? If it does not, what are the plans to ensure that students use the library?
- Are school science and computer laboratories in your school adequately equipped to serve science teachers and science students for curriculum implementation for academic achievement? If **No**, then what is the school doing to ensure that the laboratories in schools are well equipped? If yes, describe the state of the science labs and computer lab in your school.
- Please, comment freely on areas you think this interview guide has not covered.

Thank you for your time and contributions

Appendix 6: Interview guide for Area Education Officer

- Please, what is/are your qualifications? ……………………………………
- What is your year of experience? …………………………………
- In the curriculum, there is no general format for mode of assessment that requires students to read beyond textbooks. How do you ensure that students read beyond textbooks?
- In what way do you ensure that science teachers advocate using information resources beyond textbooks?
- Are school libraries in your local government adequately equipped in term of **resources** and **qualified personnel? Yes/No.** If **No**, then what are you doing to ensure that the school libraries are well equipped both in term of **resources and qualified personnel** to serve science teachers and science students for greater curriculum implementation academic performance?
- How do you ensure that **fulltime qualified librarians** are the ones managing school libraries?
- It was observed during my visitation to schools that most of the schools don't have **"library study period"**. What are the plan to ensure that schools create time for students to use library?
- Are school science and computer laboratories in your local government adequately equipped to serve science teachers and science students for greater curriculum implementation academic achievement? **Yes/No.** If **No**, then what are you doing to ensure that the laboratories in schools are well equipped?
- Please, comment freely on areas you think this interview guide has not covered.

Thank you for your time and contributions

Appendix 7: Interview guide for director of State Library Board

- Please, what is/are your qualifications? ………………………………………
- What is your year of experience? …………………………………
- Are school libraries in the state adequately equipped in term of **resources** and **qualified personnel? Yes/No.** If **No**, then what are you doing to ensure that the school libraries are well equipped both in term of **resources and qualified personnel** to serve science teachers and science students for greater curriculum implementation and academic achievement?
- How do you ensure that **fulltime qualified librarians** are the ones managing school libraries?
- It was observed during my visitation to schools that most of the schools don't have **"library study period"**. What are the plan to ensure that schools create time for students to use library?
- In what way do you ensure that science teachers advocate using information resources beyond textbooks?
- Please, comment freely on areas you think this interview guide has not covered.

Thank you for your time and contributions

Appendix 8: Interview guide for director of Teaching Service Commission

- Please, what is/are your qualifications? ………………………………………
- What is your year of experience? …………………………………………
- In the curriculum, there is no general format for mode of assessment that requires students to read beyond textbooks. How do you ensure that students read beyond textbooks?
- In what way do you ensure that science teachers advocate using information resources beyond textbooks?
- Are school libraries in the state adequately equipped in term of **resources** and **qualified personnel? Yes/No.** If **No**, then what are you doing to ensure that the school libraries are well equipped both in term of **resources and qualified personnel** to serve science teachers and science students for greater curriculum implementation and academic achievement?
- How do you ensure that **fulltime qualified librarians** are the ones managing school libraries?
- It was observed during my visitation to schools that most of the schools don't have **"library study period"**. What are the plan to ensure that schools create time for students to use library?
- Are school science and computer laboratories in the state adequately equipped to serve science teachers and science students for greater curriculum implementation and academic achievement? **Yes/No.** If **No**, then what are you doing to ensure that the laboratories in schools are well equipped?
- Please, comment freely on areas you think this interview guide has not covered

Thank you for your time and contributions

Appendix 9: Interview guide for Permanent Secretary, Ministry of Education, Science & Technology

- Please, what is/are your qualifications? ………………………………………
- What is your year of experience? …………………………………………
- In the curriculum, there is no general format for mode of assessment that requires students to read beyond textbooks. How do you ensure that students read beyond textbooks?
- In what way do you ensure that science teachers advocate using information resources beyond textbooks?
- Are school libraries in the state adequately equipped in term of **resources** and **qualified personnel? Yes**/**No.** If **No**, then what are you doing to ensure that the school libraries are well equipped both in term of **resources and qualified personnel** to serve science teachers and science students for greater curriculum implementation and academic achievement?
- How do you ensure that **fulltime qualified librarians** are the ones managing school libraries?
- It was observed during my visitation to schools that most of the schools don't have **"library study period"**. What are the plan to ensure that schools create time for students to use library?
- Are school science and computer laboratories in the state adequately equipped to serve science teachers and science students for greater curriculum implementation and academic achievement? **Yes**/**No.** If **No**, then what are you doing to ensure that the laboratories in schools are well equipped?
- Please, comment freely on areas you think this interview guide has not covered

Thank you for your time and contribution

Appendix 10: Library and laboratory observation guide

Name of the school____

School	Number of science books (in accession registers) for each subject, i.e. Mathematic (M), Physics (P), Chemistry (C) and Biology (B) and the dates of publication (DOP) which were recorded in range					Nature of resources other than textbooks e.g. Encyclopaedia, Dictionaries, non Non fiction science etc. with date of publication (DOP) and copies	Number of computers/ laptops in the computer lab	No of resources allowed to be borrow by teacher (T) and student (S)		Are the science laboratories well equipped? Physics (P), Chemistry (C) and Biology (B)			Practical period for a science subject per week	Availability of library study period	School type
	M	P	C	B	DOP			T	S	P	C	B			
SCHL#															

Key: Y = Yes, N = No, MRC = Multichoice Resource Centre, CLNA = computer laboratory not available; 3 in 1 = (Multipurpose) one laboratory being used for physics, chemistry and biology, NLOR = Not lending out resources, A = Available, NA = Not available

Appendix 11: UWC ethical clearance

UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
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www.uwc.ac.za

09 October 2017

Mr O Olajide
Library and Information Science
Faculty of Arts

Ethics Reference Number: HS17/8/12

Project Title: Functional school libraries as predictors of students' academic performance in Science subjects in public senior secondary schools in Ekiti State, Nigeria.

Approval Period: 22 September 2017 – 22 September 2018

I hereby certify that the Humanities and Social Science Research Ethics Committee of the University of the Western Cape approved the methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER - 130416-049

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

Appendix 12: approval to carry out research in public senior secondary schools in Ekiti State

MINISTRY OF EDUCATION, SCIENCE & TECHNOLOGY,
EKITI STATE OF NIGERIA
PHASE IV, NEW SECRETARIAT, ADO-EKITI.
SCHOOLS' DEPARTMENT

Your Ref: No...............................
All Communications should be addressed to
EK/ED/SCHLS/1111/

10th January, 2018

Olabode Olajide
Department of Library & Information Science,
University of the Western Cape,
Private Bag x17
Bellville, 7535
Cape Town.

RE: REQUEST FOR INTERVIEW AND AN APPROVAL TO CARRY OUT RESEARCH IN PUBLIC SENIOR SECONDARY SCHOOLS IN EKITI STATE: LETTER OF APPROVAL.

I am directed to acknowledge the receipt of your letter dated 28th December, 2017 on the above subject and to convey the approval of the Ministry of Education, Science & Technology, Ado Ekiti to you on your request for permission to carry out research in Public Senior Secondary Schools in Ado; Ido/Osi and Ikere Local Government Areas of Ekiti State as requested.

2. However, you are to note that information gathered is to be used strictly for the purpose of the research work alone. You are also required to submit to this Ministry a copy of the result and conclusion of your findings to assist in policy making in the Education Sector.

3. Thank you.

E.A Daramola
For: Permanent Secretary

Appendix 13: Approval to carry out interview and research in public senior secondary schools in Ikere Local Government Area

TELEGRAM.................. ...Orisun Imo, Orisun Oye TELEPHONE ....

MINISTRY OF EDUCATION, SCIENCE & TECHNOLOGY

EKITI STATE OF NIGERIA

PHASE IV, NEW SECRETARIAT, ADO-EKITI.

AREA EDUCATION OFFICE **IKERE**

Your Ref: No....

All Communications should be addressed to the Area Education Officer

Our Ref No:..IK/AEO/AD.10/...............

Date: 14th Feb, 2018

The Principals,
Ikere Local Government,
Ikere-Ekiti

RE: REQUEST FOR INTERVIEW AND APPROVAL TO CARRY OUT RESEARCH IN PUBLIC SENIOR SECONDARY SCHOOLS IN EKITI STATE

LETTER OF APPROVAL

This is to inform you that the Ministry of Education, Science and Technology, Ado, has granted Mr. Olabode Olajide approval to carry out research in Public Senior Secondary Schools in Ikere Local Government Area of Ekiti State.

2. In view of the above, you are requested to please give him maximum assistance needed.

3. Thank you.

14/02/18

Babalotin E. S.
Area Education Officer,
Ikere-Ekiti.

Appendix 14: Approval to carry out interview and research in public senior secondary schools in Ado Local Government Area

TELEGRAM... TELEPHONE

MINISTRY OF EDUCATION SCIENCE AND TECHNOLOGY,
EKITISTATE OF NIGERIA
Area Education Office
Office 2, Ado-Ekiti

Your Ref: No..
All Communications should be addressed to
The Permanent Secretary quoting:
Our Ref No. EK/ED/AEO2/ADK/07/ 01

15th Feb., 2018

Olabode Olajide,
Department of Library & Information Science,
University of the Western Cape,
Private Bag x 17,
Bellville 7535,
Cape Town.

RE-REQUEST FOR INTERVIEW AND APPROVAL TO CARRY OUT RESEARCH IN PUBLIC SENIOR SECONDARY SCHOOLS IN EKITI STATE

Above subject matter refers please.

2. Consequent upon the approval of the Ministry of Education Science & Technology as signed by the Director Schools Department, I wish to convey the approval of this office to you that you are permitted to conduct your Research in the under listed Schools and that you should abide by the rules and regulations of the schools during the period of your research.

1. Baptist High School, Ado-Ekiti.
2. Christ Girls' School, Ado-Ekiti.
3. Christ's School, Ado-Ekiti.
4. Ola-Oluwa Muslim Grammar School, Ado-Ekiti.

3. This letter serves as your entry permit into these schools please.

AREA EDUCATION OFFICE
OFFICE 2, ADO-EKITI
SIGN. DATE. 15/2/18

Olasebikan M. T. (Mrs)
Area Education Office
Ado II

Appendix 15: Letter of information for Area Education Officer

Dear Sir/Madam
Request for interview session
I, Olabode Olajide a PhD student, Department of Library & Information Science, University of the Western Cape, South Africa conducting a research on **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.** The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria.

The major priority of the Nigerian Government, as you are aware, has always been to reposition science, technical and vocational education in the scheme of national education for optimum performance (National Policy on Education, 2004). This is further affirmed in Nigeria Vision 20:2020, which is a national effort aimed at growing and developing Nigeria and bringing her to the league of the world's 20 leading economies by year 2020.

Part of my study is to collect data about school libraries and science curricula implementation in secondary schools in Ekiti State. To this end I would like to request an interview session with you which should last approximately 40 minutes. The interview schedule (see attached) is a guide.

Participation in this research project is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage.

If you agree to the interview, the attached consent form requires your signature. Please be assured that your confidentiality and anonymity of records identifying you as a participant will be maintained by the Department of Library & Information Science, University of the Western Cape throughout the study and no reference will be made to your name in the thesis, presentations or publications based on the study. If you have any questions or concerns about participating in this study, please feel free to contact me or my supervisor using the numbers and/or email addresses indicated below.

Yours sincerely,

Olabode Olajide
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville
7535
Email: bordey2016@gmail.com; Tel: 08036250056, +27613915225

Contact details of my PhD supervisor:
Prof Sandy Zinn
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville
7535
Email: szinn@uwc.ac.za
Tel: 021 9592349

Appendix 16: Consent form – Area Education Officer

The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences. ☐
(If I wish to withdraw I may contact the researcher or supervisor at any time)

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I……………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………*Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.*

Researcher:

Olabode Olajide
Mobile number: 08036250056
Email: 3777011@myuwc.ac.za

Supervisor:

Prof Sandy Zinn
Office number: +2721 9592349
Email: szinn@uwc.ca.za

HOD:

Prof Sandy Zinn
Office number: +27219592349
Email: szinn@uwc.ca.za

Appendix 17: Letter of information for director of State Library Board

The Director
State Library Board
Ado-Ekiti
Ekiti State
Nigeria

Dear Madam
Request for interview
I, Olabode Olajide a PhD student, Department of Library & Information Science, University of the Western Cape, South Africa conducting a research on **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.** The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria.

The major priority of the Nigerian Government, as you are aware, has always been to reposition science, technical and vocational education in the scheme of national education for optimum performance (National Policy on Education, 2004). This is further affirmed in Nigeria Vision 20:2020, which is a national effort aimed at growing and developing Nigeria and bringing her to the league of the world's 20 leading economies by year 2020. Part of my study is to collect data about school libraries and science curricula implementation in secondary schools in Ekiti State. To this end I would like to request an interview session which you may put down. Find attached interview schedule as a guide.

Participation in this research project is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage.

Please be assured that your confidentiality and anonymity of records identifying you as a participant will be maintained by the Department of Library & Information Science, University of the Western Cape throughout the study and no reference will be made to your name in the thesis, presentations or publications based on the study. If you have any questions or concerns about participating in this study, please feel free to contact me or my supervisor using the numbers and/or email addresses indicated below.

Yours sincerely,

Olabode Olajide
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville
7535
Email: bordey2016@gmail.com; Tel: 08036250056, +27613915225

Contact details of my PhD supervisor:
Prof Sandy Zinn
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville
7535
Email: szinn@uwc.ac.za
Tel: 021 9592349

Appendix 18: Consent form – Director of State Library Board

The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences.
(If I wish to withdraw I may contact the researcher or supervisor at any time) ☐

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I………………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:

Olabode Olajide
Mobile number: 08036250056
Email: 3777011@myuwc.ac.za

Supervisor:

Prof Sandy Zinn
Office number: +2721 9592349
Email: szinn@uwc.ca.za

HOD:

Prof Sandy Zinn
Office number: +27219592349
Email: szinn@uwc.ca.za

Appendix 19: Letter of information for Director of Teaching Service Commission

The Director
Teaching Service Commission
Ado-Ekiti, Ekiti State
Nigeria

Dear Sir
Request for interview session
I, Olabode Olajide a PhD student, Department of Library and Information Science, University of the Western Cape, South Africa conducting a research on **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.** My aim is to ascertain:

- The status of school libraries in secondary schools in Ekiti State.
- The extent to which science teachers advocate using information resources beyond the textbooks.
- How knowledgeable school librarians are about the science curricula.
- The extent to which the quality of resources influence curriculum implementation.

The major priority of the Nigerian Government, as you are aware, has always been to reposition science, technical and vocational education in the scheme of national education for optimum performance (National Policy on Education, 2004). This is further affirmed in Nigeria Vision 20:2020, which is a national effort aimed at growing and developing Nigeria and bringing her to the league of the world's 20 leading economies by year 2020.

Part of my study is to collect data about school libraries and science curricula implementation in secondary schools in Ekiti State. To this end I would like to request an interview session with you which should last approximately 40 minutes. The interview schedule below is a guide.

Interview guide

- In the curriculum, there is no general format for mode of assessment that requires student to read beyond textbooks, what measures are in place to ensure that students read beyond textbooks?
- How do you ensure that fulltime qualified librarians are the ones managing school libraries in the state?
- In what way do you ensure that science teachers advocate using information resources beyond textbooks?
- What measures are in place to ensure school libraries in the state adequately equipped in term of **resources** and **qualified personnel** to serve science teachers and science students for greater curriculum implementation and academic achievement?
- What measures are in place to ensure science and computer laboratories in the schools adequately equipped to serve science teachers and science students for greater curriculum implementation and academic achievement?

Participation in this research project is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage.

If you agree to the interview, the attached consent form requires your signature. Please be assured that your confidentiality and anonymity of records identifying you as a participant will be maintained by the Department of Library & Information Science, University of the Western Cape throughout the study and no reference will be made to your name and the names of schools selected for the study in the thesis, presentations or publications based on the study. If you have any questions or concerns about participating in this study, please feel free to contact me or my supervisor using the numbers and/or email addresses indicated below.

Yours sincerely,

Olabode Olajide
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville 7535
Email: bordey2016@gmail.com
Tel: 08036250056, +27613915225

Contact details of my PhD supervisor:
Prof Sandy Zinn
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville 7535
Email: szinn@uwc.ac.za
Tel: 021 9592349

Appendix 20: Consent form – Director of Teaching Service Commission

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The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences. ☐
(If I wish to withdraw I may contact the researcher or supervisor at any time)

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I……………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………*Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.*

Researcher:	Supervisor:	HOD:
Olabode Olajide Mobile number: 08036250056 Email: 3777011@myuwc.ac.za	Prof Sandy Zinn Office number: +2721 9592349 Email: szinn@uwc.ca.za	Prof Sandy Zinn Office number: +27219592349 Email: szinn@uwc.ca.za

Appendix 21: Letter of information for Permanent Secretary

Ministry of Education, Science and Technology
Ado-Ekiti
Ekiti State
Nigeria

Dear Madam

Request for interview and an approval to carry out research in public senior secondary schools in Ekiti State

I, Olabode Olajide a PhD student, Department of Library & Information Science, University of the Western Cape, South Africa conducting a research on **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.** The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

The major priority of the Nigerian Government, as you are aware, has always been to reposition science, technical and vocational education in the scheme of national education for optimum performance (National Policy on Education, 2004). This is further affirmed in Nigeria Vision 20:2020, which is a national effort aimed at growing and developing Nigeria and bringing her to the league of the world's 20 leading economies by year 2020.

Part of my study is to collect data about school libraries and science curricula implementation in secondary schools in Ekiti State. To this end I would like to request an interview session with you which should last approximately 40 minutes. The interview schedule (see attached) is a guide.

Participation in this research project is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage.

If you agree to the interview, the attached consent form requires your signature. Please be assured that your confidentiality and anonymity of records identifying you as a participant will be maintained by the Department of Library & Information Science, University of the Western Cape throughout the study and no reference will be made to your name in the thesis, presentations or publications based on the study.

In addition, I also request an approval letter to conduct the study with, most especially, school librarians, science teachers and science students in the state. If you have any questions or concerns about participating in this study, please feel free to contact me or my supervisor using the numbers and/or email addresses indicated below.

Yours sincerely,

Olabode Olajide
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville 7535
Email: bordey2016@gmail.com
Tel: 08036250056, +27613915225

Contact details of my PhD supervisor:

Prof Sandy Zinn
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville 7535
Email: szinn@uwc.ac.za
Tel: 021 9592349

Appendix 22: Consent form – Permanent Secretary

The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences. ☐
(If I wish to withdraw I may contact the researcher or supervisor at any time)

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I………………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………*Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.*

Researcher:	**Supervisor:**	**HOD:**
Olabode Olajide Mobile number: 08036250056 Email: 3777011@myuwc.ac.za	Prof Sandy Zinn Office number: +2721 9592349 Email: szinn@uwc.ca.za	Prof Sandy Zinn Office number: +27219592349 Email: szinn@uwc.ca.za

Appendix 23: Letter of information for parent/guardian

Dear Parent/Guardian,

I, Olabode Olajide, a PhD student in the Department of Library & Information Science, University of the Western Cape, South Africa. I would like your child to participate in my research project, which looks at **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.** The aims of the study is:

- To determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria.
- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

To collect the data, I will give your child questionnaire to fill, and this will take place in his/her school.

In the light of this, I therefore request your permission for your child to participate in the study by providing answers to the questions on the questionnaire. Their responses to the questionnaire will be most valuable for this study. Please be assured that all their responses will be used only for research purposes and will also be kept confidential as no reference will be made to his/her name and the child's school in the thesis, presentations or publications based on the study. You are also assured that the students can withdraw at any stage of the research process without any form of disadvantage.

If you have any questions or concerns about the students participation in this research, please feel free to contact me, Olabode Olajide, bordey2016@gmail.com or by mobile at 08036250056. You can also contact my supervisor, Dr Sandy Zinn, szinn@uwc.ac.za or telephone number +2721 9592349.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached document, you indicate that you understand the purpose of the project.

Thank you.

Yours sincerely,

Olabode Olajide

Appendix 24: Consent form – parent/guardian

The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences. ☐
(If I wish to withdraw I may contact the researcher or supervisor at any time)

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I………………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………*Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.*

Researcher:	**Supervisor:**	**HOD:**
Olabode Olajide Mobile number: 08036250056 Email: 3777011@myuwc.ac.za	Prof Sandy Zinn Office number: +2721 9592349 Email: szinn@uwc.ca.za	Prof Sandy Zinn Office number: +27219592349 Email: szinn@uwc.ca.za

Appendix 25: Letter of information for principal

Principal
…………………………
…………………………

Dear Sir/Madam
Request for interview session
I, Olabode Olajide a PhD student, Department of Library & Information Science, University of the Western Cape, South Africa conducting a research on **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.** The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria.

The major priority of the Nigerian Government, as you are aware, has always been to reposition science, technical and vocational education in the scheme of national education for optimum performance (National Policy on Education, 2004). This is further affirmed in Nigeria Vision 20:2020, which is a national effort aimed at growing and developing Nigeria and bringing her to the league of the world's 20 leading economies by year 2020.

Part of my study is to collect data about school libraries and science curricula implementation in secondary schools in Ekiti State. To this end I would like to request an interview session with you which should last approximately 40 minutes. The interview schedule (see attached) is a guide.Participation in this research project is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage.

If you agree to the interview, the attached consent form requires your signature. Please be assured that your confidentiality and anonymity of records identifying you as a participant will be maintained by the Department of Library & Information Science, University of the Western Cape throughout the study and no reference will be made to your name in the thesis, presentations or publications based on the study. If you have any questions or concerns about participating in this study, please feel free to contact me or my supervisor using the numbers and/or email addresses indicated below.

Yours sincerely,

Olabode Olajide

University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville
7535
Email: bordey2016@gmail.com; Tel: 08036250056, +27613915225

Contact details of my PhD supervisor:
Prof Sandy Zinn
University of the Western Cape
Department of Library & Information Science
Private Bag X17, Bellville
7535
Email: szinn@uwc.ac.za
Tel: 021 9592349

Appendix 26: Consent form – school principal

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the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences.
(If I wish to withdraw I may contact the researcher or supervisor at any time) ☐

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I………………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………

Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.

Researcher:	Supervisor:	HOD:
Olabode Olajide Mobile number: 08036250056 Email: 3777011@myuwc.ac.za	Prof Sandy Zinn Office number: +2721 9592349 Email: szinn@uwc.ca.za	Prof Sandy Zinn Office number: +27219592349 Email: szinn@uwc.ca.za

Appendix 27: Letter of information for school librarian

Dear School librarian,

I, Olabode Olajide, a PhD student in the Department of Library & Information Science, University of the Western Cape, South Africa. I would like you to participate in my research project, which looks at **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.**

The aims of the study is:

- To find out the impact of school libraries on the students' performance in science subjects in your school.
- To find out the status (availability) of school libraries in your schools.
- To know the extent to which science teachers advocate/encourage using information resources beyond the textbooks.
- To know if the availability of library resources makes a difference in students' performance in science in your school.

To collect the data, I will give you questionnaire to fill, and this will take place in your school.

In the light of this, I therefore request your assistance to participate in the study by providing answers to the questions on the questionnaire. Your responses to the questionnaire will be most valuable for this study. Please be assured that all your responses will be used only for research purposes and will also be kept confidential as no reference will be made to your names and that of your schools in the thesis, presentations or publications based on the study. You are also assured that you can withdraw at any stage of the research process without any form of disadvantage.

If you have any questions or concerns about your participation in this research, please feel free to contact me, Olabode Olajide, bordey2016@gmail.com or by mobile at 08036250056. You can also contact my supervisor, Prof Sandy Zinn, szinn@uwc.ac.za or telephone number +2721 9592349.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached document, you indicate that you understand the purpose of the project.

Yours sincerely

Olabode Olajide

Appendix 28: Consent form – school librarian

The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences.
(If I wish to withdraw I may contact the researcher or supervisor at any time) ☐

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I………………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………*Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.*

Researcher:	Supervisor:	HOD:
Olabode Olajide Mobile number: 08036250056 Email: 3777011@myuwc.ac.za	Prof Sandy Zinn Office number: +2721 9592349 Email: szinn@uwc.ca.za	Prof Sandy Zinn Office number: +27219592349 Email: szinn@uwc.ca.za

Appendix 29: Letter of information for science teacher

Dear Science teacher,

I, Olabode Olajide, a PhD student in the Department of Library & Information Science, University of the Western Cape, South Africa. I would like you to participate in my research project, which looks at **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria.**

The aims of the study is:

- To determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria.
- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

To collect the data, I will give you questionnaire to fill, and this will take place in your school.

In the light of this, I therefore request your assistance to participate in the study by providing answers to the questions on the questionnaire. Your responses to the questionnaire will be most valuable for this study. Please be assured that all your responses will be used only for research purposes and will also be kept confidential as no reference will be made to your names and that of your schools in the thesis, presentations or publications based on the study. You are also assured that you can withdraw at any stage of the research process without any form of disadvantage.

If you have any questions or concerns about your participation in this research, please feel free to contact me, Olabode Olajide, bordey2016@gmail.com or by mobile at 08036250056. You can also contact my supervisor, Prof Sandy Zinn, szinn@uwc.ac.za or telephone number +2721 9592349.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached document, you indicate that you understand the purpose of the project.

Yours sincerely

Olabode Olajide

Appendix 30: Consent form – science teacher

The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me.

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences.
(If I wish to withdraw I may contact the researcher or supervisor at any time)

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research.

I understand that I will not receive any payment for participating in this project.

I agree for the data collected from me to be used in future research.

I agree to take part in the above research project.

Declaration of Consent

I……………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………*Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.*

Researcher:

Olabode Olajide
Mobile number: 08036250056
Email: 3777011@myuwc.ac.za

Supervisor:

Prof Sandy Zinn
Office number: +2721 9592349
Email: szinn@uwc.ca.za

HOD:

Prof Sandy Zinn
Office number: +27219592349
Email: szinn@uwc.ca.za

Appendix 31: Letter of information for science student

I, Olabode Olajide, a PhD student in the Department of Library & Information Science, University of the Western Cape, South Africa. I would like your child to participate in my research project, which looks at **the role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria**

The aims of the study is:

- To determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria.
- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

To collect the data, I will give you questionnaire to fill, and this will take place in your school.

In the light of this, I therefore request your assistance to participate in the study by providing answers to the questions on the questionnaire. Your responses to the questionnaire will be most valuable for this study. Please be assured that all your responses will be used only for research purposes and will also be kept confidential as no reference will be made to your names and that of your schools in the thesis, presentations or publications based on the study. You are also assured that you can withdraw at any stage of the research process without any form of disadvantage.

If you have any questions or concerns about your participation in this research, please feel free to contact me, Olabode Olajide, bordey2016@gmail.com or by mobile at 08036250056. You can also contact my supervisor, Prof Sandy Zinn, szinn@uwc.ac.za or telephone number +2721 9592349.

This information sheet is for you to keep so that you can be aware of the purpose of the study. With your signature on the attached document, you indicate that you understand the purpose of the project.

Yours sincerely

Olabode Olajide

Appendix 32: Consent form – science student

The role of school libraries in supporting an inquiry based approach for teaching and learning science subjects in senior secondary schools in Ekiti State, Nigeria

Researcher: Olabode Olajide
Year: 2017

Project Aims:

The main aim of this study is to determine the impact of school libraries on the students' performance in science subjects in Ekiti State, Nigeria. The specific objectives are:

- To find out the status of school libraries in secondary schools in Ekiti State, Nigeria.
- To know the extent to which science teachers advocate using information resources beyond the textbooks.
- To find out how knowledgeable school librarians are about the science curricula.
- To know the extent to which the quality of resources influence curriculum implementation.
- To know if the availability of library resources makes a difference in students' performance in science in rural and urban areas.

Please initial boxes

I confirm that I have read and understood the information sheet explaining the above research project and I have had the opportunity to ask questions about the project and what will be expected of me. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without any negative consequences.
(If I wish to withdraw I may contact the researcher or supervisor at any time) ☐

I understand my responses and personal data will be kept strictly confidential. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the reports or publications that result from the research. ☐

I understand that I will not receive any payment for participating in this project. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Declaration of Consent

I………………………………………………………… (full names of respondent) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.
I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF RESPONDENT DATE

……………………………. ……………………

SIGNATURE OF RESEARCHER DATE

………………………… ……………………*Copies: All participants will receive a copy of the signed and dated version of the consent form and information sheet for themselves. A copy of this will be filed and kept in a secure location for research purposes only.*

Researcher:	Supervisor:	HOD:
Olabode Olajide Mobile number: 08036250056 Email: 3777011@myuwc.ac.za	Prof Sandy Zinn Office number: +2721 9592349 Email: szinn@uwc.ca.za	Prof Sandy Zinn Office number: +27219592349 Email: szinn@uwc.ca.za

Appendix 33: Equipment/apparatus/chemicals expected to be in science laboratories

- **Chemistry Lab**

Item	Quantity	Item	Quantity
Wash bottle	10	Sudan (iii) solution	
Petri dishes	10	1000ml round bottom flask	4
Rubber funnel	12	Mortar and pestle	1
Fehling solution A in bottle	2	Thick flat bottom flask	2
Fehling solution B in bottle	2	Flexible flat bottom flask	2
Silver nitrate	10g	250 ml round bottom flask	2
Benedict Qualitative reagent	70g	Red litmus paper	1
Copper II sulphate	50g	Blue litmus paper	2
Sodium sulphate	50g	Burette	7
Million reagent	20 litres	Pipette	10
Distilled water		Ammonium carbonate	
Barium chloride solution	100cm^3	Washing Brush	2
Big test tubes	8	Small test tubes	38
Dilute tetraoxosulphate (VI) Acid	3 litres	Big Measuring cylinder	8
Ferrous suphate	10g	Small Measuring cylinder	3
Sodium carbonate chemical	20g	Big beaker	7
Formalin solution	100ml	Small beaker	13
Sodium sulphate GPR	50g	Big conical flask	24
Calcium chloride	60g	Small conical flask	4
Potassium hydroxide	20g	Glass rods	3
Local starch	100g	Testube holders	8
Common salt (NaCl)	50g	Retort stands	18
Eosine	30g	Small round bottom flask	2
Zinc Carbonate Chemical	50g	Forceps	2
Methyl Red		Hydrometer	1
Wet& Dry thermometer	1	Liebig condenser	2
Glycerin	1	l-shape tube	1
Sudan III solution	50ml	1 meter rubber tubing	1
Iodine solution	50g	Nose mask	1 pack
Iron fillings	50g	Distillation flask	1
Calcium Hydroxide	50g	Fractionating color	1
Silver Nitrate solution	50ml	Soxlet Apparatus	1
Ammonia solution	50ml	Heating mantle	1
Ethanol	20ml	Box of organic chemistry model	1
Spatula	6	Weigh balance	2
Indicator bottles	3	Flat bottom flask	2
Concentrated hydrochloride acid	20ml	Round bottom flask	3
Concentrated Trioxonitrate (v) acid	50ml	Standard flask	6
Concentrated tetraoxosulphate vi acid	200ml	Test tube	76
Testube Rags	18	Cylinder	3
Filter paper	9 packs	Electronic weighing balance	1
Lead Nitrate	1 bottle	Funnels	14
Zinc chloride	1 bottle	Bottles	6
Copper sulphate	1 bottle	Petril dithes	32
Fehling's solution B	1 litre	Ferrous chloride	300g
Fehling's solution A	1 litre	Calcium nitrate	1 bottle
Alkaline pyrogellol	1 bottle	Rubber tubing	3
Sucrose	1 bottle	Methanol	1 litre
d-fructose	1 bottle	Benedict's solution	1 litre
Million's reagent	1litre	Litmus solution	1 bottle

- **Physics Lab**

Equipment	Quantity	Equipment	Quantity
Ammeter	13	Pulleys	4
Ball & ring	1	Ray box	6
Bimetallic strip	1	Resistance box	4
Calorimeter	3	Resistor (1)	12

Cellotex boards	31	Resistor (2)	19
Cork	39	Resistor (5)	11
Crocodile clips	12	Retort stand	6
Electrical keys	9	Pheostart	5
Galvanometer	4	Scale pan	3
G-clamp	5	Screen	9
Jockey	7	Sonometer	1
Knife edge	11	Spiral spring	9
Lead- Acid accumulator	2	Spring balance (1 N)	4
Lens holder	14	Spring balance (10 N)	6
Lenses	36	Stop watch	9
Magnets	10	Syringe	16
Mass hanger	10	Tacked pin	4
Masses(10g)	12	Wooden ruler	17
Masses (100g)	57	Mass (5g)	4
Masses (20)	18	Mass (25g)	2
Masses (50g)	42	Iron feling	1
Mercury	1	Resistor (10)	5
Meter bridge	2	Thermometer (clinical)	8
Meter rules	8	Thermometer (infrared)	1
Micro slides	2	Thermometer (wet & dry)	1
Micrometer screw guage	5	Tuning fork	1
Mirrors	33	Vernier caliper	4
Optical pin	2	Voltmeter	9
Pendulum bulb	16	Wooden masses	5
Potentiometer	8	Wooden planes	5
Prism (rectangular)	12	Wooden pulleys	4
Prism (triangular)	19		
Consumables			
Dry cell battery	7	Connecting wires	15
Thread	2	Constantan wire	1

- **Biology Lab**

Item	Quantity	Item	Quantity
Bottle A		**Bottle G**	
Toad	1	Cockroaches	11
Crab	3	Crab	1
Scorpion	1	Prawn	1
Comb of a fowl	1	Dragon lies	1
Bottle B		**Bottle H**	
Liver	5	Termite	10
Gizzard	1	Gill	1
Heart	1	Mammalian gland	1
		Beef	1
Bottle C		Millipedes	1
Snake	7	Kidney	1
Lizard	1	Lung	1
		Tape-worm	8
Bottle D			
Scorpion	1	**Section B**	
Snake	1	Petridish	12
Rat (small)	1	Skeleton	1
		Femur	1
Bottle E		Snail shell	1
Tilapia fish	1	Artificial kidney	1
Bat	1	Axis	10
Rat	1	Thoracic vertebra	10
		Atlas	8
Bottle F		Skill	4
Snail	2	Microscope	2

Appendix 34: Marking scheme (rubrics) designed by WAEC/NECO for senior secondary school

Physics:

THE WEST AFRICAN EXAMINATIONS COUNCIL
WASSCE FOR SCHOOL CANDIDATES 2018
FINAL MARKING SCHEME
PHYSICS 3 A & B (NIGERIA & THE GAMBIA)

(Maximum marks obtainable: 50 marks)

Rubrics: *Candidates were required to answer any* **two** *questions.*

GENERAL NOTES:

1. **Each** question is marked on a total of **25** marks under different sub-headings: Observations; Graph; slope; Deductions; Accuracy; Precautions and Short-answer questions.

2. (i) Penalties earned under **one** sub-heading are **not** transferable if **no** marks are earned in that section.
   (ii) Units wrong or missing attract loss of ½ mark **each** (unit may be stated in table or graph). There is **no** penalty for derived units.
   (iii) If **two** or more columns have the same unit in a table, the penalty for missing unit in the **two** or more columns is loss of ½ mark only.
   (iv) Inconsistent significant figures (s.f) attract a loss of ½ mark per column up to a maximum of **1** mark per table.
   (v) Systematic errors (s.e) attract a loss of **1** mark.
   (vi) Disregard of instruction (d.i) attracts loss of **1** mark
   (vii) Where a candidate plots value different from the values he obtained in an experiment, award zero for plotting, slope, intercept and deductions from such graph
   (vii) Gross errors (g.e) should not be confused with systematic errors (s.e) or disregard of instruction (d.i).
   (viii) Quantities read from table must be recorded to at least 3 decimal places e.g. (reciprocals, logs etc) Or to 3 s.f. depending on the values required.
   (ix) When readings are repeated and any of the mean value is wrongly calculated, award mark for the mean column if in trend and deduct 1 mark for the wrong calculation.
   (x) If a candidate invents his/her own values (which are different from expected experimental values), treat as gross error. Calculations from such values under observations, graph, scales, plotting, line, slope, intercept and deductions from such graph should be awarded zero.

3. **GRAPHS**:
   (i) For scales to be reasonable, graph must occupy at least ⅓ of page.
   (ii) Scales using multiples or sub-multiples of prime numbers such as 3,7,9,13 etc are **not** acceptable.
   (iii) Points should be plotted correctly to nearest half square on both axes
   (iv) To obtain the suitable line of best fit mark, at least three points must be correctly plotted.
   (v) Where points have been matched, candidate can only score for axes distinguished. The candidate will also be awarded zero for slope, intercept.
   (vi) Origin is part of graph if requested, or if intercept is required

4. **SLOPE**:
   (i) Large right-angled triangle implies that it occupies at least ⅓ of graph.
   (ii) To obtain correct arithmetic mark, candidate must have read Δx or Δy correctly.
   (iii) Accept coordinate method of slope provided points are chosen on the line drawn

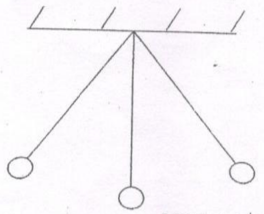
PRECAUTIONS [02]

Award 1 mark **each** for any 2 correct precautious stated in acceptable tense.

e.g. - Avoided parallax error in reading of stopwatch/clock/metre rule
- Noted/Corrected/Avoided zero error on stop watch/clock/metre rule
- Avoided draught
- Avoided conical oscillation
- Ensured that support was rigid/firm
- Ensured bob/pendulum was free from table/did not touch table
- Repeated readings shown on table

b(i) $\sqrt{75cm} = 8.66$
Shown on graph [½]
Corresponding value of T correctly read and recorded [½] [1]

(ii)



[2]

2 (a) **OBSERVATIONS [8]**

(i) Diameter a_o of the illuminated object, measured and recorded to at least 1 d.p in cm [½]

(ii) Five values of **x** measured and recorded to at least 1 d.p in cm [1]
(Deduct ½ mark for each wrong or missing value)

(iii) **Five** values of **v** measured and recorded to at least 1 d.p in cm and in trend
Trend: As **x** increases, v decreases [1½]
(Deduct ½ mark for each wrong or missing value)

(iv) **Five** values of **a** measured and recorded to at least 1 d.p in cm and in trend
Trend: As **x** increases, a decreases [1½]
(Deduct ½ mark for each wrong or missing value)

(v) **Five** values of $y = \frac{a}{a_o}$ correctly evaluated to at least 2 d.p [1]
(Deduct ½ mark for each wrong or missing value)

(vi) Five values of $P = \frac{1+y^2}{y}$ correctly evaluated to at least 2 d.p [1]
(Deduct ½ mark for each wrong or missing value)

(vii) Five values of **T = x+v** correctly evaluated [½]

(viii) Composite table showing at least **x, v, a, y, p** and **T** [1]

GRAPH [06]

(i)	Both axes correctly distinguished (½ mark each)	[1]
(ii)	Reasonable Scales (½ mark each)	[1]
(iii)	**Five** points correctly plotted (Deduct 1 mark for each wrong or missing point)	[3]
(iv)	Line of best fit	[1]

SLOPE [02]

(i)	Large right-angled triangle	[½]
(ii)	ΔP correctly determined	[½]
(iii)	ΔT correctly determined	[½]
(iv)	$\frac{\Delta P}{\Delta T}$ correctly evaluated	[½]

INTERCEPT [01]

Intercept **c**, on the horizontal axis

Correctly shown [½]
Correctly read [½]

EVALUATION [01]

$K = \frac{C}{2}$ Correct substitution [½]
Correct Arithmetic [½]

ACCURACY [01]

Based on $K = \frac{C}{2}$ = focal length ± 10%

OR

$K = \frac{1}{slope}$ = focal length ± 10% [01]

PRECAUTIONS [02]

Award 1 mark **each** for any 2 correct precautious stated in acceptable tense.

e.g.

- Coaxial arrangement of optical instruments
- Avoided parallax error in reading metre rule
- **x** measured from middle of the lens
- Lens kept upright
- Repeated readings shown on table
- Surface of lens cleaned
- Noted/corrected/Avoided zero error on metre rule

4

b(i) The distance between the optical centre and the principal focus of the lens is 20cm

OR

If parallel beam of light is incident on the lens, it is brought to a focus at a point 20cm from the lens [2]

(ii) $\frac{1}{x} + \frac{1}{v} = \frac{1}{f}$ (½)

$1 + \frac{x}{v} = \frac{x}{f}$

$1 + \frac{1}{m} = \frac{x}{f}$

$x = f\left(1 + \frac{1}{m}\right)$ (½)

$= 20\left(1 + \frac{1}{5}\right)$ (½)

x = 24cm (½)

OR

(ii) $\frac{1}{x} + \frac{1}{v} = \frac{1}{f}$ (½)

$m = \frac{v}{x}$

$5 = \frac{v}{x}$

v = 5x (½)

$\frac{1}{x} + \frac{1}{5x} = \frac{1}{20}$ (½)

$\frac{6}{5x} = \frac{1}{20}$

x = 24cm (½)

3. (a) **OBSERVATIONS [11]**

(i) **Five** values of **d** correctly read and recorded to at least 1 d.p in cm [2]
(Deduct ½ mark for each wrong or missing value)

(ii) Five values of **I** correctly read and recorded to at least 1 d.p in A and in trend
Trend; As **d** increases, **I** decreases [5]
(Award 1 mark each)

(iii) Five values of $\mathbf{I^{-1}}$ correctly evaluated to at least 3 s.f. [1½]
(Deduct ½ mark for each wrong or missing value)

(iv) Five values of log $\mathbf{I^{-1}}$ correctly evaluated to 3 s.f [1½]
(Deduct ½ mark for each wrong or missing value)

(v) Composite table showing at least **d, I, $\mathbf{I^{-1}}$ and log $\mathbf{I^{-1}}$** [1]

GRAPH [06]

(i)	Both axes correctly distinguished (½ mark each)	[1]
(ii)	Reasonable scale (½ mark each)	[1]
(iii)	Five points correctly plotted (Deduct 1 mark for each wrong or missing point)	[3]
(iv)	Line of best fit	[1]

SLOPE [02]

(i)	Large right-angled triangle	[½]
(ii)	$\Delta log I^{-1}$ correctly determined	[½]
(iii)	Δd correctly determined	[½]
(iv)	$\frac{\Delta log\, I^{-1}}{\Delta d}$ correctly evaluated	[½]

PRECAUTIONS [02]

Award 1 mark **each** for any 2 correct precautious stated in acceptable tense.
e.g

- Key opened in between readings/key opened when readings were not taken
- Tight connections ensured
- Avoided parallax error when taking reading on ammeter/metre rule
- Repeated readings shown
- Avoided/Noted/corrected zero error on ammeter/metre rule
- Clean terminals ensured
- Avoided dragging jockey on the potentiometer

b(i)	$I^{-1} = \frac{1}{1.5} = 0.67$	[½]
	Log (I^{-1}) = - 0.174	[½]
	Log (I^{-1}) correctly shown on graph	[½]
	Corresponding value of **d** correctly read and recorded	[½]

(ii) **Factors affecting resistance of a wire**

- Length of wire
- Cross sectional area/thickness/diameter/radius of wire
- Resistivity/nature of wire
- Temperature

(Any 2 x 1)

ALTERNATIVE B

1. (a) **OBSERVATIONS [09]**

(i) The value of **G** = 50.0 ± 1 0 cm [1]
(ii) **Six** values of **M** correctly recorded in g [1]
(Deduct ½ mark for each wrong or missing value)
(iii) **Six** values of **K** recorded to at least 1dp in cm and in trend [3]
(Award ½ mark **each**)
(Trend: As M increases, K decreases)
(iv) **Six** values of **X = K - 5** correctly determined [2]
(Deduct ½ mark for each wrong or missing value)
(v) **Six** values of $\frac{1}{X}$ correctly evaluated to at least 3 d.p [1]
(Deduct ½ mark for each wrong or missing value)
(vi) Composite table showing at least **M, K, X and** $\frac{1}{X}$ [1]

NOTE: If **K** is missing, award zero for **X and** $\frac{1}{X}$

GRAPH [06]

(i) Both axes correctly distinguished (½ mark each) [1]
(ii) Reasonable Scales (½ mark each) [1]
(iii) Six points correctly plotted [3]
(Award ½ mark for **each**)
(iv) Line of best fit [1]

NOTE: If axes do not start from the origin (0,0), deduct 1 mark for **d.i.**

SLOPE [02]

(i) Large right-angled triangle [½]
(ii) Δ**M** correctly determined [½]
(iii) Δ**1/X** correctly determined [½]
(iv) $\frac{\Delta M}{\Delta \frac{1}{X}}$ correctly evaluated [½]

DEDUCTION [01]

Intercept on the vertical axis OR
Value of **M** when $\frac{1}{X} = 0$

Correctly shown [½]
Correctly read [½]

7

ACCURACY [01]

Based on the intercept on M axis = Mass of the ruler supplied ± 10%

OR

$$\frac{Slope}{Intercept\ on\ M\ axis} = 45 \pm 2.0\ \text{cm}$$

PRECAUTIONS [02]

Award 1 mark each for any two correct precautions stated in acceptable tense [2]

Eg.

- Avoided errors due to parallax in reading the metre rule
- Ensured rigid support
- Avoided draught
- Repeated readings shown on table
- Avoided/Noted/Corrected zero error on metre rule
- Ensured mass did not rest on/touch the table

b(i) Moment of a force about a point is the product of the force and the perpendicular distance of its line of action from the point [2]

(ii) Moment of couple = one force x perpendicular distance between the forces [1]

= 20 x 0.5 [½]

= 10 Nm [½]

2. (a) **OBSERVATIONS [11]**

(i) **Five** complete traces showing at least **AB** perpendicular to **ST, NQ** perpendicular to **AB, CQ** and **QR** [2]

(Deduct ½ mark for each wrong or missing trace)

(ii) **Five** values of **x** correctly measured and recorded to at least 1d.p in cm [1]

(Deduct ½ mark for each wrong or missing value)

(iii) **Five** values of θ_1 correctly measured and recorded in degrees and in trend

Trend: (As **x** increases, θ_1 decreases) [2½]

(Award ½ mark for **each**)

(iv) **Five** values of θ_2 correctly measured and recorded in degrees and in trend

Trend: (As **x** increases, θ_2 decreases and $\theta_2 = \theta_1 \pm 1°$) [2½]

(Award ½ mark for **each**)

(v) **Five** values of x^{-1} correctly evaluated to at least 3d.p [1]

(Deduct ½ mark for each wrong or missing value)

(vi) Five values of tan θ_2 correctly evaluated to at least 3 s.f [1]

(Deduct ½ mark for each wrong or missing value)

(vii) Composite table showing at least **x**, θ_1, θ_2, x^{-1} and **tan** θ_2 [1]

NOTE: (i) If no traces award zero for i, ii, iii and iv

(ii) If no pin points, award zero for i, ii, iii and iv

GRAPH [06]

(i)	Both axes correctly distinguished (½ mark each)	[1]
(ii)	Reasonable Scales (½ mark each)	[1]
(iii)	**Five** points correctly plotted (Deduct 1 mark for each wrong or missing point)	[3]
(iv)	Line of best fit	[1]

SLOPE [02]

(i)	Large right-angled triangle	[½]
(ii)	Δ**tan** θ_2 correctly determined	[½]
(iii)	ΔX^{-1} correctly determined	[½]
(iv)	$\frac{\Delta \tan \theta_2}{\Delta X^{-1}}$ correctly evaluated	[½]

PRECAUTIONS [02]

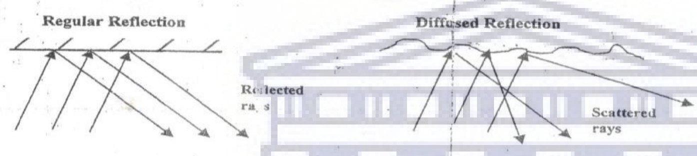
Award 1 mark **each** for any **two** correct precautions stated in acceptable tense
E.g.

- Neat traces/sharp pencil (seen in traces)
- Ensured pins were vertical/upright/erect
- Repeated readings shown on table
- Avoided parallax error in reading protractor/metre rule
- Noted/Corrected zero error on metre rule
- Reasonable spacing of pins (about 4 cm apart)

b(i) (α) Regular reflection occurs when light falls on a smooth (glass) surface while diffused reflection occurs when light falls on a rough surface [1]
In regular reflection incident parallel rays are parallel after reflection while in diffuse reflection incident parallel rays are scattered after reflection [1]

OR

(β)



(ii) Distance of image from object = 25 + 25 = 50cm [1]
Object size = image size [1]

Chemistry:

GRAPH [06]

(i)	Both axes correctly distinguished (½ mark each)	[1]
(ii)	Reasonable Scales (½ mark each)	[1]
(iii)	**Five** points correctly plotted (Deduct 1 mark for each wrong or missing point)	[3]
(iv)	Line of best fit	[1]

SLOPE [02]

(i)	Large right-angled triangle	[½]
(ii)	$\Delta \tan \theta_2$ correctly determined	[½]
(iii)	ΔX^{-1} correctly determined	[½]
(iv)	$\frac{\Delta \tan \theta_2}{\Delta X^{-1}}$ correctly evaluated	[½]

PRECAUTIONS [02]

Award 1 mark **each** for any **two** correct precautions stated in acceptable tense

E.g.

- Neat traces/sharp pencil (seen in traces)
- Ensured pins were vertical/upright/erect
- Repeated readings shown on table
- Avoided parallax error in reading protractor/metre rule
- Noted/Corrected zero error on metre rule
- Reasonable spacing of pins (about 4 cm apart)

b(i) (α) Regular reflection occurs when light falls on a smooth (glass) surface while diffused reflection occurs when light falls on a rough surface [1]

In regular reflection incident parallel rays are parallel after reflection while in diffuse reflection incident parallel rays are scattered after reflection [1]

OR

(β)

(ii)	Distance of image from object = 25 + 25 = 50cm	[1]
	Object size = image size	[1]

Q2. [G = $NH_4Cl(s)$]

Test	Observation	Inference
(a) G + heat	White fumes/ vapour (1) solidify at the cool end of the test tube (1)	NH_4^+ salt present (1) (3)
(b) (i) G + H_2O	Salt dissolves / colourless solution (1) obtained. Test tube cold to touch (1)	G is a soluble salt (1) Dissolution is endothermic (1) (4)
(ii) Solution G + litmus paper	Blue litmus paper turned red (1)	Solution is acidic (1) (2)
(c) (i) Solution G + excess NaOH(aq) + warm	No visible reaction (1) / No ppt was formed. A colourless gas (1) with a choking/irritating/pungent smell (1) which turned red litmus paper blue/ formed white fumes with HCl (1)	NH_3 (1) from NH_4^+ (1) (6)
(ii) Solution G + $AgNO_3$ (aq)	White ppt (1) formed	Cl^- or CO_3^{2-} (1)
+ HNO_3	Ppt insoluble (1)	Cl^- present (1)
+ NH_3 (aq)	Ppt dissolved (1)	Cl^- present (1) (6)

Q2 [21 marks] → [20 marks]

3. (a)(i) Amber-coloured/ Dark brown (reagent) bottle (1)
$KMnO_{4\,(aq)}$ is decomposed by light (1)
Amber-coloured bottle reduces the intensity of light (1) entering the bottle.

(ii) Burette / graduated pipette (1)
Delivers accurate volume of liquid (1) **[5 marks]**

(b) (i) The white ppt formed is amphoteric (1); hence, reacts with excess $NaOH_{(aq)}$ to give soluble products (1)
The white ppt formed by the second solution is not amphoteric (1); hence, does not react with excess NaOH(aq) (1)

(ii) Due to oxidation (1) of Fe^{2+} in the solution to Fe^{3+} (1) by atmospheric oxygen.
[6 marks]
Q3 [11 marks]

(c) (i) Less than 7 (1)
(ii) greater than 7 (1)

Q1 [21 marks]

Q2 [C = $(NH_4)_2SO_4$ (aq); D = $FeCl_3$(aq)]

Test	Observation	Inference
(a) (i) C + Na OH(aq)	No visible reaction/no ppt (1)	
+ warm	A colourless gas (1) with pungent/chocking/irritating smell (1) evolved. Gas turned damp red litmus blue/formed white fumes with conc HCl vapour (1)	Gas is NH_3 (1) from NH_4^+ (1) (6)
(ii) C + $HCl_{(aq)}$ + $BaCl_{2(aq)}$	No visible reaction (1) White ppt (1) formed	SO_4^{2-} (1) present (– 1 for a wrong additional ion) (3)
(b) (i) D + $NH_{3(aq)}$ + excess	Reddish-brown/brown ppt (1) Ppt insoluble (1)	Fe^{3+} (1) present (3)
(ii) D + $AgNO_{3(aq)}$ + $HNO_{3\,(aq)}$	White ppt (1) Ppt insoluble (1)	Cl^- (1) or CO_3^{2-} (1) present Cl^- present (1) (5)

6mks

Q2 [17 marks]

Q3. (a) (i) Lime water turns milky with CO_2 because insoluble $CaCO_3$ /$CaCO_3$(s) (1) is formed.
Milkiness disappears when excess CO_2 reacts with $CaCO_3$ in water medium forming the soluble $Ca(HCO_3)_2$ /$Ca(HCO_3)_2$ (aq) (1).
(Accept correct IUPAC names of $CaCO_3$ and $Ca(HCO_3)_2$)

2mks

(ii) Calcium hydroxide is not amphoteric (1) Does not react with an alkali NaOH (1) whereas lead (II) hydroxide is amphoteric (1), so reacts with excess NaOH (1)

4mks

[6 marks]

(b) (i) *Primary standard solution* is one whose concentration is known and can be used to standardise another solution. *Or*
Primary standard solution is a solution of known concentration prepared from pure/non-deliquescent/ non-hygroscopic substance. 2/0

(ii) M(Na_2CO_3) = 106 g mol^{-1} (1) (no score for wrong unit)
m(Na_2CO_3) = C × M × V
= 0.15 × 106 × 0.25 (1)
= 3.98 g (1) (Accept 3.975 g)

[5 marks]

3

Biology:

NATIONAL EXAMINATIONS COUNCIL
2018 SENIOR SCHOOL CERTIFICATE EXAMINATION
(INTERNAL)

FINAL MARKING SCHEME

BIOLOGY II

1a ONE ROLE EACH IN PHOTOSYNTHESIS

(i) Sunlight:- Supplies energy needed in photosynthetic process.

(ii) Chlorophyll – Traps sunlight energy for photosynthetic process.

$2 \times 1mark = 2marks$

b. **Five** types of bones found in the forearm of man

- Radius
- Ulna
- Humerus
- Carpals/wrist bones
- Meta-carpals
- Phalenges Phalanges

NOTE: Spellings must be correct to score.

Any $5 \times 1mark = 5marks$

c. **Three** functions of Worker caste in a termitarium:

- Searches for food for other castes
- Feeds other castes
- Builds the Termotarium
- Repairs/maintains the Termotarium
- Removes the eggs from the royal chambers and cares for them
- Stroking and grooming the queen
- Performs supplementary defensive duties when the termitarium is under attack.

Any $3 \times 1mark = 3marks$

d. Definition of Ecosystem

- The basic functional unit of nature.
- consisting of living/biotic and non living/abiotic components.
- All interacting with one another to maintain a stable environment/system.

Any $2 \times 1mark = 2marks$

e. Diagram of Nephron (Leave space for diagram)

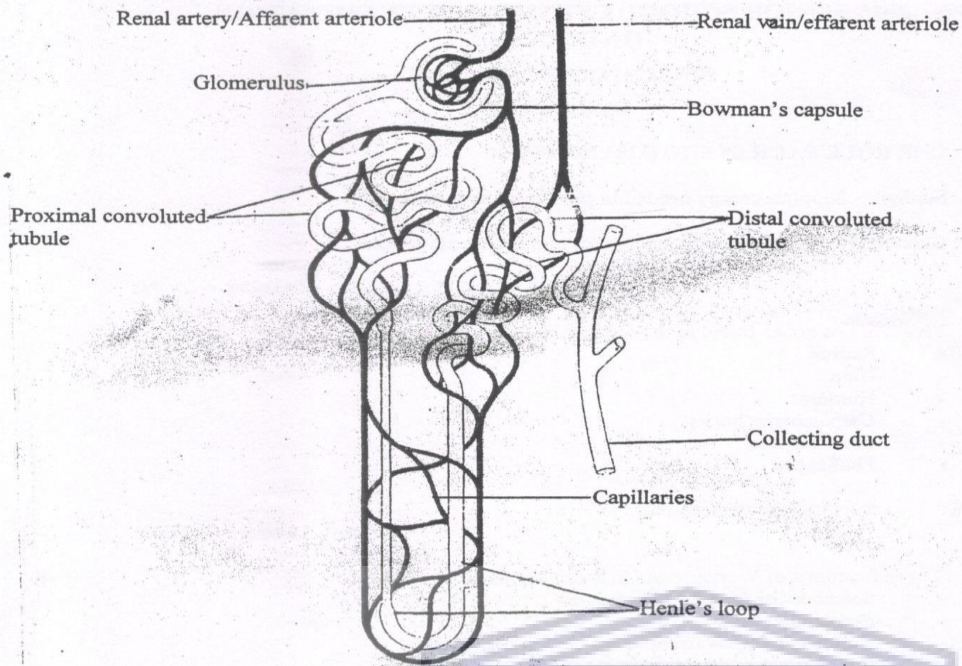


Diagram of Nephron

TL - Diagram of Nephron	**1mark**
SZ - Size 8 – 10cm measured vertically	**1mark**
CL - Clarity of lines/line rot broken =½; lines not wooly = ½	**1mark**
NL - Neat labeling (rulled guide lines ½; horizontal labelle ½	**1mark**

Details

CD - Collecting duct fully shown
PD - Proximal and distal tubules properly convoluted
UH - U – shaped loop of Henle shown

Any $2 \times 1mark = 2marks$

Labels: Bowman's capsule; Renal arteny; Renal vein; Renal capillary, Henle's loop, collecting duct; proximal convoluted tubule; distal convoluted tubule; glomerulus; afferent arteriole; efferent arteriole; *Any* $4 \times \frac{1}{2}\,mark = 2marks$

NB: Spellings must be correct to score

Total = 20marks

2a **Definitions of the following terms:-**

(i) - **Gene:-** The basic unit of inheritance/hereditary unit
- Located on the chromosome
- Through which characters are transmitted from parents to offspring's.

Any $2 \times 1 =$ ***2marks***

(ii) Implantation:- The process where by a fertilized egg/embryo; is embedded/attached to the wall of the uterus of mammals .

Any $2 \times 1 =$ ***2marks***

(iii) Specie
- the basic /smallest unit of classification; of a population group related organisms;
- that can interbreed within themselves;
- to produce fertile organisms.

Any $2 \times 1 =$ ***2marks***

(iv) Saprophytes – organisms that obtain their food; from dead/decaying organic matter.

Any $2 \times 1 =$ ***2marks***

b.(i) **Four functions of the mammalian skeleton**
- Gives shape to the body
- protects delicate parts of the body
- Helps in movement/ locomotion
- Serves as attachment for muscles
- Helps in breathing
- Supports the body framework

Any $4 \times 1 mark = 4marks$

(ii) **Two muscles that bring about the movement of the forearm**
- Biceps/flexor muscles;
- Triceps/extensor muscles

$2 \times 1 mark = 2marks$

NOTE: Spellings must be correct to score.

(iii) **Three digestive enzymes found in the small intestine and their functions**

Digestive enzyme	Function
- Trypsin	Converts protein and peptones to polypeptides
- Lipase	Converts fat and oil to fatty acid/carboxylic acid and glycerol
- Erepsin	Converts polypeptides to amino acids
- Maltase	Converts maltose to two units of glucose
- Sucrase	Converts sucrose to glucose and fructose
- Lactase	Converts lactose to glucose and galactose
- Amylopsin	Converts starch to maltose

N.B: Enzyme must correspond with the function to score
- Enzyme - **1mark**
- Function - **1mark**
- Wrong function; no score; enzyme alone can score
- Spellings of enzymes must be correct to score

Any $3 \times 2mark = 6$**marks**

Total = 20marks

3a(i) **Three diseases of the Liver**
- Gall stone
- Viral/infective hepatitis
- Liver cirrihosis
- Cancer/tumor of the liver
- Amoebic liver abscess

N.B Spellings must be correct to score

Any $3 \times 1mark = 3marks$

(iii) Five difference between plant and animal cells

Plant Cell	Animal Cell
- It possesses chloroplast/chlorophyll/plastids	Has no chloroplast/chlorophyll/plastids
- Has definite shape	Has no definite shape
- Has rigid cellulose cell wall	Has no rigid cellulose cell wall
- Has large central vacuole	Has numerous small vacuoles/vacuoles may be absent / many If numerous / is absent no sco
- Stores lipids as oil	stores lipid as fat
- Centrosomes and centrioles are absent	Centrosomes and centrioles are present
- Usually large in size	Usually small in size
- Lysosome absent	Lysosome present
- Store carbohydrate as starch	Store carbohydrate as glycogen

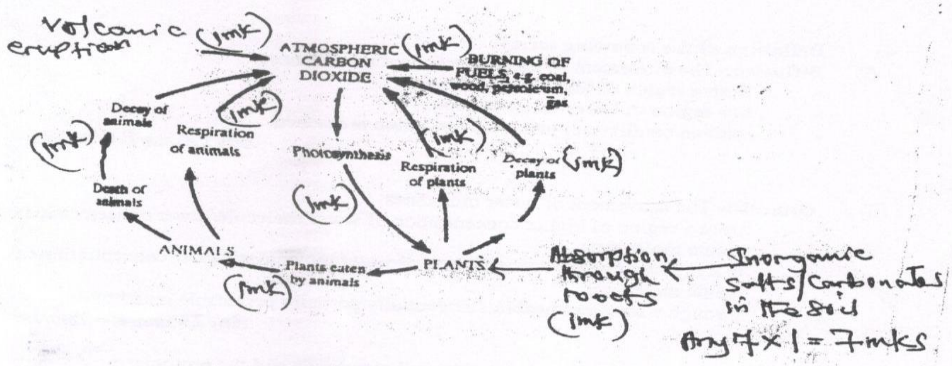
N.B: Points must correspond to score

If no tabulation, minus (–) **1mark**

Any $5 \times 1mark = 5marks$

4

3b. **Annotated diagram of carbon cycle**



NB: (TL) Title – Carbon cycle/Diagram of the carbon cycle – **1mark**
AN – Annotation **7marks**

c.(i) **Two types of supporting tissues in plants**
- Turgid parenchyma
- Collenchyma
- Sclerenchyma

N.B Spellings must be correct to score
Underlined word is operative

Any $2 \times 1 mark = 2 marks$

(ii) **Two characteristics of Reptiles:**
- They are poikilothermic/Cold blooded;
- They have dry skin covered with scales
- They have homodont teeth/dentition
- They undergo internal fertilization
- No parental care for the young
- Posses incomplete developed four chambered heart
- Possess middle and inner ears

Any $2 \times 1 mark = 2 marks$

Total = 20marks

4a **Definition of the following terms**

(i) **Diffusion:-**The movement of molecules/ionsof a substance;

- from a region of higher concentration;
- to a region of lower concentration;
- until an equilibrium or even distribution is reached.

$Any\ 2 \times 1mark = 2marks$

(ii) **Osmosis:-** The movement of water molecules

- from a region of higher concentration of water molecule/lower concentration of solute molecules;
- to a region of lower concentration of water molecules/higher concentration of solute molecules;
- through a semi-permeable/differentially/partially permeable membrane.

$Any\ 2 \times 1mark = 2marks$

(iii) **Plasmolysis:-** The process whereby the cell membrane and the protoplasm;

- shrink away from the cell wall
- due to excessive loss of water from the cell/exosmosis.

$Any\ 2 \times 1mark = 2marks$

b.(i) **Four Effects of overcrowding:**

- shortage of space
- shortage of food
- competition for food/water/air/light/soil nutrient/mate
- diseases are easily spread
- leads to cannibalism/predation
- causes high death rate/mortality
- leads to migration/emigration

$Any\ 4 \times 1mark = 4marks$

(ii) Two ways of conserving wild life

- Establishment of forest reserves/afforestation;
- Establishment of game reserves/zoos
- Control of hunting to prevent extinction
- Prohibition of poaching/killing of animal's in game reserves
- Prohibition of bush-burning
- Creation of awareness on the value of wildlife
- Preventing pollution from destroying aquatic life
- Prohibition of deforestation

$Any\ 2 \times 1mark = 2marks$

(iii) **Two examples of social Animals**

- Bees;
- Wasps;
- Termites;
- Ants;
- Fishes;
- Foxes;
- Wolves;
- Monkeys;
- Baboons;
- Chimpanzees;

$Any\, 2 \times 1 mark = 2 marks$

NB: Spellings must be correct to score

4c. **Definition of Terms**

(i) Metamorphosis

- A process of gradual changes of forms and shapes;
- during the development of an organism
- from the fertilized egg to the adult stage.

$Any\, 2 \times 1 mark = 2 marks$

(ii) **Two examples of insects that undergo incomplete metamorphoses**

- Cockroach
- Grass hopper/locust
- Termite
- Dragon fly
- Green fly
- Aphids

NB: Spellings must be correct to score

$Any\, 2 \times 1 mark = 2 marks$

Two examples of Berry fruit

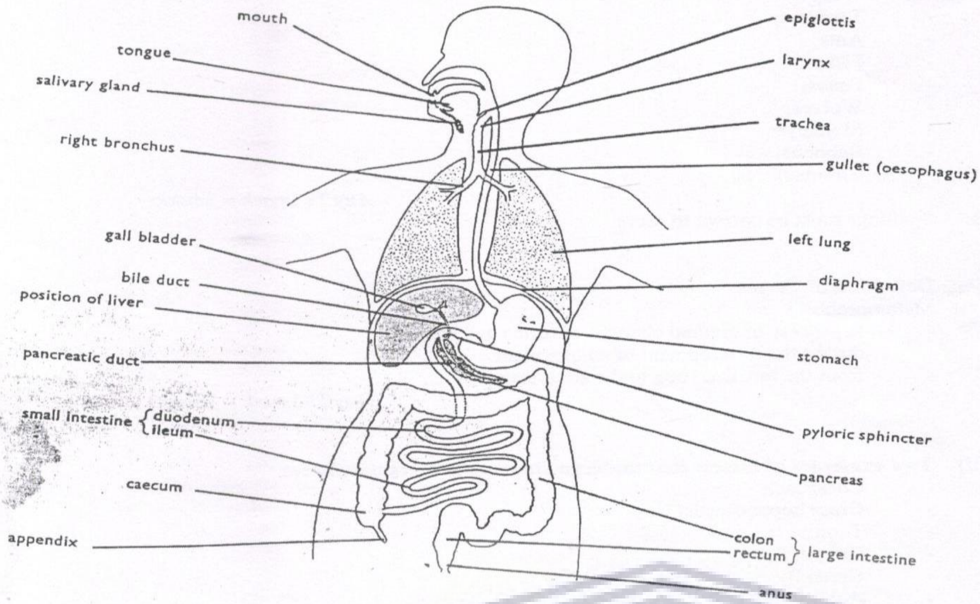
(iii)
- Tomato
- Orange/Grape/Lemon/Tangerine/Lime
- Melon
- Pawpaw
- Pepper
- Guava
- Garden egg
- Cucumber

$Any\, 2 \times 1 mark = 2 marks$

NB: Spellings must be correct to score

Total 20marks

5a(i) Diagram of the Human Alimentary Canal.



TL	-	Diagram of the human Alimentary Canal	**1mark**
		QUALITY	
SZ	-	Size 8 – 10cm (vertical measurement)	**1mark**
CL	-	Clarity of Lines (lines not wooly ½), line not broken ½)	**1mark**
NL	-	Neat labelling (rulled guideline½; horizontal labels ½)	**1mark**
		DETAILS	
BSS	-	Bean shaped stomach	**1mark**
ATD	-	Ascending transverse –descending colon	**1mark**
Lb	-	Labels: Mouth; oesophagus/gullet; stomach; duodenum; small intestine/ilum; large intestine/colon; Apendix; rectum; Anus *Any 4 × ½ mark = 2marks*	

NB: Spellings must be correct to score

8

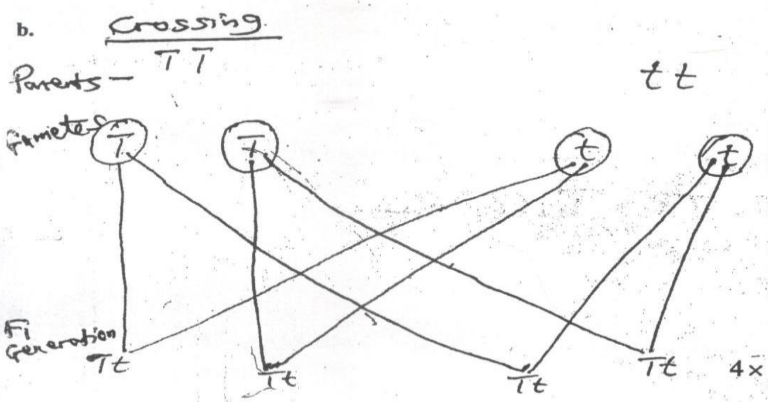
(ii) **Completion of Table**

S/N	Part of digestive system	Enzyme present
1	Mouth	Ptyalin
2	Stomach	Rennin/pepsin
3	Small intestine	Lipase/maltase/erepsin/lactase/sucrase

Any $3 \times 1 mark = 3 marks$

NB: Spellings must be correct to score

b.



$4 \times \frac{1}{2} mark = 2 marks$

$4 \times \frac{1}{2} mark = 2 marks$

Phenotypic ratio – 4 : 0 = ½mark

Punnet square method

X	T	t
T	TT	Tt
t	Tt	tt

Gametes = $4 \times \frac{1}{2} mark = 2 marks$

f_2 generation × ½ = 2marks

Phenotypic ratio = 3 : 1 = ½mark

NB: No crossing sign (X) no marking in F_1 and F_2 generations
- Any incorrect F_1 generation, no score for Phenotypic ratios in F_1 and F_2 generations
- Wrong F_1 generation, no marking for F_2 generation
- No punnet square no marking for F_2 generation

Total 20marks

Mathematics:

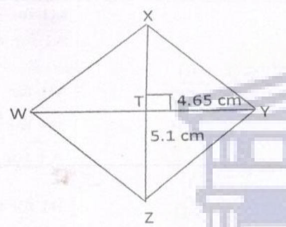
WASSCE FOR SCHOOL CANDIDATES, 2018

GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY)- NIGERIA AND THE GAMBIA

Question Number	Details	Marks
1.	Purchase price = ₦900,000.00 Depreciation for 1st year = $\frac{30}{100}$ × ₦900,000.00 = ₦270,000.00	M1 for $\frac{30}{100}$ × ₦900,000.00
	Balance = ₦(900,000.00 – 270,000.00) = ₦630,000.00	M1 for ₦(900,000.00 – 270,000.00) A1 for ₦630,000.00
	Deprecation for 2nd year = $\frac{22}{100}$ × ₦630,000.00 = ₦138,600.00	M1 for finding any depreciated value
	Balance = ₦(630,000.00 – 138,600.00) = ₦491,400.00	A1 for ₦491,400.00
	Deprecation for 3rd year = $\frac{22}{100}$ × ₦491,400.00 = ₦108,108.00	
	Balance = ₦(491,400.00 – 108,108.00) = ₦383,292.00	A1 for ₦383,292.00
	Deprecation for 4th year = $\frac{22}{100}$ × ₦383,292.00 = ₦84,324.24	
	Balance = ₦(383,292.00 – 84,324.24) = ₦298,967.76	A1 for ₦298,967.76
	Value of car on 28th February, 2015 ≈ ₦299,000.00 correct to the **nearest hundred naira**.	A1 for ₦299,000.00 correct to the **nearest hundred naira**. [Insist on **correct answer only**]
	ALITER Value of car after 1st depreciation = $\frac{70}{100}$ × ₦900,000.00 = ₦630,000.00	M1M1 for $\frac{70}{100}$ × ₦900,000.00 A1 for ₦630,000.00
	Value of car after 2nd depreciation = $\frac{78}{100}$ × ₦630,000.00 = ₦491,400.00	M1 for finding any value of car A1 for ₦491,400.00
	Value of car after 3rd depreciation = $\frac{78}{100}$ × ₦491,400.00 = ₦383,292.00	A1 for ₦383,292.00
	Value of car after 4th depreciation = $\frac{78}{100}$ × ₦383,292.00 = ₦298,967.76	A1 for ₦298,967.76
	Value of car on 28th February, 2015 ≈ ₦299,000.00 correct to the **nearest hundred naira**.	A1 for ₦299,000.00 correct to the **nearest hundred naira**. [Insist on **correct answer only**] [8 Marks]

2

WASSCE FOR SCHOOL CANDIDATES, 2018
GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

Question Number	Details	Marks
2. (a)	$y = 2px^2 - p^2x - 14$ $10 = 2p(3)^2 - p^2(3) - 14$ $10 = 18p - 3p^2 - 14$ $p^2 - 6p + 8 = 0$ $(p-4)(p-2) = 0$ $p = 4$ or $p = 2$	M1 for $10 = 2p(3)^2 - p^2(3) - 14$ A1 for $p^2 - 6p + 8 = 0$ M1 for solving A1$\left(\frac{-1}{2}\text{ee}\right)$ for p = 4 or 2 (4 Marks)
(b)	$3y - 2x = 21$ ....(1) × 4 $4y + 5x = 5$ ....(2) × 3 $12y - 8x = 84$ ....(3) $12y + 15x = 15$ ....(4) Subtract equations (4) from (3) $-23x = 69$ $x = -3$ Substitute for x in equation (1) $3y - 2(-3) = 21$ $3y + 6 = 21$ $3y = 15$ $y = 5$	M1 for solving A1 for $x = -3$ A1 for $y = 5$ A1 for Q = (– 3, 5) (4 Marks) **[8 Marks]**
3. (a)	 $\lvert XT\rvert = \frac{1}{2} \times 10.2 = 5.1\ cm$ $\lvert TY\rvert = \frac{1}{2} \times 9.3 = 4.65\ cm$ From Δ XTY, $\lvert XY\rvert^2 = (5.1)^2 + (4.65)^2 = 47.6325$ $\lvert XY\rvert = \sqrt{47.6325} = 6.9016$ cm Perimeter of Rhombus WXYZ = 4 × 6.9016 = 27.6064 cm Perimeter of Rhombus WXYZ ≈ 27.6 cm correct to **one decimal** place	B1 for either 5.1 cm or 4.65 cm M1 for $\lvert XY\rvert^2 = (5.1)^2 + (4.65)^2$ M1 for 4 × 6.9016 A1 for Perimeter of Rhombus ≈ 27.6 cm correct to **one decimal** place. (4 Marks)

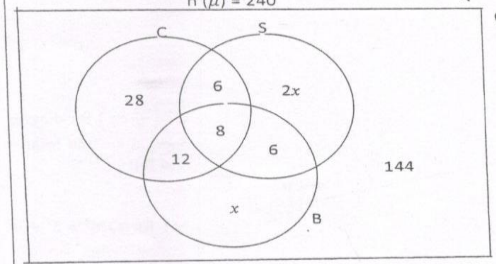
WASSCE FOR SCHOOL CANDIDATES, 2018
GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

Question Number	Details	Marks
3 (b)	$\cos x = \frac{4}{5}$ and $\tan x = \frac{3}{4}$ $5\cos x - 4\tan x = 5(\frac{4}{5}) - 4(\frac{3}{4})$ $= 4 - 3$ $= 1$	B1 for either $\cos x = \frac{4}{5}$ or $\tan x = \frac{3}{4}$ M1 for $5(\frac{4}{5}) - 4(\frac{3}{4})$ M1 for simplifying A1 for 1 (4 Marks) **[8 Marks]**
4. (a) (i) (ii) (b)	$3x + 15^\circ = x + 90^\circ$ $3x - x = 90^\circ - 15^\circ$ $2x = 75^\circ$ $x = 37.5^\circ$ $\angle RSQ = 180^\circ - (3 \times 37.5 + 15)^\circ$ $= 180^\circ - 127.5^\circ$ $= 52.5^\circ$ $2N4_{seven} = 15N_{nine}$ $(2 \times 7^2) + (N \times 7) + (4 \times 7^0) = (1 \times 9^2) + (5 \times 9) + (N \times 9^0)$ $102 + 7N = 126 + N$ $6N = 24$ $N = 4$	M1 for $3x + 15^\circ = x + 90^\circ$ M1 for solving A1 for $x = 37.5^\circ$ M1 for solving A1 for $\angle RSQ = 52.5^\circ$ (5 Marks) M1 for conversion to base ten on either side correctly M1 for solving A1 for N = 4 (3 Marks) **[8 Marks]**
5. (a) (b)	$\frac{m+n+s+p+q}{5} = 12$ $m+n+s+p+q = 60$ $\frac{(m+4)+(n-3)+(s+6)+(p-2)+(q+8)}{5}$ $= \frac{m+n+s+p+q+13}{5} = \frac{60+13}{5}$ $= 14\frac{3}{5}$ (Accept 14.6) 75^{th} percentile $= \frac{75}{100} \times 500 = 375$ 25^{th} percentile $= \frac{25}{100} \times 500 = 125$ Number of people between 15 and 65 years = 375 – 125 = 250	M1 for $\frac{m+n+s+p+q}{5} = 12$ A1 for $m+n+s+p+q = 60$ M1 for $\frac{(m+4)+(n-3)+(s+6)+(p-2)+(q+8)}{5}$ M1 for $\frac{60+13}{5}$ A1 for $14\frac{3}{5}$ (Accept 14.6) (5 Marks) B1 for either 375 or 125 M1 for subtraction A1 for 250 (3 Marks) **[8 Marks]**

4

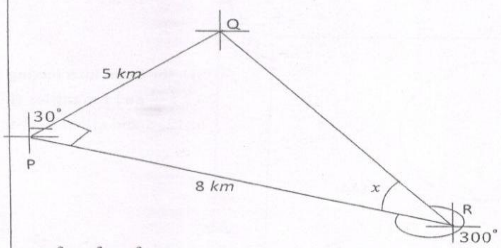
WASSCE FOR SCHOOL CANDIDATES, 2018

GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

Question Number	Details	Marks
6. (a)	Let C = Clutch, S = Steering and B = Brakes. Number of cars that failed the test = $\frac{40}{100} \times 240 = 96$	No diagram no mark M1A1 for $\frac{40}{100} \times 240 = 96$
	n (μ) = 240 	M1 for three intersecting sets A3 $\left(\frac{-1}{2}\text{ee}\right)$ for entries showing 28, x, $2x$, 6, 6, 12, 8 and either 240 or 96 (6 Marks)
(b) (i)	$28 + 6 + 12 + 6 + 8 + x + 2x = 240 - 144$ $3x + 60 = 96$ $x = 12$ The number of cars with faulty brakes = $12 + 12 + 14$ $= 38$	M1 for $28 + 6 + 12 + 6 + 8 + x + 2x = 96$ A1 for $x = 12$ M1 for $12 + 12 + 14$ A1 for 38
(ii)	Number of cars with **only one** fault = $28 + 12 + 2(12)$ $= 28 + 36$ $= 64$	M1 for $28 + 12 + 2(12)$ A1 for 64 (6 Marks) **[12 Marks]**
7. (a)	Gradient = $\frac{-7-5}{-4-2} = \frac{-12}{-6} = 2$ Equation of line is $y = mx + c$ Substituting $x = 2$ and $y = 5$ where m = gradient = 2, $5 = 4 + c$ $c = 5 - 4 = 1$ Therefore, equation of the line is $y = 2x + 1$	M1A1 for gradient M1 for $5 = 4 + c$ A1 for $y = 2x + 1$ (or equivalent) (4 Marks)

WASSCE FOR SCHOOL CANDIDATES, 2018

GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

Question Number	Details	Marks
7. (b) (i)		B2 $\left(\frac{-1}{2}\text{ee}\right)$ for diagram showing (30°, 90°, 5 *km*, 8 *km* and relative positions of P, Q and R).
(ii)	$\lvert QR\rvert^2 = 5^2 + 8^2 = 25 + 64 = 89$ $\lvert QR\rvert = \sqrt{89} = 9.4340$ *km* ≈ 9.43 *km* correct to **three** significant figures. $\tan x = \frac{5}{8} = 0.6250$ $x = \tan^{-1}(0.6250) = 32.01^\circ$ Bearing of R from Q = $90^\circ + 32.01^\circ + 30^\circ = 152.01^\circ$ $\approx 152^\circ$, correct to **three** significant figures	M1 for $\lvert QR\rvert^2 = 5^2 + 8^2$ A1 for $\lvert QR\rvert = 9.43$ *km* M1 for $\tan x = \frac{5}{8}$ or its equivalent A1 for $x = 32.01^\circ$ M1 for $90^\circ + 32.01^\circ + 30^\circ$ or equivalent A1 for 152° or S28°E. (8 Marks) **[12 Marks]**

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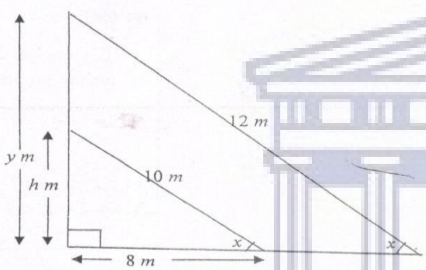
WASSCE FOR SCHOOL CANDIDATES, 2018
GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

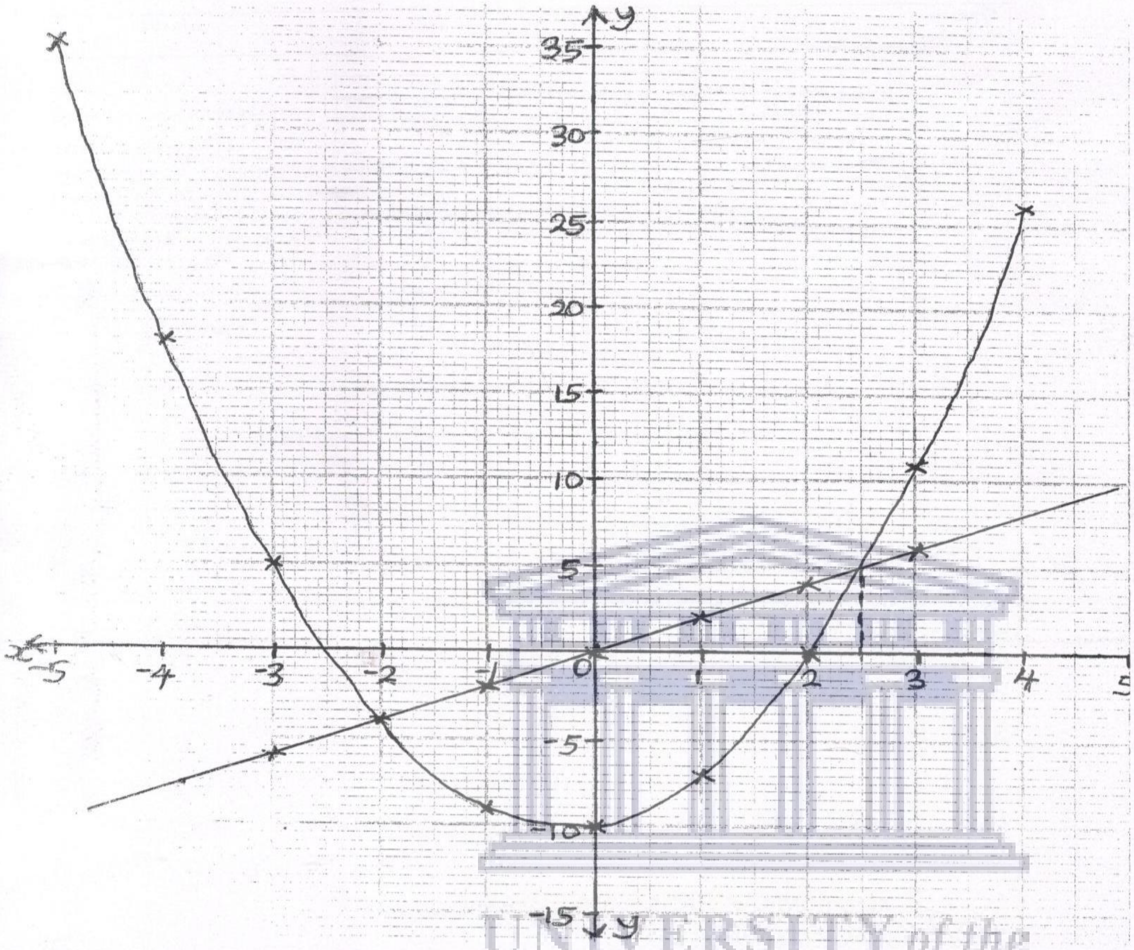
Question Number	Details	Marks
8. (a)	Cost of book to Lamin = ₦300.00 Percentage profit for selling the book to Bola = $x\%$ Let selling price = s.p (L) $x\% = \frac{s.p(L)-300}{300} \times 100\%$ $3x$ = s.p (L) – 300 s.p(L) = ₦$(3x + 300)$ The cost of the book to Bola = ₦$(3x+ 300)$ Bola sold the same book to James at a percentage profit of $x\%$ Let selling price = s.p (B) $x\% = \frac{s.p(B)-(3x+300)}{(3x+300)} \times 100\%$ $(3x + 300)x$ = [s.p (B) – $(3x + 300)$] 100 s.p(B) = $\frac{3x^2+6000x+30000}{100}$ The cost of the book to James = $\frac{3x^2+6000x+30000}{100}$ James paid ₦$(6x + \frac{3}{4})$ than what Lamin paid, then James paid = $6x + \frac{3}{4} + 300$ $\frac{3x^2+6000x+30000}{100} = 6x + \frac{3}{4} + 300$ $3x^2 + 600x + 30000 = 600x + 75 + 30000$ $3x^2 = 75$ $x^2 = 25$ $x = 5$	M1 for $x\% = \frac{s.p(L)-300}{300} \times 100\%$ A1 for ₦$(3x + 300)$ M1 for $x\% = \frac{s.p(B)-(3x+300)}{(3x+300)} \times 100\%$ A1 for $\frac{3x^2+6000x+30000}{100}$ B1 for $6x + \frac{3}{4} + 300$ M1 for $\frac{3x^2+6000x+30000}{100} = 6x + \frac{3}{4} + 300$ M1 for solving A1 for $x = 5$ (8 Marks)
(b)	$3x - 2 < 10 + x < 2 + 5x$ $3x - 2 < 10 + x$ $2x < 12$ $x < 6$ $10 + x < 2 + 5x$ $8 < 4x$ $2 < x$ The range of values of x is $2 < x < 6$.	M1 for solving either inequality A1 for $x < 6$ A1 for $2 < x$ A1 for $2 < x < 6$ (4 Marks) **[12 Marks]**
9. (a)	Using cosine rule, $\|TQ\|^2 = 6^2 + 4^2 - 2 \times 6 \times 4 \times \cos 30^\circ$ $= 52 - 41.568 = 10.432$ $\|TQ\| = \sqrt{10.432} = 3.2299\ cm$ $\frac{4}{10} = \frac{3.2299}{\|SR\|}$ $\|SR\| = \frac{10 \times 3.2299}{4} = 8.07475cm$ $\|SR\| = 8\ cm$ correct to the nearest whole number	M1 for, $\|TQ\|^2 = 6^2 + 4^2 - 2 \times 6 \times 4 \times \cos 30^\circ$ A1 for $3.2299\ cm$ M1 for $\frac{4}{10} = \frac{3.2299}{\|SR\|}$ A1 for $\|SR\| = 8\ cm$ (4 Marks)

Question Number	Details	Marks
9. (b)	Area of Δ PTQ $= \frac{1}{2} \times 4 \times 6 \times \sin 30^\circ$ $= 6\ cm^2$ $\frac{4}{10} = \frac{6}{6 + \lvert QR \rvert}$ $4\lvert QR\rvert = 36$ $\lvert QR\rvert = 9\ cm$ $\lvert PR\rvert = (6+9)\ cm$ $= 15cm$ Area of Δ SPR $= \frac{1}{2} \times 10 \times 15 \times \sin 30^\circ$ $= 37.5\ cm^2$ Area of TQRS $= 37.5 - 6$ $= 31.5\ cm^2$ $\approx 32\ cm^2$, correct to the **nearest** whole number	M1 for $\frac{1}{2} \times 4 \times 6 \times \sin 30^\circ$ A1 for $6\ cm^2$ M1 for $\lvert PR\rvert = (6+9)\ cm$ A1 for $\lvert PR\rvert = 15\ cm$ M1 for $\frac{1}{2} \times 10 \times 15 \times \sin 30^\circ$ A1 for $37.5\ cm^2$ M1 for $(37.5 - 6)cm^2$ A1 for $32\ cm^2$ (8 Marks) **[12 Marks]**
10. (a)	From Δ PSQ, $\lvert SQ\rvert^2 = 5^2 + 12^2 = 169$ $\lvert SQ\rvert = 13\ cm$ Using properties of similar triangle, $\frac{\lvert PR\rvert}{5} = \frac{12}{13}$ $\lvert PR\rvert = \frac{5 \times 12}{13} = 4.6154\ cm$ $\lvert PR\rvert = 4.62\ cm$ correct to **three** significant figures.	M1 for $\lvert SQ\rvert^2 = 5^2 + 12^2$ A1 for $\lvert SQ\rvert = 13\ cm$ M1 for $\frac{\lvert PR\rvert}{5} = \frac{12}{13}$ M1 for solving A1 for $\lvert PR\rvert = 4.62cm$ (5 Marks)
(b) (i)		B2$\left(\frac{-1}{2}\text{ee}\right)$ for diagram showing (8m, 10m, 12m, and equal angles)
(ii)	$h^2 = 10^2 - 8^2 = 36$ $h = 6\ m$ Using properties of similar triangle, $\frac{6}{y} = \frac{10}{12}$ $y = \frac{6 \times 12}{10} = 7.2\ m$	M1 for $h^2 = 10^2 - 8^2$ A1 for $h = 6\ m$ M1 for $\frac{6}{y} = \frac{10}{12}$ M1 for solving A1 for $y = 7.2\ m$ (7 Marks) **[12 Marks]**

WASSCE FOR SCHOOL CANDIDATES, 2018

GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

Question Number	Details	Marks
11. (a)	x: -5, -4, -3, -2, -1, 0, 1, 2, 3, 4 y: 35, 18, 5, -4, -9, -10, -7, 0, 11, 26	B3$\left(\frac{-1}{2}\text{ee}\right)$ for table (3 Marks)
(b)	For the graph, see attached.	B3$\left(\frac{-1}{2}\text{ee}\right)$ for graph (3 Marks)
(c) (i)	The solution of $2x^2 + x = 10$ is $x = -2.5\ (\pm 0.1)$ or $x = 2(\pm 0.1)$	B1B1 for $x = -2.5\ (\pm 0.1)$ or $2(\pm 0.1)$ (2 Marks)
(ii)	First we draw the graph of $y = 2x$ as shown in the graph attached. The solution of $2x^2 + x = 10 = 2x$ is $x = -2\ (\pm 0.1)$ or $x = 2.5\ (\pm 0.1)$	M1A1 for graph of $y = 2x$ A1A1 for $x = -2\ (\pm 0.1)$ or $2.5\ (\pm 0.1)$ (4 Marks) **[12 Marks]**



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WASSCE FOR SCHOOL CANDIDATES, 2018

GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

Question Number	Details	Marks
12.(a)	$p\begin{pmatrix}2\\3\end{pmatrix} + q\begin{pmatrix}5\\-2\end{pmatrix} = \begin{pmatrix}-4\\13\end{pmatrix}$	M1 for correct substitution
	$\begin{pmatrix}2p\\3p\end{pmatrix} + \begin{pmatrix}5q\\-2q\end{pmatrix} = \begin{pmatrix}-4\\13\end{pmatrix}$	
	$2p + 5q = -4$ ………………(1) × 3	M1 for forming equations
	$3p - 2q = 13$………………..(2) × 2	A1 for both equations correct
	$6p + 15q = -12$……………....(3)	
	$6p - 4q = 26$………………..(4)	
	Subtracting equations (3) from (4)	
	$-19q = 38$	M1 for solving
	$q = -2$	A1 for $q = -2$
	$2p + 5(-2) = -4$	
	$2p = 6$	
	$p = 3$	A1 for $p = 3$ (6 Marks)
(b) (i)	See attached graph	B1$\left(\frac{-1}{2}\text{ee}\right)$ for axes
(ii)	See attached graph for the quadrilateral WXYZ with W(2,3), X(4,-1), Y(-3,-4) and Z(-3,2).	B2 (-1 ee) for quad. WXYZ
(iii)	See the attached for the image of the quadrilateral WXYZ under an anticlockwise rotation of 90^0 is $W_1(-3,2)$, $X_1(1,4)$, $Y_1(4, -3)$ and $Z_1(-2,-3)$.	B3(-1 ee) for image of WXYZ (6 Marks) **[12 Marks]**

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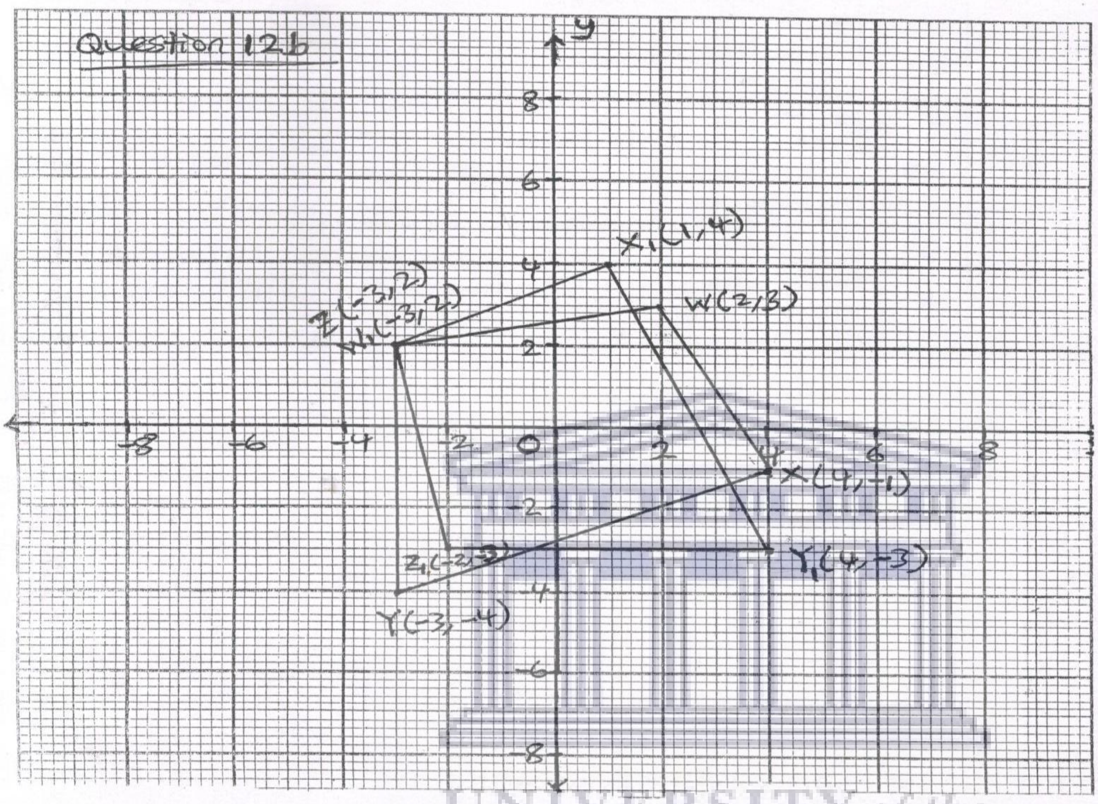
WASSCE FOR SCHOOL CANDIDATES, 2018

GENERAL MATHEMATICS / MATHEMATICS (CORE) 2 (ESSAY) - NIGERIA AND THE GAMBIA

(To be fastened together with other answers to paper)

Name.. Index Number..



Appendix 35: 2007 Curriculum for Nigerian senior secondary school (table of content)

Physics:

PHYSICS CURRICULUM FOR SECONDARY SCHOOLS

INTRODUCTION

Physics is crucial for effective living in the modern age of science and technology. Given its application in ir professions, it is necessary that every student is given an opportunity to acquire some of its concepts Unfortunately, the teaching and learning of Physics has been fraught with challenges which prevent many stu well in external examinations. The philosophy, objectives and content of the Physics curriculum ha professionals in the field to be satisfactory; but its implementation has fallen short of expectation becau number of qualified teachers, inadequate equipment to ensure the performance of related student activiti enhancing meaningful learning, and the nature of the subject that appears to evoke difficulty.

In the face of these challenges, we are faced with many issues which need to be addressed in a curriculum t appropriateness and currency in a rapidly changing world that is moderated by information and communicatior

Consequently, the general **objectives** of the Physics Curriculum, as earlier accepted, remain to:

1. provide basic literacy in Physics for functional living in the society;
2. acquire basic concepts and principles of Physics as a preparation for further studies;
3. acquire essential scientific skills and attitudes as a preparation for technological application of Physics; a
4. stimulate and enhance creativity.

Unlike the existing curriculum which was structured with the conceptual approach to content selection, we h

approach for this curriculum to ensure compliance with national and global issues without necessarily overlo

six themes, which have related concepts and topics, are:

- **Interaction of Matter, Space and Time**
- Conservation Principles
- Waves: Motion without Material Transfer
- Fields at Rest and in Motion
- Energy Quantization and Duality of Matter
- Physics in Technology

Like before, the **spiral approach** to content organization has been used while the guided-discovery metho recommended, all in an effort to achieve the stated objectives of the curriculum. In order to stimulate creativ skills and correct attitudes in students, the course is student-activity oriented with emphasis on experi discussion and problem-solving. The introduction of the theme: Physics in Technology provides an opportu and operation of workable devices as well as acquaintance with some products of modern technology.

In evaluating the course based on this curriculum, we recommend an assessment protocol that takes c domains of educational objectives with assessment instruments that include multiple choice items, s questions, and essay questions.

Mathematics:

TABLE OF CONTENT PAGE

YEAR	THEME	TOPIC	F
SS 1	1. Number and Numeration	Indices and Logarithms Set	
	2. Algebraic Process	1. quadratic equations 2. graphical representation of quadratic equation	
	3. geometry	Plane geometry Menstruation Trigonometry	
	4. Statistics	1. Data presentation: Tallying 2. Graphical presentation of data	

YEAR	THEME	TOPIC	
SS 1I	1. Number and Numeration	Indices and Logarithm Number approximation Error estimation Progression and Regression	
	2. Algebraic Process	1. quadratic equations 2. Inequalities	
	3. geometry	Plane geometry Trigonometry	
	4. Statistics	1. Group Data presentation and 2. Measures of Central tendency and dispersion for ungrouped and grouped data 3. Probability	

YEAR	THEME	TOPIC	RE
SS 1II	1. Number and Numeration	Laws of logarithm and application, matrices, number bases other than 10, Modular Arithmetic, Variation, Surds	
	2. Algebraic Process	1. linear equations 2. quadratic equation and application 3. Algebraic fractions	
	3. geometry	1. Menstruation: multiple dimensional objects 2. Trigonometry 3. Coordinate geometry	
	4. Introductory Calculators	1. differentiation of poly nomial 2. integration of Polynomial	

Chemistry:

TABLE OF CONTENTS

SS1

SS2

THEME: THE CHEMICAL WORLD

THEME: CHEMISTRY AND ENVIRONMENT

THEME: CHEMISTRY AND INDUSTRY

Biology:

Microorganisms around us. = = = = = = =

Microorganisms in action. = = = = = = =

Towards better health = = = = = = = =

Aquatic habitat (Marine Habitat) = = = = = = = =

Terrestrial Habitat = = = = = = = =

Unicellular Organisms and Invertebrates = = = = =

Senior Secondary 2 (SS 2)

Theme 1: **Organisation of Life** = = = = = = = =

Classification of Plants = = = = = = = =

Theme 2: **The Organism at Work** = = = = = = =

Digestive System = = = = = = = =

Transportation System = = = = = = = =

Respiratory System = = = = = = = =

Excretory Systems = = = = = = = =

Theme 3: **The Organism and its Environment** = = = = = =

Nutrient Cycling in Nature = = = = = = =

Ecological Management: Association, Tolerance, Adaptation, Pollution. = =

Conservation of Natural Resources = = = = = =

Pests and Diseases of Crops = = = = = = =

Theme 4: **Continuity of Life** = = = = = = = =

Reproductive Systems in Vertebrates = = = = = =

Reproductive Systems in Plants = = = = = = =

Pollination in Plants = = = = = = = =

Senior Secondary 3 (SS 3)

Theme 2: **The Organism at Work** = = = = = = =

Regulation of Internal Environment = = = = = =

Nervous Co-ordination = = = = = = = =

Sense Organs = = = = = = = = =

Theme 3: **The Organism and its Environment** = = = = = =

Ecology of Population = = = = = = = =

Balance in Nature = = = = = = = =

Theme 4: **Continuity of Life** = = = = = = = =

Reproductive System and Reproduction in Humans = = = =

Development of New Seeds = = = = = = =

Fruits = = = = = = = = = =

Reproductive Behaviours = = = = = = =

Biology of Heredity (Genetics) = = = = = = =

Variation and Evolution = = = = = = = =

Evolution = = = = = = = =

Appendix 36: South Africa curriculum and assessment policy statement for grades 10 – 12 (Physical sciences)

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

CURRICULUM AND ASSESSMENT POLICY STATEMENT

GRADES 10-12

PHYSICAL SCIENCES

CONTENTS