Instructional Resources, Teacher-related Factors and Students' Academic Achievement in Practical Aspect of Biology in Oyo State, Nigeria

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Certification

This is to certify that Olumide Temitayo AKINPELU with the Matriculation Number LCU/PG/003013 carried out this research work titled "Instructional Resources, Teacher related Factors and Senior Secondary School Students' Academic Achievement in Practical Aspect of Biology in Oyo State" in the Department of Arts & Social Science Education, Faculty of Education, Lead City University, Ibadan, Nigeria, for the award of Masters of Education Degree (MEd) in Educational Management and that this has not been previously submitted.

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Dedication

I dedicate my thesis to the Almighty God who started this work with me and saw me through.

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“Even though the above institution and persons have assisted in the process of this research work, I alone stand responsible for the errors, if any is found in the work”.

Abstract

The study investigated the influence of Instructional Resources and Teacher-related Factors on Students' Academic Achievement in Biology Practical in Secondary Schools in Oyo State, Nigeria. Research of Literature shows influence of the combinations of many variables on the students' academic achievement but not these two variables together, -Instructional Resources and Teacher-related Factors, which provided the gap for this study to fill. Research questions were posed and two hypotheses guided the study. Study population comprised of all the SS2 (Senior Secondary School Students, 81,083) in Oyo State, Nigeria, Sample size consisted of 500 students. The Expost Facto research design was employed. Data collection was conducted using the Instructional Resources and Teacher-related Factors Questionnaire (IRTRFQ) and the Practical Biology Test (PBT). Result showed low availability level of instructional resources ($\bar{x}$ =1.69), low utilization of instructional resources, ($\bar{x}$ =1.90) and also high status of teacher- related factors ($\bar{x}$ =3.12). Multiple regression analysis revealed an R .171, R^2 .029, Adjusted R^2 .023, indicating that the independent variables accounted for 2.3% of the variance in students' Biology practical performance. ANOVA results showed F2, 497 = 7.514; p=.05. Standardized Beta (B) weights indicated significant contributions of teacher-related factors (B = -0.119, t = -2.653; p=.05) and instructional resources (B = -0.106, t = -2.380; p=.05) to student achievement. The findings demonstrated that both variables significantly influence students' performance in Biology Practical. It is recommended that the government enhance support for schools through the provision of instructional resources and materials. Also, teachers who are the link between teaching and learning in our school system should be availed the opportunity to attend hands-on training

Keywords: Instructional Resources, Teacher-related Factors, Academic Achievement, Biology, Oyo State

Word Count: 265

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Chapter One

Introduction

1.1 Background to the Study

Academic achievement is a major aspect of school system. Recently, there has been an attitude behaviour formation and modification over the deplorable level of academic achievement of senior secondary school students in both internal and external examinations in Biology, of which practical holds a great percentage, (Objective Questions – 60marks, Theory – 60 marks, Practical – 80 marks). It has been conceived as the reflection of students' ability in academic work which shows how well a student performs in test and examination. It is disheartening to note that despite all laudable objectives of sciences in secondary schools and its importance to the national development, students' achievement in West African Senior School Certificate has been poor from 2019 to 2022[1]. This was further buttressed by the trend in the students' achievement in West African Senior School Certificate in Biology from 2019 to 2022.

The academic achievement of students is an area that is given wide research over the years. This is due to the poor performance of students observed in public and private schools examination[2]. Academic achievement is referred to as the knowledge attained or skills developed in the school subjects, usually determined by test scores or marks assigned by the teacher[3]. Quite remarkably, regular poor academic achievement by the majority students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners[4]. Substantial research on the effectiveness of teaching methods indicates that the quality of teaching is often reflected by the achievements of learners. Instructional resources therefore, are essential and significant tools needed for teaching and learning of school subjects to promote teachers' efficiency and improve students' performance.

Grades are certainly the most well-known indicator of academic achievement[2]. Grades are the student's "score" for their classwork and overall tenure. Grades are most often a tallying or average of assignment and test scores and may often be affected by factors such as attendance and instructor opinion of the student as well. Academic achievement refers to the outcome of education; the extent to which the student, teacher or institution have achieved their educational goals. Academic achievement or performance is the ability to study and remember facts and being able to communicate one's knowledge verbally or written on paper. In the context of this study, academic achievement refers to the extent to which students have achieved mastery of the objectives of the subjects they are exposed to in school[5].

The Nigerian secondary school education has for some time now become a source of concern to Nigerians. The concern focuses essentially on the quality of education which has been declining at an alarming and embarrassing rate. Teaching is an "art" but the success of a teacher lies in making his subject so simple as to make it intelligible for his students[6]. In order to make students learn effectively, the teacher has to adopt the right method of teaching. According to the interest which students show in science subjects and Biology in particular and the mastery they demonstrate on completion of a course of study depend on the teaching methods and materials. In-spite of much focus on teaching strategies in Biology, students' performance in the subject has continued to record a persistent variation trend in Oyo state. For example, in the year 2019 report by WAEC reveals that about 58% of the students in Oyo State failed to score credits in Biology[5].

The results of WASSCE of 2019 and 2020 are examples of the rate of decline in Nigerian secondary school education system which requires relevant and availability of instructional resources with some relevant teaching methods. The West African Examinations Council Results Statistics 2019-2020 reflected that a total of 1.57 million

candidates sat for WAEC in 2019 as public students as against 1.56m candidates in 2019[6,7]. Similarly, a total of 109,798 candidates sat for WAEC as private students in 2020 as against 133,258 candidates in 2019. 54,417 of the candidates were male while the remaining 55,561 were female. 47,122 of the candidates had 5 credits and above including English Language, 47,434 had 5 credits and above including Mathematics while 37,184 of the candidates had 5 credits and above including Mathematics, English Language and Biology[6]. The percentage of candidates with 5 credits and above including Mathematics & English Language is put at 33.81%. Who is to be blamed for the decline? It is clear from the results above that something is wrong with so many things within the school system. It is not only the provision of funds, infrastructure and remuneration of staff but also the availability of adequate instructional resources and relevant teaching methods by the teachers[7].

Biology is the science of life. All living organisms share several key properties such as order, sensitivity or response to stimuli, reproduction, growth and development, regulation, homeostasis and energy processing. Biology is a natural science concerned with the study of life and living organisms. It is a vast and eclectic field composed of many specialized disciplines that study the structure, function, growth, distribution, evolution or other features of living organisms. Biology is often approached on the basis of levels that deal with functional units of life. Biology is a natural science that studies the symptoms of nature. Biology as one of the fields of science provides a variety of learning experiences to understand the concepts and processes of science. It acts as a tool to achieve these goals.

Practical work is considered as hands – on learning experience, which prompts thinking about the world in which we live. Practical work creates exceptional learning surrounding that helps students to construct their knowledge, enhance logical inquiry and

psychomotor skills. Also, practical work offers an interactive experience to students where they can broaden their scope of constructivism learning and provides opportunities for students to actually do science as opposed to learning science[8].

Practical work in Biology helps students understand biological concepts better[8]. Similarly, a scholar assert that students understand natural phenomena better when science teachers give students opportunities to engage with and fully participate in practical work. According to another scholar, during practical activities students learn Biology more effectively and discover basic concepts, principles and laws[9]. In addition, practical work offers an essential opportunity for students to link first-hand experience with scientific concepts and ideas. The Nigerian senior high school Biology curriculum is designed to guide and inculcate in the learner skills of observation, measurement, formulation hypothesis, predication, designing, investigation, recording and interpretation of data, drawing conclusions and communicating them[10]. It provides the learner with the necessary tools for employment in laboratory, industry, agriculture, forestry, health care, administration and teaching. Furthermore, it equips the learner for further studies and research in pure and applied science and technology that are vital areas for the advancement of society and make the learner capable of critical thinking, making meaningful decisions and solving problems[10]. It is also emphasised that the teaching of Biology should be student-centred and activity oriented where the teacher acts as a facilitator[11]. Biology teachers with good practical work practices are therefore needed to achieve the set objectives of the Senior High School Biology syllabus in Nigeria.

The effectiveness of Biology practical activity depends on the practical knowledge level, skills and the ability of the Biology teacher to organize practical work[12]. Notwithstanding, Biology teachers demographic variables such as sex, academic qualification, area of specialization, years of teaching experience and professional status

also affect their practices in organizing practical work. Similarly, Biology teachers' demographic factors also affect students' academic achievements in Biology practical examination. A study carried out by a scholar to examine the influence of gender on the productivity of secondary school teachers in Delta State, Nigeria showed that male teachers were more productive than their female counterparts[13]. Also, a study showed that teacher qualification accounted for approximately 40 to 60 % of students' academic achievements in science. Also, some studies have proven that advanced academic degrees have positive effect on students' performance[14].Experienced Biology teachers have richer background of experience to draw from and can contribute to their practical work practices[15]. A study showed that teachers with more years of teaching experience made students had higher academic achievements than teachers with less years of teaching experience[16].

Effective implementation of Biology practical activities in many developing countries including Nigeria is a general problem as there are so many constraints. Some of these constraints include the inexistence of adequate conditions and availability of equipment and laboratory materials, including financial resources, to teach practical Biology, poor preparation of teachers, poor implementation of practical procedures, overwhelming activities demanded by the curriculum and bad practical work practices teachers exhibit when organizing practical work. Another scholar posits that unavailability of science teachers in schools, lack of materials, lack of funds and time have constrained the teaching of Biology practical lessons[17]. Consequently, many students fail to perform well in Biology. The constraints encountered by Biology teachers when organizing practical work make them either neglect or place less emphasis on the practical skills development aspect of learning Biology. Lack of in-service training for Biology teachers is one of the main reasons for few and poor practical activities carried

out in schools by Biology teachers, was posit by a scholar. A scholar asserted that the poor quality of practical work carried out in Biology classrooms leads students to develop undesirable attitudes toward practical work[18].

The performance of students in West African Senior School Certificate Examinations (WASSCE) in Biology practical is not encouraging, even though, Nigeria is said to be one of the first independent sub-Saharan African country to embark on a comprehensive drive to promote science education and the application of science in industrial and social development[15]. The performance of students who wrote the May/June West African Senior School Certificate Examination (WASSCE) Biology paper 2 (practical), improved in 2019 and 2020, declined significantly in 2021 and improved slightly in 2022 with raw mean performance scores of (29.0 ± 8.2), (31.0 ± 11.7), (24.0 ± 9.2) and (27.0 ± 10.3) respectively. Candidate's inability to spell technical terms correctly, answer questions on adaptation and to relate structure with functions of specimens in practical Biology made students lose huge marks. In addition, poor drawing of specimens, drawing specimens without adding magnification, inability to title drawings and labelling with guidelines that are not ruled.

Practical work needs to be carried out during Biology lessons to change students' perception and improve on their academic work. However, the situation in most schools in many developing countries including Nigeria is different. Teachers lack exposure to science process skills to carry out activities in class[19]. As a result, teachers try avoiding the practical work in the laboratory and do not understand the importance of laboratory experiments. The findings of a research work carried out by some scholars on teachers view on the role of science practical activities in the teaching of science in Nigeria Senior High Schools was that little emphasis was placed on the use of science practical work to develop students' cognitive skills.

To overcome these problems, there is need to strive for a balance of effective teaching methods such as co-operative learning, Discovery and simulation method of instruction. In Nigeria for example, Teachers are familiar with the use of a number of teaching methods but more especially the conventional methods like lecture, discussion and demonstration methods. Currently, Co-operative learning and Guided Discovery methods of instructional strategies among others were employed by teachers in Nigeria. The question now is, does Cooperative learning, Simulation and Guided Discovery methods of instruction help students' understanding and learning of, and enhance achievement in Biology if employed by Biology teachers in the classrooms? This provides the impetus for this study too. It is against this background that the researcher investigated the influence of instructional resources and teachers teaching method as determinants of student academic achievement in practical Biology in secondary schools in Oyo state, Nigeria.

Biology as a science has been offered to enhance laboratory activity, providing concrete experience, stimulate interactions in schools and increase scientific literacy. This practical oriented subject requires participatory, exploratory, experimental and child – centred approach of instruction and adequate learning resources. According to the National Policy on Education, it is the responsibility of government to provide the following educational resource and service for effective teaching and learning at the basic education level: School libraries, school health services, guidance and counselling services, educational resource centres, laboratories and workshops with the teacher – student ratio of one is to thirty-five. The availability, accessibility and utilization of these learning resource and services are necessary for the effective teaching and learning of Biology. A good deal of expected learning outcomes cannot be realized, in Biology at the secondary school as a result of non - availability of instructional resources as well as lack

of effective utilization of appropriate instructional resources. Science teaching is resource intensive, and so it may be very difficult to find some of the instructional resources for the teaching of some sciences in schools adequately[20].

Resources are human and material input. A scholar defined resources as equipment which the teachers can use to help in the achievement of lesson objectives[21]. Learning or interactional resources are educational inputs which are of vital importance to the teaching of all science subjects in secondary school. It was stated by a scholar that learning or instructional resources are human and material resources that are used as instrument of impacting knowledge, skills and attitude to learners. Learning resources are material things that facilitate the teaching and learning process by appealing to the learner's senses of hearing, (audio), seeing (visual), tasting, touching and smelling. It was opined that different instructional resources of the teachers are necessitated by the fact that the learners have their differences and on the fact that learning is more effective if it takes place through the five senses of hearing, seeing tasting, touching and smelling[22]. He maintains that these learning resources include school buildings such as classrooms, assembly halls, laboratories, workshops and libraries, teaching aids and other devices such as modern educational hard ware

Instructional resources have been observed as a powerful strategy to bring about effective teaching and learning. The importance of quality and adequate instructional resources in teaching and learning can occur through their effective utilization during classroom teaching. Instructional resources here include all the tools that the teachers can use to make the learning more interesting and memorable. Instructional resources include books, audio-visual, software and hardware of educational technology. The availability, adequacy and relevance of instructional resources in classrooms can influence quality teaching, which can have positive effect on students' learning and academic

performance[23]. The insight on linking instructional resources to students' academic performance serve critical in the provision of quality education. The title of the thesis, role of instructional resources in academic performance in community secondary schools in Rombo district originates from these ideas. Efficiency and high productivity in teaching and learning process can only be achieved through the use of instructional resources. In my views, teaching and learning start from the access to quality and adequate instructional resources, and these should be prepared well before the class interaction.

Instructional resources are teachers' strategic factor in organizing and providing education. This is so because they help to elaborate a concept that the teacher could not, without an instructional material. This allows students to learn more comfortably therefore influencing positively their academic performance[24]. Also, Instructional resources are considered important in teaching and learning in all levels of education because textbooks and other resource materials are basic tools. Absence or inadequacy makes teachers handle subjects in an abstract manner, portraying it as dry and non-exciting. For example, textbooks, charts, maps, audio-visual and electronic instructional resources such as radio, tape recorder, television and video tape recorder contribute much in making learning more interesting[21].

The importance of instructional resources is also evident in the performance of students. According to the scholar, schools, whose teachers use more instructional resources perform better than schools, whose teachers do not use instructional resources. This corroborated the study by another scholar that private schools performed better than public schools because students and teachers are provided with sufficient and quality teaching and learning resources. From this importance, schools at all levels of education have been advised to have quality and adequate instructional facilities to raise academic

performance of their students. The advice emanated from the fact that instructional facilities have a potent factor to qualitative education. The dictum is that "teaching is inseparable from learning but learning is separable from teaching." This means that teachers do the teaching to make the students learn, but with quality and adequate instructional facilities, students can learn adequately without the teachers. Instructional resources such as the size of classroom, sitting position and arrangement, availability of tables, chairs, chalkboards, shelves on which instruments for practical are placed, are important in the teaching transaction[25]. According to these scholars, availability of instructional resources can work best if other conditions are met such as the quality of classroom and the quality of teachers to use these resources.

School with well-equipped Biology laboratories have better results in the school certificate science examinations than those that are ill-equipped[24]. Corroborating this, a scholar reiterated that students instructed entirely by the laboratory facilities had higher attitude scores but lower achievement scores than students instructed entirely by the traditional lecture or textbook mode. On the same topic, it was opined that no course in science and mathematics can be considered as complete without including some practical work[25]. Thus, practical work forms an important feature in any science and mathematics course, and lastly, a scholar maintains that in secondary schools, the modern teaching of science will necessitate laboratories[26].

Physical facilities are facilities that consist of all the buildings, grounds, equipment and infrastructure required to create your product. Product quality and profitability are directly affected by the condition of the physical surroundings, equipment and work areas, regardless of the size of scale of your manufacturing operation. It is any structure fixed or moveable of whatever kind and any part thereof, used or intended to be used for teaching, lecturing or instructing or as a dwelling house. Physical facilities refer

to the school plant, that is, the school buildings, classrooms, library, toilet facilities, offices and other materials in infrastructure that would likely motivate students towards learning. Physical facilities are germane to effective learning and academic performance of students. A scholar reported that physical facilities is the main factor contributing to academic achievement in the school system. He also argued that the availability of school buildings and other plants are very important as they could enhance effective teaching and learning[27].

From the foregoing one can see that instructional resources and teachers' teaching methods play a crucial role in academic achievement of a child. This problem of poor achievement is more pronounced in ill-equipped schools hence it becomes necessary to find out the influence of Instructional Resources, Teacher related factors and Senior School Students' academic achievement in practical aspect of Biology in Oyo State, Nigeria.

On the aspect of teacher`s knowledge of subject matter, a teacher needs to understand subject matter deeply and flexibly so that they can have good cognitive understanding and relate one idea to another. Teachers need to see how ideas connect across various fields and to everyday life. This enables teachers to make ideas accessible to learners. A scholar introduced the phrase 'pedagogical content knowledge' and brought a new wave of scholarly articles on teachers' knowledge of their subject matter and the importance of this knowledge for successful teaching. Teachers need to master two types of knowledge which are content knowledge and knowledge of curricular development. Content knowledge refers to 'deep' knowledge of the subject itself; the theories, principles and concept of a particular discipline.

It even encompasses the teaching process which includes the presentation and communication of the content the best way for students to learn the specific concept and topics of a subject. Teachers need to understand what they teach and when possible, to understand it in several ways. This provides a variety of opportunities for different categories of learners to understand at their different paces. Students understand a lesson more when lesson are taught by a teacher who masters his subject very well. The teacher must have a good grasp of the subject matter if he is to command respect of his student. Knowledge of the subject matter is a key factor that influences teacher's quality and also affect student achievement. Positive interpersonal relationship is important for healthy human functioning even in the area of learning, most studies agree that there is a significant correlation between the quality of personal relationship and academic performance[27].Positive relationship can predict good academic performance while those festered with conflicts and misunderstandings can lead to poor academic performance.

Every human being loves to be acknowledged, loved and understood, so when a teacher meets these emotional needs of the learners, they open up to the teaching and this will ultimately have a great positive impact on their academic achievement. A withdrawn, nonchalant and uncaring teacher will unsuspectingly sow the seed of hatred for the subject in the hearts of the student. Although so many other factors such as lesson delivery, class size, parental development and social dynamics in a school all work to contribute to student achievement, yet a teacher with good rapport with the student will produce motivated students and ultimately a good academic achievement[28]. A good interpersonal skill brings about self-confidence and emotional balance and intelligence in students. Interpersonal interaction skills give the teacher the ability to provide core conditions which are essential in creating a positive educational or learning setting. It enhances student warmth and eagerness to learn.

Instructional Resources such as physical facilities, instructional materials, and electronic materials; and teacher-related factors such as teaching methods, teacher's knowledge of the subject matter and teacher's interpersonal relationship are all variables that could impact the academic achievements of students in secondary schools. That is the essence of this study.

1.2 Statement of the Problem

Instructional resources and teaching methods have been observed as factors to be reckoned with in the teaching and learning of Biology practical. In view of these, most teachers of Biology still resort to the theoretical method of teaching the subject with an unbefitting method. This undoubtedly, is contrary to the objective of Biology education, which is greatly needed at this period of our development with emphasis on practical oriented learning. With the researcher's experience as a practitioner in secondary schools, the researcher observed that most teachers in secondary schools in the state did not fully make use of instructional resources in the teaching of Biology to their students also in the methods that seem unbefitting too. This negligence of the effective use of the instructional facilities and materials in teaching and learning of practical Biology which is common to both the trained and untrained teachers could have negative impacts on the academic achievement of students in Biology practical in secondary schools in Ibadan, Oyo State.

Hence, the question of academic achievement and students' achievement in SSCE is therefore usually discussed both in and outside the academic circles. In the last few years, it has been observed in most secondary schools that a high percentage of students are performing very poorly in science-based subjects especially in Biology practical in National Examinations for example, The West African Examination Council (WAEC)

and National Examination Council (NECO)[29]. Due to ill motivated behaviour of the students towards the Education, Inadequate professional teachers, existence of lazy teachers and Inadequate teaching facilities and appropriate teaching methods[15,24]. From these reports, there is need to find out the reason for poor academic activities in secondary schools. The observations and reports from examining bodies revealed that a high percentage of students fail Biology examination. The failure is likely to be as a result of a lot of problems from inadequate facilities, old and dilapidated structures, inadequate or unavailability of instructional resources and unqualified teachers, thereby making the system ineffective[30]. Most studies that look into the teacher teaching method and state of instructional resources in schools, rarely attach poor achievement with lack of, or inadequacy of these materials. It is against this background that the researcher seeks to establish the influence of Instructional Resources, Teacher-related factors on Senior School Students' academic achievement in practical aspect of Biology in Oyo State, Nigeria.

1.3 Aim and Objectives of the Study

The main aim of the study was to investigate the influence of Instructional Resources, Teacher related factors and Senior School Students' academic achievement in practical aspect of Biology in Oyo State, Nigeria. The objectives are to:

i. identify the level of academic achievement in practical Biology among Senior Secondary School students in Oyo state
ii. examine the availability level of instructional resources for teaching practical in Oyo State Senior Secondary schools.
iii. examine the level of utilization of instructional resources for teaching practical in Oyo State Senior Secondary Schools.

iv. identify the status of teacher-related factors in Oyo State Senior Secondary Schools.

v. determine the joint contribution of instructional resources and teacher-related factors on students' academic achievement in Biology practical in Senior Secondary Schools in Oyo State.

vi. ascertain the relative influence of instructional resources and teacher - related factors on students' academic achievement in Biology practical in senior secondary schools in Oyo state.

1.4 Research Questions

The following research questions guided the study:

1. What is the level of academic achievement of Biology practical among senior secondary school students in Oyo state?
2. What is the availability level of instructional resources for teaching Biology practical in Oyo state Secondary Schools?
3. What is the level of utilization of instructional resources for teaching Biology in Oyo State Secondary Schools?
4. What is the status of teacher-related factors in Oyo state Senior Secondary Schools?

1.5 Hypotheses

The following null hypotheses guided the study and was tested at 0.05 level of significant.

$H_0$1: There will be no significant joint contribution of instructional resources and teacher-related factors on students' academic achievement in Biology practical in senior secondary schools in Oyo state.

$H_0$2: There will be no significant relative influence of instructional resources and teacher-related factors on students' academic achievement in Biology practical in senior secondary schools in Oyo state.

1.6 Significance of the Study

The findings from this study would be of immense benefits to the government, policy makers, principals, teachers, parents as well as student researchers. The findings would help the government and policy makers in formulating effective planning and implementation policies and programmes for improved school academic activities. It would also provide policy makers with intelligent forecast and analysis of future needs of the schools in the areas of building laboratories and facilities that would enhance practical related subjects.

The study would provide the school principals the opportunity to improve the teaching methods (demonstration, descriptive, lecture) and provision of adequate instructional resources so as to ensure both quality teaching and learning in the schools. It would enable them appreciate the contribution of instructional resources and teaching methods on students' academic achievement especially in Biology.

The findings would enable the teachers to appreciate the need for proper instructional delivery. It would help the teacher to improve both in teaching effectiveness and increased productivity in the schools. Teachers would learn the importance of hands-on activities and improvisation which would positively impact the students.

Students would not be left out of the benefits of this study, as they are the direct beneficiaries. The study was geared towards finding solutions to their poor academic achievements. As teachers improve in their teaching methods and hands-on activities, these will provide a conducive learning environment for the students and ultimately bring about an improved academic achievement

Finally, the study would be of benefit to the student researchers as it will provide a valid working document or literature in investigating other areas not covered by this study. Thus, it would serve as a point of reference to future researchers in the field.

1.7 Scope of the Study

The scope of the study is to examine the influence of instructional resources and teacher-related factors on Senior School Students' academic achievement in practical aspect of Biology in Oyo State, Nigeria. The objectives of the study are to identify the level of academic achievement in practical Biology among senior secondary school students in Oyo State; to examine both the availability and the utilization of instructional resources for teaching Biology practical and identify the status of teacher-related factors in Oyo State Senior Secondary Schools in Oyo State. The geographical area covered all the students in the 33 local government areas in Oyo State, Nigeria. The target population were the 81,083 Senior Secondary School 2 students and the sample size was 500 students. Four research questions were posed and two hypotheses guided the study. The Ex-post Facto Research Design and multiple regression analysis were employed.

1.8 Limitation of the Study

The rising fuel costs and scarcity posed major challenges in distributing the research instruments for this study. Additionally, some schools did not allow access to the respondents. Nevertheless, the findings of the study are deemed valid and reliable.

1.9 Operational Definition of Terms

For clarity and precision, the terms used in the study are explained as follows:

Academic Achievement: It refers to student scores in Biology practical administered to students of Secondary Schools in Oyo State in the course of the study.

Biology: This refers to the study of living things.

Biology Practical: This refers to the hands-on-activities during Biology class or lesson.

Instructional Resources: This refers to material resources such as physical facilities which include buildings, ground, school plants, electronic resources such as radio, tape recorder, projection and video tape recorder and Biology laboratory equipment such as microscopes and ecological materials.

Physical Facilities: This refers to the facilities that are available to facilitate students' outcome. It includes buildings, equipment such as basketball courts, school plant and workshop in Secondary Schools in Oyo State

Biology Laboratory: This can be in form of open space of study building boarded by walls and roofs

Electronic Facilities: These are any means of communication or teaching, using electronic gadgets such as tape recorder, radio, projector and video tape recorder

Teacher-Related Factors: These are factors that directly affect the teachers' performance in Secondary Schools in Oyo State.

Teaching Methods: This refers to the instructional strategies that are needed to facilitate teaching and learning such as Cooperative learning, Simulation and Guided Discovery methods.

Teacher Knowledge on Subject Matter: This refers to content knowledge of the discipline taught by the teacher.

Interpersonal Relationship: This refers to social association, connection, or affiliation between two or more persons.

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Chapter Two

Literature Review

The review of the related literature for this study was carried out under the following subheadings: conceptual review, theoretical review, review of empirical studies, conceptual framework and literature reviewed summary.

2.1 Conceptual Review

2.1.1 Concept of Instructional Resources

2.1.2 Types of Instructional Resources/Materials

2.1.3 Instructional Resources Used in Teaching Biology and Biology Practical

2.1.4 Sources and Production of Instructional Resources

2.1.5 The Rationale for the Production of Instructional Resources

2.1.6 Importance of Instructional Resources in Teaching and Learning

2.1.7 Characteristics of Instructional Resources

2.1.8 Intrinsic and Extrinsic Value of Instructional Resources

2.1.9 Qualities of Good Instructional Resources/Materials

2.1.10 Improvisation of Instructional Resources

2.1.11 Laboratory Facilities

2.1.12 Electronic Facilities

2.1.13 Physical Facilities

2.1 Conceptual Review

2.1.1 Concept of Instructional Resources

Instructional Resources have been identified as very important variables in the teaching and learning and that effective learning cannot take place without availability of basic relevant instructional resources. Instructional Resources are the teaching aids that

facilitate quick understand of the subject matter in the classroom[1]. Instructional Resources, including textbooks, educational media (library, media print, non-print, and electronic resources), computer software, videotapes, films, DVDs, and instructional television programs represent fundamental resources for schools for enhancing instruction, furthering the pursuit of knowledge, and providing experiences of educational significance for class groups or for individual students. It is the shared responsibility of the state and district to provide an adequate number and range of Instructional Resources and resources in a variety of formats that are appropriate, timely, and essential to the attainment of specified educational objectives. It is also the responsibility of state and district to provide Instructional Resources that are free of bias, stereotypes, distortions, and prejudices. The importance of Instructional Resources cannot be underestimated. Instructional Resources are a range of materials and equipment which make a visual impression on the students, assist the teacher in his task, helping him increase his effectiveness in the classroom. Instructional Resources communicate information effectively, promote the acquisition and longer retention of knowledge, when they are systematically designed, reproduced, used and evaluated. Lack of Instructional Resources to serve as teaching aids that facilitate quick understand of the subject matter in the classroom is a great impediment to conducive learning environment for STM Education[2]. He went further to put it that for effective STM learning relevant materials such as equipment in the laboratories, charts, diagrams, chemical, models, specimen, and for technology, technological device like computer, tape recorder and video cassette recorder must be made available in the classroom so as to assist students to have a design of what is taught in their mind.

Various studies have shown that a proper use of teaching materials will positively enhance the teaching and learning process in science [3]. It was observed that various

reasons have been deduced as major factors among which is lack of necessary teaching materials/aids in schools as responsible for the observed poor trend on students performances for the SSCE for the period 2010 – 2019[4]. Laboratory facilities and instructional performance materials to which students have been exposed have contributing factors to the student's academic achievement[5]. It was observed that poor laboratory facilities and lack of relevant textbooks are among factors that are responsible for low performance of students in physics, chemistry and Biology[6].

In addition, Instructional Resources have been defined as essential and significant tools needed for teaching and learning of school subjects to promote teachers' efficiency and improve students' performance[7]. Instructional Resources, however, do not achieve any of the attributed values on their own. Their usefulness depends on what the teacher makes out of them. This infers that intelligent handling of these materials in the classroom is necessary. For effective utilization of Instructional Resources, teachers must understand how to use and control Instructional Resources. It is mandatory for the classroom teacher that uses these devices to direct the attention of students to focus on the application of the Instructional Resources for lesson delivery. In the same vein, it was viewed that Instructional Resources as helping the teachers to communicate effectively with students in order to achieve the desired objectives where ordinary words or verbalization have been found to be inadequate for effective teaching[8]. Thus, it serves as a channel through which message, ideas and information are disseminated more easily. Education that hopes to promote the quality of students in schools with a global outlook must be enhanced with the aim of achieving pre-determined educational goals that characterize the 21st century. The Federal Republic of Nigeria in her National Policy of Education emphasized on making learning experiences more meaningful and realistic for children by advocating for the development and promotion of effective use of innovative

materials in schools[9]. This implies that government is also aware that Instructional Resources ensure better retention, stimulate and motivate students to learn. Thus, it encourages participation especially if students are allowed to manipulate materials used.

Instructional Resources are print and non-print items that are designed to impact information to students in the educational process[10]. Instructional Resources include items such as prints, textbooks, magazines, newspapers, slides, pictures, workbooks, electronic media, among others. Instructional Resources play a very important role in the teaching-learning process the availabilities of textbook, appropriate chalkboard, Mathematics kits, Science kit, teaching guide, science guide, audio-visual aids, overhead projector, among others are the important Instructional Resources. The first instructional material is the textbook[11]. Various definitions to textbook emphasize the role of textbook as tool for learning. Textbook is the nucleus to all the learning activities related to a particular curriculum. Textbook plays a vital role in imparting knowledge to the students in the third world countries.

Teaching at any level requires that students be exposed to some form of simulation. Instructional Resources as objects or devises that help the teacher to make learning meaningful to the learners. Instructional Resources, which are educational inputs, are of vital importance to the teaching of any subject in the school curriculum. These materials and resources include audio tapes recorders, video tape recorders, slide projectors, still pictures, programmed instructional film strips, maps, chart, graphs and many more; offer a variety of learning experience individually or in combination to meet different teaching and learning experiences. Teaching and learning materials are those that are accessed in the School environment, collected and brought[12]. Instructional Resources can be improvised[13]. Improvisation demands adventure, creativity, curiosity and perseverance on the part of teachers. Such skills are only realized through well-

planned training program on improvisation [14]. Instructional strategies need to be identified where the use of manipulative is often suggested as some of the effective approaches to improve student achievement[15].

The skill of producing local Instructional Resources is applicable to many different abilities across all academic and non–academic discipline. Teaching–learning may not easily be achieved through the mere use of verbal words. As such producing Instructional Resources becomes very necessary. The focus of teaching is on the natural reciprocating of comprehension and production in communication; on the functional and collaborative practice of language in flexible learning environment; and individual possession of skills. Students find it easy and joyful when learning with Instructional Resources as such, improvisation reveals that there are possibilities of alternatives to teaching and learning aids. It should therefore meet specific teaching and learning situation. Improvisation in Biology has become imperative in teaching and learning because the economic situation makes the cost of facilities and equipment very high amidst decreasing or near lack of purchasing power[16].

Therefore, the teacher education programme must integrate material development whereby teachers learn how to design and construct various materials and equipment which could be used for teaching-learning process [17]. Improvisations of Instructional Resources in Biology by teacher that are innovative in concepts encourage students and teachers to be more creative, innovative and original. It also develops skills in the cognitive, affective and psychomotor domains.

Studies have been conducted mainly focusing on pedagogical and curriculum trends. However, studies on the role of instructional resources in academic performance

for practical Biology are highly needed due to the importance discussed above and the challenges facing the Biology practical.

Moreover, some teachers lack essential skills to make quality teaching and learning aids. According to a National Audit report, some schools are completely lacking material resources such as textbooks, charts, maps, audio-visual and electronic instructional resources such as radio, tape recorder, television and video tape recorder. From these facts efforts to improve the quality of provision of education in our schools have appeared to slow down, as some of these challenges were not prioritized in the Educational law[18]. If the country aims at producing a competitive economy to meet global market demands, as stipulated in the vision of the Ministry of Education, Science and Technology, availability of quality and adequate instructional facilities in our secondary schools should be given a high priority. In this study strategy for making quality instructional resources available are suggested as an attempt to narrow efficiency gap in the provision of education in Oyo state[19].

Inadequacy of quality instructional resources is not confined to Oyo state, Nigeria, as this is a worldwide phenomenon. Even in developed countries for example, United States of America especially in schools whose majority of population are the poor and minority students are less funded and lack essential quality instructional resources. In addition, policies associated with school funding, resource allocations, and tracking leave minority students with fewer and lower-quality books, curriculum materials, laboratories, and computers[20].

It has been asserted that science education programmes cannot be taught effectively without the existence of equipment for teaching[21]. This is because instructional resources help those who learn to develop problem-solving skills and

scientific attitudes. Elaborating further on the same point, it was emphasized that when instructional resources are provided to meet relative needs of teaching process, students will have access to the reference materials mentioned by the teacher, and also each student will be able to learn at his or her own pace[22]. The overall result is that students will perform much better

The availability of instructional resources is important in achieving effectiveness in educational delivery and supervision in the school system. Instructional resources include both the printed and audio-visual materials and as well resource places and person. Printed instructional resources include, but not limited to textbooks, journal articles, instructor manuals and guides, student workbooks, assignments, and other reference materials. Audio-visual materials consist of electronic videos, audiotapes, slides, filmstrips, radio and/or television[23].

A study alerted on the gross inadequacy and under-utilization of instructional resources necessary to compensate for the inadequacies of sense organs and to reinforce the capacity of dominant organs[24]. It was noted that school teachers should try their possible best in the provision of locally made materials in substitution for the standard ones to promote their lessons. Basic materials such as textbooks, chalkboard and essential equipment like computer, projector, television and video are not readily available in many schools[25].

Today, many teachers under rate the use of instructional resources in most of their teaching exercises and some of these materials are not usually available for teachers' use. Most teachers cling to verbal instruction as the only way to impart knowledge. The researcher is of the view that something has to be done to change teachers' negative attitude towards the teaching of Biology. The researcher is also of the view that utilization

of instructional resources would make teaching and learning of Biology interesting and comparatively easy. This study is of the view that instructional resources for teaching Biology should be selected, supplied and be used effectively[22,26]. The realization of this objective depends on the utilization principles. These principles include; the learner's characteristics, behavioural objectives and instructional constraints[27]

Selection of materials can help in-depth understanding of lesson by the students in which they make the lesson attractive, thereby capturing their attention and motivating them to learn. Before, the instructional resources are maps, chart, and so on, which are used to enhance the teaching and learning of Biology practical, but presently there is technological advancement where film slide, iPad, laptop, projector, television and internet system are the instructional resources which helps in teaching and learning process.

2.1.2 Types of Instructional Resources

Instructional Resources can be classified in several ways. For instance, one can distinguish between auditory, visual and reading materials[28]. However, for the purpose of classification, learning materials for teaching Biology can be classified as follows:

i. Printed and reference materials: Textbooks, newspapers, magazines, government documents, teachers‟ guide, duplicated materials, journals, hand book, bulletins, pictures, work books, pamphlets, leaflets.
ii. Graphic materials: Graphs, charts, diagram, maps, globes.
iii. Display materials: Chalkboard, bulletin boards, flat pictures, magnet boards and flannel board.
iv. Projected materials: Television, video tape, overhead projector, slides and slide projector and transparencies.

v. Audio and other visual materials: Radio, model, computer, tape recording etc.

However, Biology teaching aids can be classified into two classes. They are:

a. Visual aids.

b. Audio-visual aids.

The visual aids are those teaching aids that can be clearly seen with our eyes vividly. Examples of visual aids are: chalkboard, Biology textbooks, charts, model. While audio-visual aids are those that we can hear and see, by producing sound that the sound are expressed in thought. They appeal to our senses of hearing and sight. Audio visual aids include: tape video, television, projectors and motion pictures.

Traditional Instructional Resources

In those days, the Instructional Resources are models, maps, charts and diagrams, which are used to enhance the teaching and learning but nowadays the Instructional Resources that enhance the teaching and learning of Biology are film slides, I pads, projector, television and internet system and so on.

Models

It is part of the duty of any teacher to make models, charts and diagrams. Among the most continuously useful visual aids for the teaching purposes are those the Biology teachers made for themselves. Moreover, the students should be encouraged to help, and to make such aids as a hobby especially in science club, handicraft group basket making, local cage making and so on[29].

Charts and Graphs

Chart and graph are useful for the immediate illustration of lessons and should be hung by the side of the chalkboard rather than over it for example when studying various concepts in Biology[30].

Maps, Atlases and Textbooks

Maps and atlases are important Instructional Resources for the teaching and learning of Biology. They are good companions when teaching such topics as Reproductive and transportation system.

Textbooks are the most common Instructional Resources that teachers use to disseminate knowledge. Textbooks had variety values, but are too costly for an average Nigerian student to afford. Some ways by which to ameliorate this problem is for a group of teachers to write jointly and for the school authority to ensure that copies of relevant textbooks are put into the school library to enable Biology students who cannot afford these textbooks to get assess to read them[31].

Use of Journals, Magazines and Handbooks

These are printed materials that can be effectively be used to aid Biology teaching. Biology teachers can use them to:

a. Obtain information which cannot be readily obtained from textbooks.
b. Help to bring the teacher up to date in his/her field. When the above are achieved by the Biology teacher, he/she will be able to disseminate the instruction or knowledge gained to the students. This aid effective teaching and learning in Biology[32].

Modern Instructional Resources

Technological advancement came with film slide, Ipad, laptop, projector, television and internet systems are the instructional material which helps in teaching and learning process.

Computer (iPad and Laptop)

Computer has been defined as a calculator, machine, apparatus, mechanical, electrical or electronic equipment for carrying out especially complex calculations, dealing with numerical data or stored items of other information[33]. A computer refers to a device which automatically performs operations, sorts files, edits, thus making it possible to process information with great speed, accuracy and reliability. It combines the efforts of the hardware, software and personnel to operate. Computers are machines that capture data at source, record the data, prepare data, inform acceptable to the machine, perform processing requirements and communicate the results of the processing when so required[34].

The fifth-generation computers are seen as having "artificial intelligence" and "thinking ability" as a result of its complexities and diversities. Computer is very useful because of its numerous applications in our personal and educational life. It is quite evident that the modern man is machine dependent [35]. This is because everywhere, computer has made out lives easier and much more comfortable. Projection screens enhance demonstration and allow for shared screen work; local network servers facilities paper transfer of files; access to internet can turn each seat into library; and online conferencing can stimulate active, written participation by every student. Computer also can help students visualize objects that are difficult or impossible to view e.g. shift in demand and supply[36]. Computer programmes are interactive and illustrate a concept

through attractive animation, sound and demonstration. They allow students to progress at their own pace and work individually or problem solved in a group. Computer provide immediate feedback, letting students know whether their answer is correct, if the answer is wrong the programme shows students how to correctly answer the question, computers offer a different type of activity and a change of pace from teacher-led or group instruction.

Internet

Information and communication technology has been changing so dramatically in speed and performance that practitioners have rightly referred to the phenomena as a revolution[37]. One of the most spectacular manifestations of this revolution is the internet. The internet is the international network of computers. It is the global information pool as it links hundreds of nations, thousands of companies and over fifty million of computers, (Lecture handout). In many parts of the world, the internet is an indispensable tool for business, education, research, commerce, communication and technological development.

The internet often called the NET, has been variously described as the world's largest computer network, conglomeration of thousands of computer networks, the information super-highway and cyber space[38]. Physically, internet is a lot of computers and other communication devices and carriers. The internet exchanges, digitized data.

Information is transmitted on the internet when a message is sent over the internet, Transmission Control Protocol (TCP) breaks the message down into more manageable smaller units called "packets" and attaches to each packet contains information which will enable it re-assemble and even check for errors at the receiving end[39]. The Internet Protocol (IP) labels the various packets with information containing address as of their various destinations and puts the packets on the information highway. Each packet travels

independently over the internet and may take a different part to arrive at its destination. Some of the remarkable features of internet include:

i. Real time information retrieval and transfer by transferring and retrieving in time of communication for such purposes,
ii. Global Access – it can be accessed from anywhere in the world as long as connection to a local provider can be made
iii. The internet presents information in a user-friendly mode by providing a very enabling environment for information dissemination.
iv. Dynamic – Internet content is consistently updated to provide users with current state of the art, technologies and information[40].

Within the past decade, ICT tools have fundamentally changed the way people communicate and do business. They have potential to transform the nature of education – where and how learning takes place and the roles of students and teachers in the learning process. Teacher education institutions should assume a leading role in the transformation of education or be left behind in the swirl of rapid technological change. For Biology education programme to keep the full benefits of ICTs in learning, it is essential that basic ICT tools, skills and competencies are put in place for effective learning of social studies concepts[41].

2.1.3 Instructional Resources Used in Teaching Biology

The need for adequate facilities and materials in Gombe State schools for effective teaching and learning cannot be overemphasized. Teachers could be available, but without enough facilities and materials, the effort would be useless. Instructional Resources have borne several nomenclatures from the colonial concepts of apparatus to teaching aids, teaching aid to educational media, educational media to instructional

technology, instructional technology to curriculum materials, and curriculum materials to its modern nomenclature-Instructional Resources. Each of these conceptional stages depicts the scope of its usage and application in the classroom. But the general acceptable nomenclature by professionals of education is the term "Instructional Resources"[42].

Instruction materials are indispensable in the teaching and learning process at all levels of educational system. They are referred to as a veritable channel through which instructions can be impacted in the classroom. Instructional Resources are identified to include audio-visual material of various types, pictures, or charts, books, radio, television, type writing machine, computer, chalkboard, and projectors[43]. Instructional material is that branch of pedagogy which treats the production, selection and utilization of Instructional Resources that do not depend solely on printed words but instructional technologies employing both materials and devices used in learning situation to supplement the written or spoken word with transmission of knowledge, attitude, and ideas[44]. Instructional Resources have been seen as materials that facilitate teaching and learning activities and consequently the attainment of lesson objective[45]. Hence one can rightly say that Instructional Resources are those items which the teacher uses in teaching in order to make his teaching and illustrations real and meaningful. In fact, anything a teacher uses to achieve instructional objectives. As tedious as teaching secondary school pupils is, one must have to admit that its effectiveness compulsorily requires the use of Instructional Resources. This is because these materials help to bring about variety which arouses and maintains the interest of the pupils/ learners.

Instructional Resources can also be seen as instructional media. This simply refers to some of the devices which both teachers and learners can use to enhance the quality of instruction. It also refers to all those materials that the teacher needs to incorporate in the

teaching- learning experience[46]. These materials include all forms of information carriers that can be used to promote and encourage effective teaching- learning exercise.

An effective and efficient teacher always strives as much as possible to understand his/ her learners, the subject, all the tested approaches, methods, techniques and materials before making choice of any Instructional Resources. These factors enable him/ her to interact, facilitate and consolidate the teaching procedures. In support of the above idea, it was affirmed that both instructional aim and approaches occupy the highest level of idealization as they cover a long term of attainment and implementation respectively[47]. This implies that a teacher must first of all understand the broad and specific objectives of his teaching, what to be taught (subject), component of curriculum, approaches and methods, Instructional Resources to be used in his teaching because these factors form the basis with which to accomplish the predetermined goals of primary education

Instructional Resources can be referred to as those materials that appeal to the senses. These senses are sight, smell, taste, touch and hearing. During instructional process, pupils employ one or more of these senses while learning. Also, some learn better by seeing, touching, tasting and others by hearing and smelling. These include visual aids, audio- visual aids, and audio aids[48]. The relevance of Instructional Resources in realizing the objective of secondary schools cannot be overemphasized. Their management for instructional purposes depends on what the teacher or instructor makes of them. This implies that Instructional Resources do not achieve any of the attribute values on their own; rather their usefulness depends on what the teacher makes of them[49]. For example, if a social studies teacher does not have the knowledge and manipulative skills of using any of the materials relating to the subject, the learner (pupil) will definitely find it difficult to understand the concept from him.

The neglect over the use of Instructional Resources in secondary schools for effective implementation of Biology programme is highly grievous because the approach used for conveying what is taught to the pupils also matters. In secondary schools, the strategy and Instructional Resources used for teaching are extremely important. It was asserted that learners comprehend and retain more of what they are taught when adequate and appropriate Instructional Resources are employed[50]. Learners are said to remember ninety nine percent (99%) of what they hear[51]. There is a saying that, "The more a child has seen and heard, the more he wants to see and hear". Experience beget experience, intelligence is not only something one is born with, it is also learned. Most pupils and teachers may not travel to some other parts of the world throughout their life time but they can learn about them through films, pictures, maps. Thus, through the skilful learning process, one can bring the whole world into the classroom thereby making abstract thing to come into reality.

If these assertions are correct and if Instructional Resources play an important role in making teaching and learning effective in secondary schools, then it is inevitable for teaching since that level of education covers the wide range of people who are more delicate and complex to handle, when compared with the tertiary levels of education. Instructional Resources deny itself one specific classification. The list of the materials is inexhaustible, its limit is the teacher's level of resourcefulness, creativity and imagination. Instructional Resources have been classified in different categories by different scholars.

Instructional Resources have been classified as, audio-media, visual media and audio- visual media[52]. He defined audio media as teaching and learning devices that mostly appeal to the sense of hearing. Examples are public address system, tape recorder, taking drum. According to him, visual media are teaching and learning devices that mostly appeal to the sense of seeing only, which can be further divided into projected and

non-projected visuals, examples are films slides (projected) and postures, regalia, globes and pictures (non-projected). He referred to those Instructional Resources which provide the learners with the opportunity of seeing and equally learning at same time as audio-visual. Examples are educational television, videos and film.

An elaborate classification and description of Instructional Resources was done. The classification of Instructional Resources was into six groups, viz:

- Visual materials – these are materials which appeal to the sense of seeing only, examples are pictures, diagrams, flannel boards, chalkboard, building, graphs, charts made by teacher himself.
- Audio- materials – these refer to those materials that appeal to the sense of hearing, examples are tape recorders, cassette cartridges, radio, dices, language labs, and such like.
- Audio-visual materials – these are those materials that appeal to the sense of hearing and seeing. These produce both sound and visuals. Examples, television, motion pictures with sound, slide and film strip projectors with sound accompaniment.
- Software- these include graphic materials, printed materials, slides, films and strips, overhead transparencies, cassette tape.
- Hard wares- These are the devices used in presenting materials. For example, board, chalkboard, tape recorders, projectors, and video recorders. While video tape is a material the video recorder is the equipment.
- Projected materials: include those materials, which require projections viewing. There are two types' transparent and non-transparent (opaque) projections.

Examples of non-projected materials are books, models, mock-ups graphic materials, bulletins chalkboards, simulation[53].

Instructional Resources were equally classified into groups, human and material resources[54]. Human resources consist of the teacher/resource persons, the learners and the entire tutorial and non-tutorial (supporting) staff. The material resources are grouped into tangible resources and intangible resources. The tangible resources are classified into three main groups: visual, rural and audio-visual aids. There are six types of visual aids, namely:

- Projected aids
- On-projected aids –chalkboard, bullets board and flannel board
- Pictorial Instructional Resources such as wall charts, still pictures, (photographs), graphs, maps, posters and manuals.
- Three dimensional aids-these, include regalia (real objects) models and specimen.
- Mobiles-laboratory equipment, apparatus and chemicals.
- Books.

Instructional Resources were seen by a scholar as educational media[55]. He divided them into two broad categories; printed and non-printed media[56]. The printed media include all educational information carriers printed on paper such as textbooks, reference books, workbooks, handouts, journals, among others, while the second group is the non-printed media. This group is further sub-divided into low-cost media and electronic media. The low-cost media include wall charts, slip charts, models, diagrams posters, pictures, sketches and graphic.

Electronic media; according to the scholar was further divided into software and hardware materials[57]. Software's include computer programmes, 16mm and 8mm films,

slides, microfilms and transparencies, video films, audio cassettes. The hardware materials include overhead projectors, opaque projector, slide projectors, camera, computer sets, radio, cassettes recorders, microfilm recorder, television set, transparency maker and radio cassettes[58].

Instructional Resources can be referred to as teaching aids. Teaching aids was defined as the totality of material and real-life objects employed in the instructional process[59]. It was maintained that Instructional Resources usually exist in form of real-life objects, improvise or look alike materials. They were grouped into three main types, these are:

- Visual aids; examples, charts, maps, pictures, objects and other improvised materials.
- Audio aids; these stimulates the sense of hearing only in learning. Example are; radios and cassette radios.
- Audio-visual aids[60]. They produce sound and motion effects. Example, television videos, overhead projectors, computers and among others. The effectiveness of any of these Instructional Resources depends on numbers of factors. These factors include: Relevance to the topic, appropriateness of introduction and timing.

Similarly, the selection and use of a particulars instructional material by a teacher depends on a number of factors which was highlighted to include; relevance to the objective of the lessons, availability, quality, cost, simplicity of use and learners' characteristics such as age, interest, aptitude and development level[61].

So far, one can see that Instructional Resources have undergone several conceptional definitions and classifications from various intellectuals. Its application and utilization by the teacher during instructional process enhance teaching and learning process and equally makes teaching and learning exercise to be more meaningful, enjoyable both to

the teacher and the learner. Therefore, its usefulness to the teacher and the learner depends on how relevant he/she finds them towards the attainment of pre-determined instructional objectives.

2.1.4 Sources and Production of Instructional Resources

Instructional material production is the most and compulsory task teachers, teaching-practice teachers and instructors undertake during the study of education technology. This activity provides the student-teachers as well as the instructors an opportunity to test out their ideas, and suggestions presented in different text-books and equally apply what they are learning to a concrete instructional problem.

In third world countries such as Nigeria, production of Instructional Resources is found to be a very stressful, frustrating and arduous task. Instructional material producers encounter numerous problems in the course of producing it. Some of these problems are identified as; high cost of procuring needed materials for use in production, low production skills possessed by teachers, problem of storage and maintenance, low capacity of the already existing ones. There are several stages that are involved in the production of Instructional Resources. Four basic stages were identified in Instructional Resources production, these include; choice stage, statement of objectives stage, prototype and final production stage[62].

In line with this, a scholar stated six guidelines for the production of educational media as; selection of specific instructional objectives, identification of the characteristics of the learners, selection of the content of the information which the media will convey, selection of medial for the presentation of the information, estimation of the cost or financial implications, and taking account of essential rules[63]. Production of Instructional Resources by teachers requires a lot of skills that will enhance and equally guide them in

the production. Considering these skills, it involves; lettering skills, illustrating skills, manipulating skills and mounting and /or photography skills if it were still and motion aids. This disposition maintained equally that producers of instructional material have to access the quality of their products before choosing and utilizing it in the instructional producers. In this, it was remarked that it is very important that teachers know the characteristics of a good quality Instructional Resources before choosing them for use in teaching[64]. Just because the Instructional Resources are there commercially, produced in neat and nice package or because they are recommended for instruction may not necessarily mean that they are good or that their use would enable the learner attain the objective of interaction.

It was opined that Instructional Resources produced for teaching and learning process may be said to be ideal or good if it meets the following conditions:

- Cognitive content coverage and structure
- Languages of Instructional Resources are clearly understood void of colloquial vocabulary jargons.
- Visuals content materials are often interspersed with illustrations
- Include reviews, drills, activities and assignments.
- There is inter-diplomacy approach in coverage of content
- A good instructional material should be one relevant to the content of the subject, curriculum, and its objectives.
- The last but not the least is readability. That is, its content must be readily readable and understandable at the level of the learner for whom the material (especially books) is meant for. Consequently, good Instructional Resources

should be appropriate, free of bias, up-to-date, easily obtainable and should not be too expensive[65].

The guidelines for quality assessment of instructional material include; ensure that the product is appropriate to the age of the learner and that it is simple in presenting just the essential details, ensure that it is clear in illustrations, ensure that the size is adequate, ensure that the materials are durable, readily improvisation, which is often by teacher and occasionally the learners, by publishers and instructional material development centers/industries such as National Education Technology Centers (NETC) and the Science Material Development Centers (SMDC) located in Enugu, Awka, Akure, Lagos[66].

The improvisation of Instructional Resources is generally recognized as important skill which every secondary school teacher in Nigeria and indeed in other developing countries must acquire if they are to function effectively in classroom. This is because schools in the developing countries are generally poorly equipped in terms of availability and adequacy of teaching-learning materials, especially pupils' textbooks, audio-materials, audio-visual and visual materials. A recent nation-wide survey on "condition of teaching the four core subjects" conducted by the National Teachers Institutes (NTI) Kaduna in April 2006, revealed that most secondary schools lack Instructional Resources such as textbooks, maps, charts, computers, and laboratory equipment. Also, the majority of teachers have failed to demonstrate the requisite skills for improvisation and use of Instructional Resources.

Improvisation of teaching aids by teachers to make the aids available in the school is imperative[67]. The Federal Republic of Nigeria (2004:78) in its National Policy on Education stated that 'teachers will be required to participate more in the production and assessment of education materials which the teacher will use in the classroom situation".

The essence of producing Instructional Resources is to facilitate the teaching process and if science as well as art subjects can be learned properly, it must be experienced. Hence improvisation of some, if not all the materials from locally available materials will, to a greater extent help to provide enough learning materials. Nevertheless, it has been discovered that the difficulties encountered by secondary school teachers in purchasing and improvising Instructional Resources have called insignificant changes in the behaviour and attitude of these teachers towards this vitals practice.

The problems of effective utilization of Instructional Resources in our present educational system were stressed in that untrained teachers are employed to teach in our secondary schools, colleges and of course tertiary institution[68]. As a result of insufficient training, many teachers do not recognize the potentials of many simple teaching materials available at a very little cost talk-less of how to use them. In addition to this, a scholar stated that lack of knowledge and technique in the production of instructional aids; and the type of teaching method adopted by teachers in secondary schools during classroom teaching are the major problems that hinder the production of teaching materials in school[69]. The ugly situation of unavailability of Instructional Resources in primary and secondary schools was as a result of lack of fund and shortage of experts[70].

It was equally observed that the inadequacy of funding science teaching is acute, especially this time that the country is struggling to get out of the quagmire of economic recession[71]. The cost of science equipment and other teaching materials are very high. Nigeria is a seemingly poor country and many primary and secondary schools are without laboratories. Hence, for science teachers as well as art teachers to use their meagre salary in buying science and teaching materials is quite impossible.

In view of this, a scholar noted that improvisation when applied to science teaching is often used synonymously with local production of science equipment[72]. It was opined that both concepts have to do with provision of relatively cheaper alternatives to imported science equipment. This was in line by other view that improvisation as the act of using materials or equipment obtainable from local environment or designs by either the teacher or with the help of local personnel to enhance instruction[73]. Instructional Resources, whether improvised locally or foreign have one common usefulness of concretizing the teaching and learning experiences.

However, teachers ought to know the procedures for designing alternative Instructional Resources with which they can help their learners to visualize whatever topic they want to teach. Again, if Instructional Resources are to be improvised, emphasis should be laid on using cheap and locally available materials. A classroom teacher must to conversant with types, characteristics, and advantages of Instructional Resources before he could improvise. Some science equipment that could be improvised are transparent plastic cups as beakers and conical flask, empty milk-cans to serve as germinated seed can, plastic jerry cans and pots for stacking solution in place of reagent bottles.

At times most school's heads (administrators) and classroom teachers pose ignorance of some possible sources of Instructional Resources and even their existence. As a result of this, the National Teachers Institute (NTI) in her manual for retaining secondary school teachers discussed a detailed source of Instructional Resources for effective secondary school teaching. These sources of Instructional Resources include; collection of items from the immediate locality of schools, production process by teachers and learners. Distribution of Instructional Resources to schools by government and non-government organization (NGOs), such as United National Development Programme (UNDP), United

Nations International Children's Education Fund (UNICEF), Donations from several sources such as philanthropists and public sprinted people within the school community, town unions, old pupils Association, Parent Teachers Associations, Board of Governors and other similar bodies; distribution of productions by students in tertiary institution and creation of resource center. A resource centre is a place where varieties of teaching-learning materials exist for use by teachers, learners, and other interested persons within a school or an area. Resource center can be created by institutions, a local or state government, and an individual or non-government organization.

The modern society is in a continuous flux which led to changes in our educational systems. Hence the need for inculcating Instructional Resources into teaching learning process in order to enhance learning both in primary and secondary schools. It was maintained that the need for innovative materials in schools was due to great quest for education to meet up with the changes in the society[74]. Notwithstanding, some teachers instead of understanding Instructional Resources as tools for making teaching and learning process more effective, easier and enjoyable, see Instructional Resources as instrument for decoration and not as tools to be used in teaching or that they are only meant for teaching practice student teachers of various categories.

2.1.5 The Rationale for Production of Instructional Resources

Most people seem not to be convinced on the need for production of Instructional Resources for teaching and learning purposes in secondary schools. The principles (rationale) behind the production and use of Instructional Resources for teaching and learning activities in secondary school is derived from effective planning and scientific method which emphasizes on clear identification of problems and proffers solutions towards the achievement of the objectives.

Other rationales are drawn from the numerous psychological, philosophical and educational theories propounded over the years. Some of the theories in psychology that has been of relevance to the application of Instructional Resources in teaching and learning were highlighted by a scholar[75]. They include, the behaviorist psychologist associated with skinner and their stimulus-response associations, the humanistic psychologists associated with Carl Rogers and Jane Abercrombie, the ideas of John Comenius who popularized the use of Jacque Rousseau, Heinrich Pestalozzi and John Dewey.

Some of the rationales/ principles drawn from the above theories as regard to Instructional Resources production in schools for teaching and learning activities include:

- Principle of statement of objective specifying clearly enough what the learners are intended to learn which must take into account their peculiarities.
- Principles of feedback: This implies that immediate feedback has to be given to the learner after being assessed, to enable him know his areas of weakness and strength.
- Principle of utility: The principle of utility emphasizes the need to make learning content relevant and meaningful to a learner to arouse his interest.
- Principle of transfer of learner: This stresses the need to relate learning experiences with the real-life situation, to facilitate the use of the knowledge gained in school or outside the school.
- Principle of repetition: This principle emphasizes that the more and individual practices an act, the more he improves his performances. Constant learning facilitates mastery and retention of what has been learnt.
- Principle of reinforcement: A behaviour that is reinforced has an increased likelihood of occurring again.

- Principle of individual differences: This implies that no two individuals are the same, and learning is improved when these differences are recognized during teaching and learning process among the pupils.
- Principle of sequence: It is recognized that learning is facilitated when learning experiences are presented following certain order, depending on the learner and what is being taught. This can be from simple to complex, known to unknown, chronological, amongst others.
- Principle of learner involvement: learning is facilitated when the learner participated actively in the learning experience than being a mere observes[76].

In addition to this, Instructional Resources production is necessary because these materials are lacking in our primary schools. The basic facilities in the primary schools are far from adequacy[77]. It was observed that the situation in the primary schools is equally dismal[78]. The national report of Federal Government of Nigeria/United Nations International Children's Fund (UNICEF) research on situation and policy analysis of Basic Education in Nigeria show that there is severe shortage of teaching and learning materials as indicated by teachers, parents, and community leaders surveyed[79]. Observation data indicates that 52% of the teachers use less than 25% of locally made Instructional Resources. While 31% of teachers, observed use no Instructional Resources for their lesson.

There are often good reasons for engaging in the instructional material production. Such activities frequently resolved in the production of Instructional Resources (media) resources that would otherwise be unavailable to the teacher and her pupil. Also properly conducted instructional material production provides realistic problem –solving activities that simulates the learner and add meaning to studies. Another important reason for instructional material production is that these materials developed by teachers and pupils

in their own classroom are often more suitable than commercial materials for meeting up individual needs. Again, locally produced activities permit pupils to gain experiences in thinking and communicating through essentially non-verbal means and this surely improve their literacy. Instructional Resources generally make teaching and learning process easier and effective, the effectiveness of models of instructional process in education.

2.1.6 The Importance of Instructional Resources in Teaching and Learning Process

The role of Instructional Resources in teaching and learning process cannot be over emphasized. One of the principles teachers have to continually bear in mind is that man learns through his senses. Some learn better by one or more senses, to some seeing is believing, to others, the sense of hearing, touch, smell and taste dominate in acquiring knowledge. Hence for the intended learning to take place, the teacher must communicate effectively with the learner. Instructional Resources such as television, motion pictures, carefully prepare tape sequence, helps the teachers in extending his learners' horizon of experience. They also help the teacher in providing meaningful information to the learner. When learners make use of resources in the school library, education technology center, laboratories and in their community environment, they get meaningful information that will help them solve their problems. Their interaction with primary visual sources (regalia or real objects) will also provide them with useful information.

In order to achieve effectiveness and efficiency during instructional process between the teacher and the pupils, the classroom teacher must try as much as possible to illustrate the subject matter with appropriate Instructional Resources to the learner. This is done by using real things to represent real life situation. In view of this, common sense

taught us that in the present phase of development the child will be faced with insurmountable difficulties if left learn unaided[80]. Besides, there is much to learn in so little time that utmost economy should be practiced in effect the learning. Instructional material stimulates learners' interest. It is to be noted that when the child's interest is stimulated, the teacher has to sustain such interest. The teacher needs to seek better, more lifelong realistic functional and significant problem-solving activities for learners to sustain their aroused zeal and interest. For instance, when a classroom teacher takes her pupil out for field work, their interest will likely be stimulated. Instructional Resources are used as checks to the teacher's knowledge and means of transmission.

Instructional Resources help both the teacher and the learner to overcome physical limitation during the presentation of subject matter. For example, the use of films, television, slide, tape and programs in presenting information help greatly in overcoming physical difficulties. Instructional Resources assist a teacher to transmit to a learner the facts, skills, attitude and knowledge that aid the understanding and appreciation of concepts[81]. Instructional material serves as diagnostic and remedial tools for the teacher. When instruction becomes individualized and practical, teachers are placed in a better position to observe, analyze learning process and learning outcome. Hence, he discovers that every learner needs one assistance or another, the teacher's role will shift from presentation role to that of diagnostics, corrected and their strong points enhanced and sustained.

Globally, effort is being made in the field of academic towards making teaching – learning process more effective and permanent in the minds of learners though the use of Instructional Resources. This was affirmed that the use of aids in teaching and learning are germane to good teaching[82]. Individual difference exists amongst learners of varying categories. Every learner is disabled in one way or the other. Some do not hear clearly;

some do not see very well while some are too slow in understanding. Hence the use of Instructional Resources helps him in discovering some or all the above in his learners and equally knows how to manage the materials to make learning process to be more effective and interesting.

Instructional Resources like audio-visual materials (television, video, slides films and film strips, multimedia) heighten motivation for learning through its concreteness and interest, provides freshness and variety in teaching learning process. This is because these appeal to the students or pupils at variety of abilities. A systematic use of audio-visual materials can make the subject matter clearer and appealing to the pupils of diversified background and different abilities. Thus, audio-visuals materials can foster effective learning not only for the child who reads and writes easily but also for the pupil who is not verbally gifted. Audio-visual materials encourage active participation, give needed reinforcement, widen the range of pupil's experiences, ensure order and continuity of thought and also improve the effectiveness of other materials.

Visual materials like, diagram, charts, regalia, photographs, slides, amongst others present more realistic approach in education and equally provide opportunity for class participation in groups or individually and when used, many senses are appealed to which will result to increase in the learner's performance. Some of these Instructional Resources are very good for the preservation of records and other documents. They enrich learning and make it more pleasurable.

The use of Instructional Resources is an eye opener to the teacher and promotes their better planning and scheduling. It gives the teacher enough guidance, co-ordination, supervision and more time for correction. The inherent advantages of improvisation and use of Instructional Resources were discussed [83]. Thus, it makes lessons real, useful for

the ever-teeming population of pupils/students in our schools. He stated that when materials used are easily available within the environment, the teacher plans, uses and evaluates the materials and such materials can easily be improved upon and can be used efficiently and effectively since they are designed to meet specific instructional objectives.

Instructional material brightens the classroom and brings variety in the class lesson. They aid the slow learner to brighten up and bright students/pupils learn faster. They are very effective in establishing sense or spirit to team work among learners, especially the use of computer during instructional process. It was noted that with the computer, relevant aspects of the target communicative situation can be modelled and the pupils can take in that which they are likely to meet latter[84]. He equally recognized that adding a computer to arts, science, and language instruction introduces variety to the resources and learning styles used. Learning becomes fun and the learners can be divided into small groups or pairs to work on the projects either collaboratively or competitively. Instructional Resources spur learners to learn and develop better and effective skills. The last but not the least, Instructional Resources help to promote the understanding of teaching and learning process, among others.

The use of Instructional Resources provides the physical media through which the intents and contents of the Educational Curriculum are experienced. Instructional Resources are collections of materials and equipment that process instruction and training; such materials and equipment may be derived from the objectives of teaching and learning. They assist in putting across information and enable both teaching and learning to be effectively done [85].

Instructional Resources are used to aid the transference of information from one person to another[86]. In other words, Instructional Resources promote efficiency of

education by improving the quality of teaching and learning. It offers a variety of learning experiences individually or in combination to meet different teaching and learning experiences as well as encourage learners to become skilled technicians with an endless passion for learning. Also, the importance of using Instructional Resources in the classroom was summarized to include:

a. Making the subject matter more real.
b. Explicating difficult concepts.
c. Making the learner experience what is being learnt.
d. Helping to fire the imagination of the learners.
e. Preventing misconceptions.
f. Making learning interesting amongst others.

The importance of Instructional Resources towards achieving quality education in cannot be overemphasized. When Instructional Resources are properly selected and used;

1. help to consolidate learning in the learners' mind and help him to recall things that would have been easily forgotten,
2. they are crucial in improving the overall quality of learning experiences of students,
3. makes learners employ most of their senses so as to make learning easier and a worthy experience,
4. aids the teacher in his teaching and the learner in his learning [87].

Other reasons why Instructional Resources are important in learning include;

1. extending the range of experience available to learners,
2. providing the teacher with interest compelling spring boards into a wide variety of learning activities,

3. assisting the teacher in overcoming physical difficulties of presenting subject matter,
4. helping to stimulate students interest,
5. extend attention span and make for longer retention of what is learned,
6. making it possible to cater for individual differences of learners,
7. making teaching and learning easier and more effective as well as facilitating communication[88]

It should be noted that the extent and depth of research carried out on any specific Instructional Resources depend on the amount of importance attached to it. Blending of different Instructional Resources enables the teacher transmit and the learner assimilate effectively as a result of growth in technology and knowledge explosion contended that to make learning meaningful, a professional teacher should "guide and direct learning activities based on his knowledge of how best the students may best achieve the goals expected by society selecting those activities and teaching materials best suited to the specific purpose to each day's work". They further viewed that teachers are concerned about the availability of appropriate Instructional Resources because they know how much tools influence teaching and quality of learning in the class room.

Also, it was noted that a teacher can use teaching aids in various ways to make his instructional effort more effective and thus more productive in terms of student learning and growth. He can for instance use them to arrest and sustain attention, to help him present facts and information, teach concept and principles, guide thinking and induce transfer of learning. In addition, the mental images which are created by pictorial stimuli and models are easy to recall because of the intense interest at the time of perception and thus asserted that "every teacher is to enrich and to vividly use the curriculum". He is

constantly aware of the importance of new innovation such as chats or films that can be use simultaneously by the whole class.

2.1.7 Characteristics of Instructional Resources

Learning materials was seen as essential part of practical teachings as such, in classrooms, pictures, charts and drawings should also be clear and neat[89]. Also, it is not good for a teacher to plan a lesson without some ideas of how he/she will stimulate or motivate his/her students by using pictorials illustrations (pictures, diagrams, charts and models) or materials illustrations. Graphic materials to be used in classroom should be simple, attractive, large enough and not to be crowded with illustrations and colours. Good Instructional Resources must have the following characteristics:

a. appeal to the sense (sound and sight);
b. attracts and hold attention; and
c. focus attention on essential elements to be learned at the proper time.

In order to achieve the above objectives, any materials to be used as Instructional Resources must satisfy the following characteristics;

Flexibility: In the college or university, the teacher has been taught different ways of teaching hence, while in the classroom a good Biology teacher will attempt to teach his/her lesson using a variety of methods and materials. He/she should therefore, select or construct Instructional Resources that can be instantly modified to suit change in the approaches to construction.

Colour: Since pupils are attracted by bright colours, these should be used in the preparation of teaching also much brightness should be avoided since it may distract students' attention from the objectives of the lesson and the Instructional Resources.

Simplicity: Instructional Resources must be simple and present only a far ideas at a time. This is because students cannot comprehend complex ideas presented to them at a short-time. If pictures are used, they should illustrate only a very far words or actions. If more detailed pictures are used, students will not know that they are to notice from the picture displayed.

Visibility: All the smallest detail to be used in Instructional Resources should be large enough to be seen by every student in the class. So, such should be placed conspicuously in front of the class to present a clear view to every student.

It was added that the characteristics of good teaching aids can be seen under the followings:

a. Sufficiency: Teaching aids must be sufficient enough for use;
b. Writing and Lettering: The lettering or writing must be bold, clear, neat and readable;
c. Attraction: That the aids must be neat and attractive to arouse the interest of students. All the lettering must be bold and attractive;
d. Purpose: The information in the aids must help students in learning and must be relevant to the lesson;
e. Accuracy: They must be accurate in content and language. There should be no mistakes of facts or spelling that is, misinformation; and Clarity: All details in the aids for instance, drawings, pictures and so on, should be easily seen by students far away from it. Aids such as radio, tape and television should be clear enough to be heard by all students[90].

2.1.8 Intrinsic and Extrinsic Value of Instructional Resources

The emphasis placed on the importance and need of Instructional Resources in teaching and learning of Biology by educators, psychologists and field teachers has been established by researchers. It has been proved that Instructional Resources can be used effectively not only to increase pupils performance in Biology and other subjects areas but also in informal and non-formal education such as in health education for masses, open education, agricultural instructions to farmers, public enlightenment, industrial and military training to mention but a few. The audio-visual materials under investigation are motion pictures, filmstrips, slide and transparencies, pictorials, recording and radio, and three-dimension materials. Studies concerning interaction between learners and materials are reviewed. It is pointed out that some researchers suspect that learners' characteristics are related to the effect of the materials themselves or the manner in which audio-visual materials are used[91].

Many researches had been conducted on instructional television programmed and films. The finding emphasized the value of these materials and equipment towards pupils performance. Also, researches that have been conducted into the mechanism of learning have revealed that any instructional process which evolves the involvement of as many of human sensory organs tends to quicken and facilitates processes of learning. Audio-visual materials are highly effective ways of presenting stimulus situation to the learner. He maintained that this approach provides the external prompting needed to learn and, in some instances, they are effective in communicating to the learner the kind of terminal performance expected from him. Gagne argued that, the oral communication thus provided is capable of directing the students' activities, describing the performance to be learned, guiding thinking process and providing feedback with such a combination of talents. Therefore, the audio-visual aids are effective instruments for teaching-learning of Biology.

2.1.9 Qualities of Good Instructional Resources/Materials

Instructional Resources though very important but does not substitute the role of the teacher. It rather supplements the efforts of the teacher in an attempt to achieve the instructional objectives. The type of Instructional Resources used by a teacher depends on the topic objectives, age and cognitive readiness of the learner. Instructional material must possess the following qualities or characteristics:

- A good instructional material should be adequate for the age of the learner.
- It must be absolutely relevant to the objectives of the lesson.
- It should be clear in illustration for student's understanding.
- It should be simple not be congested with irrelevant details that can obscure major element of interest.
- It must be adequate in size not too small nor too large.
- It should be improvisable.
- It should be affordable.
- It must tend towards durability.
- It must be reliable and valid.
- It must be amendable to the process of evaluation.

2.1.10 Improvisation of Instructional Resources

Improvisation is the act of making something by using whatever one can find because there is lack of equipment or material that is needed for a particular purpose. Improvisation of Instructional Resources is needed for a particular purpose. Improvisation of Instructional Resources is concerned with alternative source of supplementing and providing teaching material for a particular lesson. It is the act of using alternative material and resources to facilitate wherever there is lack or shortage of specific first-

hand teaching aids[91]. It is also, the act of designing and producing Instructional Resources to promote classroom instruction. Also, improvisation is an act of using alternative material resources to facilitate teaching and learning process. In line with the above understanding, it is maintained that improvisation is the construction of cheap and simple alternatives by the teacher or his/her nominee and selection of commonly available materials in order to facilitate the teaching/learning process. Inherent in the improvisation process is the keen sense of creativity, resourcefulness and entrepreneurial skills of teacher or his/her nominee.

The need for improvisation of Instructional Resources arose because of the scarcity and the expensiveness of readymade materials for teaching and learning. There is scarcity of Instructional Resources in most primary and secondary schools in Nigeria. He found out that one hundred percent of classroom teachers do not use films, slides, film strips, overhead projector and records. At times some of the Instructional Resources are not available in the right quality and quantity to ensure effective utilization. If Instructional Resources are to be improvised, emphasis should be laid on using cheap and locally available materials.

Another reason why improvisation is needed is because it makes the teacher and students to feel their environment and utilize local resources to attain educational objectives. There is need for teachers to look inward to explore the rich opportunities and resources found within the physical and social environment[92]. It is observed that important resources of the community are often unnoticed by many teachers.

Improvised Instructional Resources are necessary because more often than not, they are designed and produced for specific topics and lesson. The Instructional Resources prepared by the teacher are often much more appropriately designed to the task

of teaching a particular topic than anything which can be purchased off the shelf. Improvised Instructional Resources also help to make lessons real to the students. They help to bring the lesson to the understanding of the students. It is in recognition of the importance of improvised materials in achieving effective teaching and learning that teachers should be trained in the arts of production of teaching materials[71]. He strongly suggested that they must be trained to develop the habit of collecting, classifying and storing materials useful for improvisation in schools.

2.1.11 Laboratory Facilities

Laboratory facilities refer to building infrastructure and items that are fixed in place. The laboratory is a building where learners acquire scientific knowledge through observation, measurement and guided instructions. The use of laboratory facilities during science instruction helps to develop values that aid the learners in decision making. The students are involved in the scientific processes and so their skills are improved. The laboratory is where learners acquire scientific knowledge through meticulous measurement, and exact observation. Laboratory work is a vital component of biology instruction at all levels. The activities involve experimental inquiry, validating tasks and the acquisition of skills. The more the students are exposed and involved in scientific practices such as observation and experimental inquiry, they gain proficiency in exact observation, deduction and interpretation of scientific process. So the laboratory is a distinctive feature in science teaching and learning.

The biology laboratory enables students to interact with materials which otherwise were only seen inside textbooks. This enables them to have more understanding of the natural world. The laboratory is designed to accommodate both individual and group works, which further encourages the spirit of co-operation, collaboration and solving

problems together. The students become more active in their learning. The biology laboratory provides students with the ability to manipulate equipment and materials. In a situation where the laboratory is inexistent or the equipment and materials are lacking, the quality of the teaching and learning experience is adversely affected. Laboratory facilities provide meaningful learning experiences in the learners.

2.1.12 Electronic Facilities

There are so many materials being used in the laboratory for imparting knowledge to the learners. One of these categories is the electronic facilities such as projector, television, radio, tape recorders and video tape recorders. These are not usually found in the traditional laboratories with the advancement in technology and introduction of information communication technology, there is a need for schools to upgrade the equipment and facilities in the laboratory in order to enhance teaching and learning process[92].

Tape recorders and video tape recorders are needed for field work during ecological studies projectors are needed for teaching and for displaying documentaries of animal and plants that are out of reach or the locality of the school. Watching documentaries allow students to interact with life in different climes and zones. This alone can motivate the students and ultimately improve their academic performance.

2.1.13 Physical Facilities

Physical facilities in any school system range from the school buildings, classroom, library, laboratories, toilet facilities, learning materials to other infrastructure that would motivate students towards learning without these physical facilities, learning becomes inconvenient and discouraging[93]. Sitting under the sun and the rain would most

definitely demotivate learners. School physical facilities are essential to facilitate and stimulate learning programmes.

Over the years, there has been greater awareness and sensitization programmes about the importance of going to school which had resulted in population explosion without commensurate upgrading of the physical facilities to accommodate the influx. The few existing physical facilities, particularly in public schools are overstretched and dilapidating. It is therefore logical that if physical facilities are adequate and convenient, students will tend to have more interest in learning and teachers also, will work better in the ideal working environment, this will invariably lead to high performance. Experience shows that inadequate physical facilities have some adverse effect on students' interest to learning.

The poor academic performances year after year in recent times could be traced to lack of physical facilities and a conducive and motivating learning environment. A scholar opined that apart from protecting students from sun, rain, heat and cold, there should be enough space, seats, library, laboratory and internet facilities that could enhance the level of motivation and academic performance of students.

2.1.14 Teaching Methods

Teacher-Centered Methods

The approach is least practical, more theoretical and memorizing. It does not apply activity-based learning to encourage students to learn real life problems based on applied knowledge. Since the teacher controls the transmission and sharing of knowledge,

the lecturer may attempt to maximize the delivery of information while minimizing time and effort[93].

Under this method, students simply obtain information from the teacher without building their engagement level with the subject being taught. As a result, both interest and understanding of students may get lost.

Student-Centered Method

With the advent of the concept of discovery learning, many scholars today widely adopt more agile student-centered methods to enhance active learning. Most teachers today apply the student-centered approach to promote interest, analytical research, critical thinking and enjoyment among students. The teaching method is regarded more effective since it does not centralize the flow of knowledge from the lecturer to the student. The approach also motivates goal-orientated behaviour among students; hence the method is very effective in improving student achievement.

Teacher-Student Interactive Method

This teaching method applies the strategies used by both teacher-centered and student-centered approaches. The subject information produced by the learners is remembered better than the same information presented to the learners by the lecturer. The method encourages the students to search for relevant knowledge rather than the lecturer monopolizing the transmission of information to the learners. As such, research evidence on teaching approaches maintains that this teaching method is effective in improving students' academic performance.

Also, there are various instructional methods which are as follows:

a. **Explicit, Systematic and Responsive Instruction**

This is based on content-area instruction; a relatively low-cost way to intensify instruction is for educators to adopt a strongly teacher-centered approach at times, combining direct instruction with efforts to coach students in the use of research-based learning strategies. Explicit instruction refers to the overt teaching of the steps or processes necessary to accomplish a task or learn a given skill and it often involves teacher modelling and demonstrations that illustrate precisely what students are expected to do. While this sort of highly directive approach may not be effective, or even appropriate, for all learners, research strongly suggests that for many students who struggle to plan, organize and monitor their own learning, it often leads to improved mastery of both foundation skills and higher-level.

Systematic instruction refers to how effective teachers organize instruction into manageable pieces of learning and how they integrate these pieces into an overall learning goal. (For example, a teacher might break down a complex math problem into a number of smaller steps or processes and then bring them back together to solve the whole.) Further, it refers to teachers' efforts to introduce progressively more challenging tasks over time, to give students the scaffolding they need to complete those tasks successfully, and then to pull away that support gradually as students become more accomplished and independent.

b. Meta-cognitive Instruction

Meta-cognition means "thinking about thinking," and involves helping students complete academic tasks by thinking about their assignments, planning the steps to

complete assignments, and monitoring progress along the way. Students are trained to use "inner language" to guide and monitor their completion of tasks.

Many students know little about the learning process, their own strengths and weaknesses in a learning situation, and the effective strategies and techniques to use in a specific learning situation. Explicit instruction in using strategies is needed, and teachers can help students by introducing and modelling strategies, prompting students to use strategies when appropriate, monitoring strategy use, and providing feedback and reinforcement when strategies are used by students.

The goal in meta-cognitive instruction is to have students "own" the thinking and learning processes that will make it possible for them to become competent independent learners who are able to develop a deeper understanding of factual knowledge. When teaching meta-cognitive skills, the focus is on learning the processes required for a deeper understanding of knowledge so that students will be able to as apply these to future learning situations. When students are trained in using meta-cognition, over time they become better able to plan, organize, and complete complex assignments.

c. The Meta-cognitive Process

Students must understand how to self-regulate a particular cognitive process or strategy by:

i. knowing where and when to use the cognitive strategies to support particular learning goals, and

ii. actively and purposefully using this knowledge to achieve a variety of learning tasks. The ability to self-regulate (or self-manage) refers to an individual's

capacity to evaluate work and make choices about what to do next. It involves the ability to:

iii. analyze and understand the problem or task;

iv. select appropriate strategies to efficiently complete the task;

v. implement the selected strategies;

vi. sequence problem-solving activities efficiently;

vii. monitor progress to ensure that selected strategies are working;

viii. make adjustments to selected strategies, if required; and

ix. evaluate success.

d. Discussion Method

The method is teacher/learner centered. It involves the teacher and learner interacting thereby discovering new ideas and facts by inquiry. The teacher becomes a resource rather than an authority. Discussion could be on individual bases i.e. student to student or class/group discussion also referred to as tutorial. Group discussion involves preparing specific tasks or questions for group to deal with. It allows participation of everyone. People are often comfortable in small groups and the group can reach a consensus. The disadvantage is that groups may get side-tracked and therefore careful thought as to purpose of group is needed.

e. Inquiry Method

Inquiry method is also referred to as problem solving method. Man is faced with everyday problem and in attempt to find solution to the problems inquiry approach is applied based on the situation. The three types of inquiry methods are listed as: -

a. Guided inquiry

b. Modified free inquiry

c. Inquiry role approach

In guided inquiry the teacher poses a problem for the pupils to answer. The guidelines could be given as to solving the problem while the students make use of their initiative to tackle the problem.

Modified free inquiry involves the teacher formulating the problem while the students decide on the way and procedure to find solution to the problem. This method is very suitable for secondary school students and is applicable in biology and most science classes. It is learners centered, the teacher/instructor is both.

f. The Lecture Method

The lecture is a method where factual material is presented in a logical manner. It contains experience that inspires and stimulates thinking to open discussion. Lecture needs clear introduction and summary that should include examples and anecdotes. The limitations of lecture include the idea that the experts are not always good teachers, audience is passive, learning is difficult to gauge and communication is one way.

g. Use of Practical Examples

The use of practical examples in the classroom is targeted at the following two main goals:

a. Help illustrate and explain new material making the theoretical basis of the material more accessible to the students. Practical examples help students understand the new concepts being introduced.

b. Teach students how to apply their knowledge of course material to new situations that are not directly covered in class. The goal here is to show the students not only that what they are learning has practical applications, but more importantly,

how to apply their understanding of the basic principles to real engineering problems. Teachers, especially in lower-level education such as lower primary, need to effectively utilise relevant illustrations to enhance their teaching and students' learning and achievement in class. In fact, in the author's opinion, and based on her own experience, colourful and well-designed illustrations not make teaching more effective, but they also make learning more interesting and exciting for students.

h. The Flow-Chart Technique

The technique of flowcharting, as applied to a classroom scenario, is a tool for precisely and concisely representing the flow of information among various stages in the development of a theoretical concept or in the formulation or analysis of a problem. Flowcharts are a tool to organize the flow of logic and thought in a classroom, much in the way that flowcharts help in presenting the flow of materials between various units of an industrial process. The ability to organize one's flow of thought needs to be inculcated in learners as early as in primary level. As such, this technique, as well as others related to it, needs to be utilized by teachers in their lessons.

i. Project method

This is similar to the problem-solving method as it encourages the independent activity and effort of the learner under the supervision of the teacher. However, unlike the problem-solving method, the learner selects the materials himself, does the planning and logically executes the project. For the method to be effectively used, and its objective realized, the teacher should avoid the temptation of doing aspects of the work for the learner.

The method has the advantage of generating interest, curiosity and enforcing cooperation and solidarity between the learner and the teacher. Group cooperation could equally be fostered among learners when they work in groups. Besides, working in groups can provide learners the opportunity to discover their leadership qualities and potentials.

j. Vee – Mapping

Vee – mapping strategy helps students to understand how new knowledge is attained in an experimental situation. It begins by focusing attention on what they know before enquiry. Thereafter they generate research questions, design, conduct experiment and interpret data. Through interpretation of data, they arrive at new knowledge that must be integrated with their prior knowledge.

Vee – mapping has two sides – a conceptual (knowing) one and methodological (doing) one that interplay. What we know at any moment determines the question we ask, the way we find answers to the question and the way we interpret data. On the other hand, what we do determines what we will know and thus changes what we know before the experiment.

Vee – mapping can also be used to teach English and literature because it is a strategy that guides students in their quest for new knowledge and help them to interpret what they discover. It is a road map showing a route from prior knowledge to new and future knowledge. This roadmap, can be conceptualized in terms of the general questions highlighted below

- What do we want to find out? (focus question)
- What do we currently know about it? (associated words)

- How did we find answers to the former knowledge? (experiment)
- What do our observations mean? (claims of knowledge)

k. Individualized Instruction Method

This method recognizes the fact that every learner is unique especially in terms of perception and ability. Through the method, a student is made to learn, on his own, a topic or lesson according to his interest, taste, ability and pace. The learning materials are thus specifically designed for the purpose and the teacher merely serves as a consultant. The method can hardly be effectively used in most Nigerian schools because of the high cost of materials it requires. Besides, its effectiveness depends on some level of expertise by the teacher. This may be lacking in most schools.

l. Problem Solving Method

Problem-solving method is a teaching style, which emphasizes student problem solving in rich real-world contexts. Problem-based learning has become increasing popular in recent years due to the focus of the K-12 community on engineering and math education. A typical problem-based learning scenario in a technology classroom would involve a challenge or question posed to the students, which they must solve using a particular technology or multimedia form. Students would be given little, if any, formal instruction regarding the topic and would collaborate with classmates and use other resources to find the answer. The teacher would typically be an available resource to the students but would allow the students to seek and find answers on their own. Many teachers believe that one of the greatest benefits of problem-based learning is the development of higher level thinking skills, as referenced in Howard Bloom‘s research.

m. Cooperative Learning Method

There are three features of interaction that are central to successful collaboration: intimacy among participants, rich supply of external resources, such as computers, and histories of joint activity of those interacting. Cooperative learning is defined by a set of processes which help people interact together in order to accomplish a specific goal or develop an end product which is usually content specific.

In a technology classroom teachers generally present a group of students with a task or challenge and the students work together to accomplish the task. Each group of students forms a community of learners in which the core activity is the sharing and distributing of expertise or knowledge.

There are a great number of benefits, revealed through research, that come from using collaborative learning techniques. A great number of these benefits have resulted from computer use in collaboration. As learners use computers to collaborate they break down the physical barriers of school by removing time and space constraints. Learners no longer leave their group-interactions at the classroom door – groups are connected and increased time for reflection, interaction, and collaboration is provided. Adding to the learner‘s available resources through groups and technological connections will further facilitate learner development in and out of the classroom.

n. Textbook Method

Learning from a textbook, or written script, is as old as school itself. For decades, students have been given a text containing the wisdom, knowledge, and problems, of those who have gone before them. Students are expected to read the text, answer key questions posed to them in the text, and retain the knowledge for future use. Also, the

addition of images, graphs, and iconic cues has increased the effectiveness of textbook learning. Textbooks offer a great resource to students. The combination of images and text in format that is easily accessible to students has been very effective. Textbooks are a tangible vault of information which students can access as many times as needed in order to learn concepts. Textbooks are particularly useful in subject areas that are static, such as history or Math. Teachers of these subjects can use the same textbook for years because the content does not change. Many textbooks have been through numerous revisions and have been honed down to the best questions that provoke learning and understanding from student learners.

Textbooks also have challenges associated with them. In personal conversations with teachers many related that they see ―book work‖ as a punishment, which is somehow sub-par to other forms of learning – their students in many cases share their perceptions. Textbooks can be expensive and often are not handled properly, resulting in damage and costly repair or replacement costs.

o. Discovery Learning Method

Discovery Learning is a method of inquiry-based instruction, discovery learning believes that it is best for learners to discover facts and relationships for themselves. It is a method that takes place in problem solving situations where the learner draws on his or her own past experience and existing knowledge to discover facts and relationships and new truths to be learned. Students interact with the world by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments. As a result, students may be more likely to remember concepts and knowledge discovered on their own (in contrast to a transmissionist model).

p. Team Teaching Method

Team teaching involves a group of instructors working purposefully, regularly, and cooperatively to help a group of students of any age learn. Teachers together set goals for a course, design a syllabus, prepare individual lesson plans, teach students, and evaluate the results. They share insights, argue with one another, and perhaps even challenge students to decide which approach is better. Teams can be single-discipline, interdisciplinary, or school-within-a-school teams that meet with a common set of students over an extended period of time. New teachers may be paired with veteran teachers. Innovations are encouraged, and modifications in class size, location, and time are permitted. Different personalities, voices, values, and approaches spark interest, keep attention, and prevent boredom.The team-teaching approach allows for more interaction between teachers and students. Faculty evaluate students on their achievement of the learning goals; students evaluate faculty members on their teaching proficiency. Emphasis is on student and faculty growth, balancing initiative and shared responsibility, specialization and broadening horizons, the clear and interesting presentation of content and student development, democratic participation and common expectations, and cognitive, affective, and behavioral outcomes.

q. Concept Mapping Method

Concept mapping method is a great way to build upon previous knowledge by connecting new information back to it. A concept map is a visual organization and representation of knowledge. It shows concepts and ideas and the relationships among them. You create a concept map by writing key words (sometimes enclosed in shapes such as circles, boxes, triangles, etc.) and then drawing arrows between the ideas that are related. Then you add a short explanation by the arrow to explain how the concepts are related. Concept maps have been used to define the ontology of computer systems, for example with the object-role modeling or Unified Modeling Language formalism. A

concept map is a way of representing relationships between ideas, images, or words in the same way that a sentence diagram represents the grammar of a sentence, a road map represents the locations of highways and towns, and a circuit diagram represents the workings of an electrical appliance. In a concept map, each word or phrase connects to another, and links back to the original idea, word, or phrase. Concept maps are a way to develop logical thinking and study skills by revealing connections and helping students see how individual ideas form a larger whole. Concept mapping is also sometimes used for brain-storming. Although they are often personalized and idiosyncratic, concept maps can be used to communicate complex ideas.

r. Constructivists Method

Constructivist teaching is based on constructivist learning theory. Constructivist teaching is based on the belief that learning occurs as learners are actively involved in a process of meaning and knowledge construction as opposed to passively receiving information. Learners are the makers of meaning and knowledge. Constructivist approach teaching methods are based on constructivist learning theory. In the constructivist classroom, students work primarily in groups and learning and knowledge are interactive and dynamic. There is a great focus and emphasis on social and communication skills, as well as collaboration and exchange of ideas. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook. Some activities encouraged in constructivist classrooms are:

i. Experimentation: Students individually perform an experiment and then come together as a class to discuss the results.

ii. Research projects: Students research a topic and can present their findings to the class.

iii. Field trips: This allows students to put the concepts and ideas discussed in class in a real-world context. Field trips would often be followed by class discussions.

iv. Films: These provide visual context and thus bring another sense into the learning experience.

v. Class discussions: This technique is used in all of the methods described above. It is one of the most important distinctions of constructivist teaching methods.

vi. Campus wikis: These provide learners with a platform for curating helpful learning resources

s. Demonstration Method of Teaching:

Demonstration is an essential objective method of teaching in which the teacher conducts the operation, while explaining what he/she is doing before the students. In an ideal situation, the teaching approach would affect the students' achievement and motivation to learn Biology. In practical situations the students' achievement and motivation to learn Biology will be influenced by various factors which include, experimentation, demonstration.This is because the concepts involved are considered too abstract to understand and the content too difficult.

t. Content Enhancement

Content Enhancement includes a variety of research-based teaching and learning routines. Teachers can use these routines to plan and lead learning, teach concepts, explain tests, topics, and details, and increase student performance. Used in combination, these routines constitute a powerful and well-organized approach to instruction and learning that incorporates many of the effective research-based instructional practices

described throughout this section on effective instruction. An overview of the upcoming course or unit enables students to activate prior knowledge, make connections within and beyond the subject area, connect the new information to their experiential background, and become more motivated and engaged with the material to be learned. Some course and unit organizers that have been well researched are part of Content Enhancement (based on the work of Donald Deshler and his colleagues at the Center for Research on Learning, at the University of Kansas). As an approach to teaching and learning in the content areas, Content Enhancement has proven effective for various categories of students.

It was emphasized that additional classroom practices, such as individualization, collaboration and authentic assessment should be put in place. Individualization means that the teacher instructs each student by drawing upon the knowledge and experience that a particular student already possesses.

Collaborative learning means that teachers allow students to work together in groups, while authentic assessment refers to the fact that assessment occurs as an artifact of learning activities. All these can be accomplished, for instance, through individual and group projects that occur on an ongoing basis rather than at a single point in time. This then suggests that this set of classroom practices if well-tailored and used can produce qualitative improvement in the academic performances of all students, regardless of their background. Decisions made by teachers about classroom practices can either facilitate student learning or become an obstacle irrespective of the level of preparation students bring into the classrooms. The secondary school child is squarely within the adolescent years and it is known, or it should be known, the problems of children during this period. The child's mind must be at peace with what goes on in the school before he can profit

from it. To channel the immature minds of the adolescents to purposeful endeavors needs judicious guidance services in every secondary school.

The contacts with the schools revealed that only a small percentage of them have some measure of guidance services. One says, “Some measure of guidance services” because the guidance counselor is often made to teach specific subjects. A good majority of the schools have no guidance counsellors [94].

One of the reasons why the services of guidance counselors are extremely necessary in the secondary school apart from psychological and emotional reasons is the inordinate ambition of some parents especially among the elite group. They compel their children to study certain subjects leading to specific careers in life even though their children are not interested in these subjects and since they are not interested, they hardly do well in them. In their attempt to keep to their parents’ wish and in the absence of guidance counselors, they end up neither learning the subjects dictated to them by their parents, nor the other subjects they were originally interested in. A few of them who prove tough and continue to work in order to fulfil the wishes of their parents may end up as broken personalities. Eventually they fail the WAEC examination in these subjects. If one has adequate guidance services in the school, the guidance counsellor could even reach out to the parents of such children and counsel them to avoid compelling their wards to learn specific subjects.

The Use of Indoor Laboratory in the Teaching of Biology

A Laboratory is a room or a forum where science teachers and their students interact. The laboratory varies in dimension and equipment as a result of the funds available. As a science subject, biology tends to solve human problems and answer some results, records and investigation with the use of apparatus. A well-planned laboratory should be located

away from the classroom, busy roads, hostels, dining rooms, game field and lucrative or relaxation centre. This is because the materials and equipment placed could be hazardous to health[95]. Some laboratory activities require maximum concentration and as such need a quiet environment such as preparation of chemicals and testing of foods. In designing a Biology laboratory the number of students that should be accommodated, the fund and materials required are put into consideration to avoid shortage and non-availability of resource. Biology is a science subject and it is obvious that some of the concepts could be taught, bringing distant habitat nearer to the learners by displaying some specimen, apparatus and equipment in the laboratory. It is obvious that with the emphasis on science, technology and mathematics (STM) more laboratories would be in existence.

Teachers would teach with instructional materials, Students would be familiar with the concept using material and creativity. Laboratory technologists would be assigned to care of the equipment and assist the biology teacher. Dewey has pointed out that the laboratory method has the advantage over the classroom teaching in as much as the achievements of an experiment entirely diverts the attention of the student from the thought that he/she is studying. In a classroom the teacher presents a statement from a textbook according to his conception and then efforts are made by the students to reproduce the statement in their own way. In the laboratory the students encounter the facts directly without the intermediate steps of the teacher. The latter is concerned in assisting the thorough exploration of facts. Laboratory method is without doubt, of value in the cultivation of the mind. It brings the teacher and the students in close contact and thus the teacher influences the character of the students. In the laboratory the student is free to work in accordance with his/her own conception and there is no bondage of authority.

Teaching methods refer to the strategies and techniques that educators use to facilitate learning in students. Effective teaching methods are essential for engaging

students, promoting critical thinking, and ensuring that learning objectives are met. There are various teaching methods, each with its own set of principles and applications. Here are some common teaching methods:

i. **Lecture Method:** Involves the teacher presenting information to the students. Passive learning, where students listen and take notes. Useful for presenting large amounts of information efficiently.

ii. **Discussion-Based Teaching:** Encourages active participation and critical thinking. Students express their ideas, ask questions, and engage in debates. Fosters communication skills and a deeper understanding of the subject matter.

iii. **Demonstration Method:** Teachers show students how to do something, followed by students practicing the skill. Common in science and vocational subjects. Enhances understanding by combining visual and hands-on learning.

iv. **Collaborative Learning:** Students work together in groups to solve problems or complete tasks. Promotes teamwork, communication, and shared learning experiences. Encourages active participation and peer-to-peer teaching.

v. **Problem-Based Learning:** Students work on real-world problems and develop solutions. Emphasizes critical thinking, problem-solving, and self-directed learning. Encourages research skills and teamwork.

vi. **Project-Based Learning:** Students engage in long-term projects, addressing a complex question or problem. Promotes research, collaboration, and presentation skills. Encourages creativity and independent thinking.

vii. Flipped Classroom: Students learn new content at home through videos or online materials. Classroom time is used for discussions, activities, and clarifying doubts. Encourages self-paced learning and active participation during class.

viii. **Experiential Learning:** Learning through experiences, such as internships, field trips, or simulations. Engages students in real-life situations, enhancing practical skills and knowledge. Encourages reflection and application of knowledge in different contexts.

ix. **Interactive Lectures:** Combines traditional lectures with interactive elements like quizzes, polls, or discussions. Keeps students engaged and allows for immediate feedback. Enhances retention and understanding of the material.

x. **Game-Based Learning:** Uses educational games and simulations to teach concepts and skills. Increases engagement and motivation through competition and rewards. Reinforces learning objectives in an entertaining manner.

Effective teaching often involves a combination of these methods, tailored to the subject matter, the learning objectives, and the preferences of both the teacher and the students. Skilful educators adapt their teaching methods to create a dynamic and engaging learning environment, fostering a deeper understanding and a lifelong love for learning in their students.

2.1.15 Relevance of Teaching Methods

The relevance of teaching methods lies in their ability to cater to diverse learning styles, enhance student engagement, promote critical thinking, and facilitate meaningful learning experiences. Here's a detailed look at the relevance of various teaching methods in education:

i. Catering to Diverse Learning Styles:

Visual Learners: Methods like diagrams, charts, and videos are effective.

Auditory Learners: Lectures, discussions, and audio materials aid understanding.

Kinesthetic Learners: Hands-on activities, experiments, and interactive projects engage these learners. Using a variety of methods ensures that all students can grasp the content effectively.

ii. Enhancing Student Engagement:

Interactive and participatory methods keep students engaged and interested. Activities like group discussions, debates, and hands-on experiments capture attention. Engaged students are more likely to participate, ask questions, and retain information.

iii. Promoting Critical Thinking and Problem-Solving:

Methods like discussions, case studies, and problem-solving tasks encourage critical thinking. Students analyze information, consider different perspectives, and develop informed opinions. These skills are crucial for real-world problem-solving and decision-making.

iv. Facilitating Meaningful Learning:

Active learning methods, such as collaborative projects and hands-on experiments, create meaningful learning experiences. Students relate theoretical knowledge to practical applications, enhancing understanding. Meaningful learning leads to better retention and long-term knowledge retention.

v. Encouraging Autonomy and Self-Directed Learning:

Methods like flipped classrooms and project-based learning encourage self-paced learning. Students take responsibility for their education, fostering a sense of autonomy. Self-directed learners are more motivated and proactive in their studies.

vi. Addressing Multiple Intelligences:

Howard Gardner's theory of multiple intelligences suggests that people have different ways of learning and demonstrating intelligence. Teaching methods can be tailored to address linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic intelligences.

vii. Preparing Students for the Future:

The future workforce requires skills such as creativity, collaboration, critical thinking, and adaptability. Teaching methods that promote these skills prepare students for future challenges. Technological advancements also enable innovative teaching methods, ensuring students are tech-savvy.

viii. Building Social and Communication Skills:

Collaborative learning methods enhance social skills and teamwork. Activities like debates and presentations improve communication skills. These skills are vital for personal and professional success.

ix. Promoting Lifelong Learning:

Encouraging varied teaching methods fosters a love for learning. Students discover different ways to acquire knowledge, making them more open to learning throughout life. Lifelong learners adapt to new information and technologies, staying relevant in a rapidly changing world.

In summary, the relevance of teaching methods is evident in their ability to cater to diverse learning needs, foster critical thinking, promote meaningful learning, and prepare students for the future. Educators must select and combine methods thoughtfully, considering the subject matter, learning objectives, and the unique characteristics of their students to create a rich and effective learning experience.

2.1.16 Component of Teaching Methods

Teaching methods are multifaceted approaches that educators use to facilitate learning experiences. They consist of various components that are carefully designed and implemented to achieve specific learning objectives. Here are the key components of teaching methods:

i. **Learning Objectives:**

Definition: Clear and specific goals that outline what students are expected to learn or achieve.

Importance: Learning objectives guide the selection of appropriate methods and assessment tools.

ii. **Content Delivery:**

Definition: The way in which teachers present the subject matter to students.

Methods: Lectures, discussions, demonstrations, multimedia presentations, storytelling, etc.

Importance: Engaging and effective content delivery captures students' attention and enhances understanding.

iii. **Instructional Materials:**

Definition: Resources used to support teaching and learning, such as textbooks, multimedia presentations, handouts, and online resources.

Importance: Relevant and diverse instructional materials cater to different learning styles and enhance the learning experience.

iv. Classroom Activities:

Definition: Engaging tasks or exercises that involve students actively in the learning process.

Examples: Group discussions, debates, role-playing, experiments, projects, quizzes, etc.

Importance: Classroom activities promote active learning, critical thinking, and collaboration among students.

v. Assessment Methods:

Definition: Techniques used to evaluate students' understanding, skills, and knowledge.

Examples: Tests, quizzes, essays, presentations, projects, peer evaluations, etc.

Importance: Assessment methods provide feedback on students' progress and help in adjusting teaching strategies to meet their needs.

vi. **Feedback and Evaluation:**

Definition: Providing constructive feedback to students based on their performance and evaluating the effectiveness of the teaching methods.

Importance: Timely feedback helps students understand their strengths and areas for improvement, while evaluating methods ensures their ongoing effectiveness.

vii. Classroom Management:

Definition: Strategies used to create a positive and productive learning environment, including behaviour management, seating arrangements, and time management.

Importance: Effective classroom management ensures a conducive atmosphere for learning and minimizes disruptions.

viii. Technology Integration:

Definition: Incorporating technology tools and platforms to enhance teaching and learning experiences.

Examples: Smartboards, educational apps, online learning platforms, virtual reality, etc.

Importance: Technology integration engages tech-savvy students and provides access to a vast array of resources and interactive learning opportunities.

ix. Differentiation and Individualization:

Definition: Adapting teaching methods to meet the diverse learning needs of students, including those with different abilities, interests, and learning styles.

Importance: Differentiation ensures that every student can access and benefit from the learning experiences, promoting inclusivity and understanding.

x. Reflection and Adaptation:

Definition: Regularly assessing the effectiveness of teaching methods, reflecting on their outcomes, and adapting approaches based on student responses and learning outcomes.

Importance: Continuous reflection and adaptation enhance teaching methods, making them more effective and relevant to students' needs.

Understanding and integrating these components effectively enable educators to create engaging, effective, and learner-centered teaching methods that cater to the diverse

needs of their students. Successful teaching methods often involve a thoughtful combination of these components tailored to the specific context and learning objectives.

2.1.17 Interpersonal Relationship

Teaching is the art of imparting instructions to the learners in the classroom setting in the traditional concept. It is a complex process that the nation uses to bring a desirable behavioural change for its development.[96] Teachers have very important role in moulding the hives of learners to become successful and to become useful both to themselves and the society at large. Teachers help students to achieve their ideals and goal in life. For this to be realized, a teacher must have a good personality, much more expected from a teacher than any other professions. A teacher can either make or mar the future of a learner. Teacher is a noble profession.

A good personality enables a teacher to break the barrier between teacher and students, draw the students closer in learning and pass knowledge across to them without frictions.

A scholar opined that teachers who have good personalities will also have a good and harmonious relationships between teachers and other humans, including learners. They realize their positions as social being and who respect others. When the teacher creates a harmonious relationship with others, a harmonious school environment will also be created. This will invariably enhance the teaching and learning process which will ultimately bring about good academic performance in the learners. A professional teacher is able to distinguish between personal and work matters, such that learners are not victimized because of personal problems.

2.1.18 Teachers Knowledge on Subject Matter

The possession of knowledge of subject matter by teachers is very crucial in a teaching and learning situation. Knowledge of the subject matter means the information and understanding that teachers have about the subject they teach. Without adequate knowledge, teachers cannot impart the learners as they should. Knowledge of the subject matter does not stop at a teacher having a vast information about subject content or curriculum but must also possess the skill to impart it to the learners. Helping students learn subject matter involves more than the delivery of facts and information. The goal of teaching is to assist students in developing intellectual resources to enable them participate in, not merely know about, the major domains of human thought and inquiry. No matter how knowledgeable a teacher is, if he is not able to convey that knowledge to the students, it is as if he had no knowledge.

Knowledge of the subject matter is very important for a teacher to get the confidence of his students. In a situation where students discover that they had more knowledge of the subject more than the teacher, there will be chaos and unruly behaviour on the part of the students. The ability of the students to comprehend, largely depends on the teacher's knowledge of the subject matter and the ability to disseminate that knowledge in understandable language and manner to learners.

2.1.19 Academic Achievement

Academic achievement as student's success in meeting short or long term goals in education means completing high school or earning a college degree. Academic achievement really means three things; the ability to study and remember facts, being able to study effectively and see how facts fit together and form larger patterns of knowledge and being able to think for yourself in relation to facts and thirdly, to be able to

communicate. It is the level of achievement attain via the combination of inputs from student motivation and conduct. Academic achievement is generally referred to how well a student is accomplishing his or her tasks and studies, but there are quite a number of factors that determine the level and quality of students‟ academic performance”[97].

These influences according to the information includes high quality parenting (the degree to which a young star is provided with an enriched, warm and responsive learning environment which includes appropriate control and discipline over children, and are closely associated with both higher grade reading and mathematics skills); high quality child-care environments (stimulating activity and nurturing as reflected in high quality parenting) and high quality first-grade classrooms (with a focus on literacy instruction, evaluative feedback, instructional conversation, and encouraging child responsibilities). Also, it was revealed that academic achievement is how students deal with their studies and responsibilities given to them by their teachers. Academic achievement is the ability of students to obtain high grades and standard test scores in school courses, especially courses that are part of the core academic curriculum[98].

Academic achievement is a major aspect of school system. It has been conceived as the reflection of students' ability in academic work which shows how well a student performs in test and examination. The poor performance of secondary school students in different subjects as observed in the yearly results of Senior School Certificate Examination conducted by WAEC and NECO which are external bodies justifies this claim of dwindling academic performance of secondary school students in both internal and external examinations[99].

2.2 Theoretical Framework

2.2.1 Socio-cultural Theory of Teaching, Learning, and Development

Socio-cultural theory of teaching, learning and development is the first theory that framed this study. Largely inspired by the seminal works of Lev Vygotsky, this theory assumes that human minds do not develop by virtue of some predetermined cognitive structures that unfold as one matures. Rather, this theory posits that human's minds develop as a result of constant interactions with the social material world. According to Vygotsky, human mind develops through interaction with materials in the learning process where people learn from each other and use their experiences to successfully make sense of the materials they interact with. These experiences are crystallized in 'cultural tools', and the learners have to master such tools in order to develop specific knowledge and skills in solving specific problems and, in the process, become competent in specific profession. In the classroom, these tools can be a picture, a model, or pattern of solving a problem. Most often however, such tools are combinations of elements of different orders, and human language is the multi-level tool par excellence, combining culturally evolved arrangements of meanings, sounds, melody, rules of communication, and so forth.

Learning by using such tools is not something that simply helps the mind to develop. Rather, this kind of learning leads to new, more elaborate forms of mental functioning. For example, when children master such a complex cultural tool as human language, this results not only in their ability to talk but leads to completely new levels of thinking, self-regulation and mentality in general. It is the specific organization of this tool (e.g., the semantic, pragmatic and syntactic structures of language) that calls into being and in effect shapes and forms new facets of the child's mind. Importantly, cultural tools are not merely static 'things' but embodiments of certain ways of acting in human communities. In other words, they represent the functions and meanings of things, as discovered in cultural practices: they are "objects-that-can-be used- for-certain-purposes"

in human societies. As such, they can be appropriated by a child only through acting upon and with them, that is, only in the course of actively reconstructing their meaning and function. And such reconstruction of cultural tools is initially possible only in the process of cooperating and interacting with other people who already possess the knowledge (i.e. the meaning) of a given cultural tool.

2.2.2 Instructional Material Theories

Instructional material theories assume that there is a direct link between the materials that the teachers use, and the students' learning outcomes. These outcomes include higher abilities to learn, quality strategies to learn and perform classroom activities and positive attitude towards learning. Further, these theories assume that instructional materials have the capacity to develop into students the highest order of intellectual skills as they illustrate clearly, step by step how to follow the rules/principles and elaborate on the concepts, all of which have positive impact on solving new problems by analyzing the situation and formulating a plan[100]. According to Gagne et al, instructional material can be used to develop higher learning abilities to the learners through self-teaching or guided learning. This implies that the instructional materials mainly comprise "eliciting performance" and "providing feedback on performance correctness," in addition to "providing learning guidance" for guided discovery learning. Many of Gagné's ideas have broad implications for secondary teachers in community secondary schools in Rombo district. Many of these ideas have capacity building undertones with themes of students' acquisition of critical thinking and problem-solving skills. However, the theory does not relate to whether or not students can think critically in what aspects or how they can solve a particular problem by themselves. However, the

researcher is of the opinion that the purpose of instructional materials or technology in education is to stretch students' imagination and to encourage them to solve problems in their lives.

Similar ideas are held by Lev Vygotsky, a Russian psychologist who held a view that tools and signs, which are in a form of instructional materials, have the capacity to develop in students' higher level of thinking, which is important in problem-solving activities. However, since they are considered to be domain-specific, the ways instructional materials can start cognitive development is yet to be studied with respect to classroom teaching.

2.2.3 Constructivist Learning Theory

This theory originates from the work of cognitive scientists like Jean Piaget, John Dewey, Jerome Bruner, Vygotsky among others and Van Hiele theory of geometric thought. Constructivist teaching is based on the belief that learning occurs as learners are actively involved in a process of meaning and knowledge construction as opposed to passively receiving information. Through interaction with the physical situations, or concrete objects, a child's physical experience accumulates and he is able to conceptualize, think creatively and logically. The child therefore develops skills to abstract problems.

According to this theory, learners are the makers of knowledge and meaning. Constructivists' teaching fosters critical thinking, and creates motivated and independent learners. Constructivists suggest that learning is more effective when a student is engaged in the learning process rather than attempting to receive knowledge passively. Children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences. According to a scholar, learning

always occurs and cannot be separated from a social context[101]. He affirms that knowledge construction occurs within social context that involves student- student, student- expert collaboration on real world problems or tasks that build on each person's language, skills and experience shaped by individual's culture. In the classroom, constructivist view on learning can point towards a number of different teaching practices. In the most general sense, it usually means encouraging students to use active techniques (experiments, real world problems) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure he understands the students' pre-existing conceptions and guides the activity to address them and then build on them. Students in the constructivist classroom ideally become "expert learners". This gives them ever broadening tools to keep learning. With a well-planned classroom environment, the students learn how to learn. Constructivism transforms the student from a passive recipient of information to an active participant in the learning process. Always guided by the teacher, the students construct their knowledge actively rather than just mechanically ingesting knowledge from the teacher or the textbook.

The three studies all agree on the use of instructional materials to develop higher learning abilities in the learners. Students learn better when they interact with each other and with instructional materials. This is different from the passively receiving information. They are also able to develop skills to abstract problems.

2.3 Review of Empirical Studies

A study was carried out on the "Influence of Improvised teaching Instructional Resources on Chemistry Students' Performance in Senior Secondary Schools in Vandeikya Local Government Area of Benue State, Nigeria"[102]. The purpose of the study

was to ascertain use of improvised Instructional Resources on the performance of chemistry students. Two research questions guided the study and two hypotheses were raised and tested at 0.05 significant level. The study adopted descriptive survey research design. A sample of 150 senior secondary school chemistry students was used in the study to determine through simple random sampling procedure. Data used for the study was collected through researcher-made questionnaire. Mean and standard deviation statistics were used in answering the research questions while Analysis of Variance (ANOVA) was used in testing the hypotheses. The study found that students taught using improvised Instructional Resources out-performed their counterparts taught with conventional lecture method. The study recommended among others that teaching of chemistry using improvised Instructional Resources should be encouraged since it facilitates the learning of this subject.

Also, a study was conducted on "Effects of Instructional Resources on Secondary Schools Students' Academic Achievement in Social Studies in Ekiti State, Nigeria[103].The aim of the paper was to highlight the contribution of Instructional Resources to the academic achievement of secondary school students in Social Studies in Ekiti State. The population for the study comprised of all Junior Secondary School Class II students from among which 180 were sample. A multiple-choice self- designed Social Studies Achievement Test (SSAT) was used to collect data for the study. The study generated four hypotheses that were tested at the significance level of 0.05. ANOVA and ANCOVA statistical tools were used to analyse the data collected. The study found that there was a significant difference in the pre-test and post-test of students in the experimental group. The study also found that gender effect was not statistically significant in social studies. The study concluded that students who were taught with Instructional Resources performed better than those taught without. The study therefore recommended that

teachers of Social Studies should employ the use of essential Instructional Resources for their teaching and also improvise where and when the materials are not available.

A research work investigated the laboratory facilities available and its perceived effect on science students performance in Owo Local Government Area of Ondo State. Literatures relevant to the topic were reviewed and four research questions were raised to guide the study. The study adopted descriptive research design of the survey type. The population of the study comprises of all senior secondary schools students in Owo Local Government Area of Ondo State. The samples used for the study consisted of 350respondents who were proportionately selected from seven schools. A well validated questionnaire was used as an instrument for data collection in the study.

Findings from the study revealed that 93% of the respondents opine that there are adequate laboratory facilities available for use in teaching science related subjects in various schools in Owo LGA[104]. It was also revealed that 83% of the respondents argued that laboratory facilities such as evaporating dish, spring balance, micrometre screw gauge, skeleton, beaker, filter paper among others are constantly in use for teaching and learning of science subjects in Owo LGA . Finally, it was revealed that 90% of the respondents opines that laboratory facilities has positive influence on their academic performance in science subjects in that it stimulate creativity, curiosity, critical thinking, and promotes their engagement with scientific method Based on the findings of this study, the following recommendations were made: Government should provide more laboratory facilities to schools in Owo local government area to bring about effective participation of students and teachers in science subjects, Teachers and students should be encouraged to make use of the available laboratory facilities judiciously to

enhance better performance in science subjects, Unavailable facilities should be improvised to achieve the best in the teaching and learning of science subjects. This will boost students' active participation in science related practical.

Another scholar examined the relevance of physical facilities in enhancing the level of motivation and the academic performance of senior secondary school students in South West Nigeria[105]. The study adopted ex-post facto design. The population consists of all senior secondary students in South West Nigeria. The sample for the study includes one thousand and fifty senior secondary school students from three states out of the six states in the South West Geo-political zone. The researcher made use of a questionnaire and an inventory to collect data. A self-designed questionnaire tagged "Motivation and Academic Performance of Senior Secondary School Students" (MAPSSS) was used to elicit information from the respondent. The result showed that there was a significant relationship between physical facilities and students level of motivation and academic performance. Based on the findings of the study, more physical, human and material resources that are of high quality should be made available in public school to motivate students towards learning. More priority should be given to allocation of funds to make the public school conducive for teaching and learning to take place; this will improve the academic standard of public schools.

Another article examines the utilization of e-resources Modibbo Adama University of Technology, (MAUTech) Yola under the auspices of the central library, the Ibrahim Babangida Library. Academics and students are primary users of information resources of any library, hence, their responses towards the utilization of e-resources in the institution have been critically considered in this study[106]. A Mixed method research Design was adopted for the study. A case study approach was employed. The Technology Acceptance Model (TAM) and Diffusion of Innovation (DoI) theories were used to

develop the conceptual framework of this paper. Questionnaires were used as data gathering tools. Academics and students acted as participants. Major findings are lack of sufficient Internet access for academics and students and lack of training and awareness campaigns. Conclusion has shown that e-resources did not impact research and teaching of academics in MAUTech, Yola.

Yet another study sought to investigate the relationship existing between laboratory facility availability and students' academic performance in Biology across Secondary School in Ethiope East L.G.A., of Delta State, Nigeria[107]. In the course of this study, three research questions were developed and three null hypotheses were formulated. The study used was delimited to senior secondary schools two (SSII) because it is at this stage students are being exposed to practical activities that require the usage of laboratory facilities and equipment. A descriptive survey design was used while the sample of the study was made up of one hundred and three (103) respondents. The study employed a questionnaire as an instrument to gather data. The data collected was analysis Chi-square and t-test statistics. The results revealed a significant difference in academic performance of students having fairly adequate laboratory facilities in their school compared to those with in school having inadequate laboratory facilities for biology practical. Difference was also recorded in terms of the performance of male and female students in biology. No significant difference was obtained in the supplies of biology laboratory facilities in private schools and those in public schools. It was suggested that science/biology laboratory facilities should be provided to biology teachers to enable them to know how to handle the facilities.

The science laboratory became a substantial learning environment for science education, especially in realizing the K–12 science curriculum's goals, which focus on applying and demonstrating scientific knowledge[108]. Thus, this study aimed to determine

the compliance rate of science laboratories in the division of Davao del Sur, Philippines based on DepEd Order No. 48 series of 2006 which entails the prescribed science laboratories in basic education and DepEd Order No. 118 series of 2009 which stipulates the science laboratory equipment and materials. The research examined six schools in three economic categories to assess their science laboratory compliance rate. This study involved creating four matrices containing the prescribed laboratory facilities, equipment, materials, and required quantities for each equipment and material. Results revealed that the compliance rate of the sampled schools in terms of their facilities is 69.04% (good), the equipment is 65.59% (good), the materials are 43.33% (fair), and the compliance with the required quantity is 50.39% (fair). Based on the result of the study, it can be concluded that some schools in the division of Davao del Sur are lacking with the prescribed science laboratory. Thus, it is recommended that the Department of Education, Davao del Sur division to conduct a general assessment of all secondary schools to determine the status of science laboratories' physical infrastructure, equipment, and materials.

This study was carried out on the availability of laboratory facilities in teaching of Basic Science on the Students' academic performance in Upper Basic Schools, Kwara State, Nigeria[109]. This target population for the study was all Basic Science Teachers in Kwara State, Nigeria, four hundred and sixty-nine (469) Public Upper Basic Schools and three hundred and sixty-two (362) private schools are available in the study area. The researcher designed teachers' questionnaire and was administered to two hundred and thirty-six (236) Basic science teachers that were selected from forty-seven Upper Basic Schools (47) from both public and private schools in Kwara State. Researcher-designed validated questionnaire was used to extract data from the respondents on the teachers 'influence on the performance of students in Upper Basic Schools. Three research

questions were raised with two hypotheses which were tested. Percentage and t-test statistics were used to analyze the facts collected. The finding showed that influence of Basic science teachers on the performance of students in Upper Basic Schools in Kwara State, Nigeria was significantly. It was also significant based on gender and on year teaching experience of Basic science teachers. According to the findings, it is suggested that; the educational authorities and the school system should encourage the use of available resources by providing for them, the necessary materials that will influence Basic Science performance and enhance students learning. Basic Science teachers should re-assess their classroom instructional practice because there is a need for them to shift from instructional practice that will give the male and female teachers' equal opportunities to excel in instructional activities. The less-experienced Basic Science teachers should be allowed for cognate experience and help encourage the experience to acquire more experience.

One of the foundational assumptions in education is that greater teacher knowledge contributes to greater gains in student knowledge, but empirical evidence in support of this assumption is scarce[110]. Using a U.S. sample of 79 biology teachers and their 2749 high school students, we investigate whether teachers' subject matter knowledge (SMK) and knowledge of students' misconceptions (KOSM) in high school life science are associated with students' post-test performance on multiple-choice test items designed to reveal student misconceptions, after controlling for their pretext scores. We found that students were more likely to answer an item on the post-test correctly if their teachers could answer the question correctly, themselves (SMK). Teachers' ability to predict students' most common wrong answer (KOSM) for an item predicted even better student performance. Items for which a particular wrong answer rose above others in popularity saw an even greater benefit for teacher KOSM.

Knowing the content of the matter one is teaching seems to be an implicit requirement. There are, however, some nuances between learning, understanding, needing to reproduce information exactly or adapt it[111]. In this quantitative study, we tried to assess teachers' perceptions on this issue based on their professional experience. Thus, we tried to highlight which aspects of knowledge are important and valued in the direct experience with pupils and how these are reflected in the evaluations and competitions organised institutionally for teacher tenure. The sample consists of 1154 Romanian teachers in pre-university education, with national representativeness and a proportional distribution per country region. The main motivation of this study is the need to support Romanian educational policies to find appropriate evaluation formulas for candidates in accordance with the concrete requirements of the profession, as shown in the direct work with students. This approach could encourage candidates to better prepare both for the qualification exam and to develop the skills needed to engage with pupils to improve classroom work in a more realistic way, adjusted to concrete conditions. The results of the research invite us to consider the importance of evaluating teachers in accordance with classroom needs.

2.4 Conceptual Model

This conceptual model explicitly illustrates the influence of the independent variables (Instructional Resources and teaching methods) on the dependent variable (students' achievement in practical Biology). It is an adapted model. It should be emphasized, however, that these relationships are more complex and intertwined than they appear. This position is well supported in scholarly literature as well, as illustrated in Figure 2.1

Independent Variables

Instructional Resources

- Biology Laboratory facilities
- Physical Facilities
- Electronic Materials

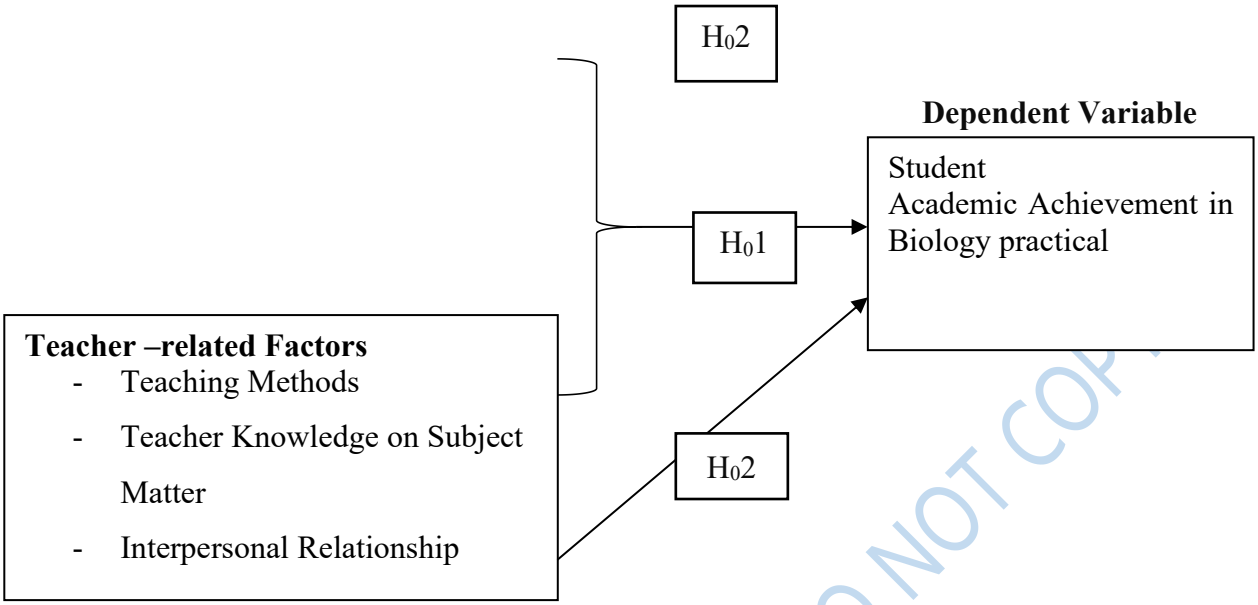

Figure 2.1: Adapted Conceptual Model of Instructional Resources, Teaching Methods and Student's Academic Achievement

Source : Researcher's Computation, 2024.

Both the Independent Variables of Instructional Resources and Teacher-related factors singularly and jointly affect the Dependent Variable of Student Academic Achievement in Biology practical.

The interaction from the conceptual model revolves around the influence of instructional resources and teacher-related factors on students' academic achievement in practical Biology. Here's how these interactions are structured:

Independent Variables:

- Instructional Resources: This includes resources like Biology laboratory facilities, physical facilities, and electronic materials.

- Teacher-related Factors: These are factors such as teaching methods, the teacher's knowledge of the subject matter, and the teacher's interpersonal relationship with students.

Dependent Variable:

- Student Academic Achievement: Specifically focused on student performance in Biology practical.

Hypotheses (H_{01}, H_{02}):

- There are hypotheses in this study indicating both singular (independent effect) and joint (combined effect) interactions between the instructional resources and teacher-related factors on the student's academic achievement. The model (adapted) suggests that both instructional resources and teacher-related factors have direct and possibly complex interactions that contribute to students' success in practical Biology sessions Fig 2.1.

2.5 Summary of Gap in Literature Reviewed

The review of literature is based on the following headings: conceptual framework, theoretical framework and review of empirical studies. It is evident that Instructional Resources and teaching methods are vital tools in effective and efficient operation of educational programme. Good Instructional Resources and teaching methods contribute immensely to higher level of educational achievement. From the review it was observed that regardless of the school type, a rich or best teaching methods enhances the smooth learning in the students. Thus, good teaching method is a key to a high performance of education institution. It also discusses the influence of Instructional Resources with regard to quality. The theoretical framework deals with the theories of learning which includes learning models and social learning approach.

Both theoretical and empirical evidence showed that many authors based their studies on specific subject other than Biology. This is primarily due to their areas of interest, both conceptually and computationally. Previous studies such as those carried out, compared one and or two variables other than the variables used in this study in relation to achievement in their study. Hence, there was not a known work that considered the two variables of Instructional Resources and teaching methods in a single study as this present researcher does. This serves as a gap this study stands to cover. Early research in the field showed a variety of inconsistent and conflicting findings. More so, different researchers used different operational definition of term for teaching methods, Instructional Resources and academic achievement. It is this gap that arouses the researcher's interest to undertake a study on the influence of Instructional Resources and teaching method as a determinant on students' academic achievement in Biology practical in secondary schools in Oyo State.

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Chapter Three

Methodology

This chapter explained the methodology and procedures that were used in the study. The main focus of the chapter includes, the research design, the population of the study, sample and sampling techniques, research instrument, validation of the instrument, reliability of the instrument, method of data collection of the instrument, and method of data analysis.

3.1 Research Design

The ex-post facto research design was adopted because it is aimed at determining the existing interactions of Instructional Resources, Teacher related factors and Senior School Students' academic achievement in practical aspect of Biology in Oyo State, Nigeria. Ex-post facto design is one in which the researcher investigates possible cause-and-effect relationship about the current status of the phenomena under investigation by observing an existing state of affairs and searching through the data for possible causal factors. In this type of design, both the effect and alleged causal factors have already occurred and was studied retrospectively without manipulation.

3.2 Population of the Study

In this study, the targeted population consisted of all the eighty-one thousand and eight three students (81,083) in the Senior Secondary School 2 in Oyo State[1].

Table 3.1. Population of Study in the 33 Local Governments in Oyo State

S/N	Local Government Areas	No of Schools in the Local Government	Male	Female	Total
1	Afijio	17	691	697	1388
2	Akinyele	36	2479	2277	4756
3	Atiba	15	1434	1647	3081
4	Atisbo	12	512	498	1010
5	Egbeda	30	2388	2412	4800
6	Ibadan North	42	2735	2875	5610
7	Ibadan North West	13	879	938	1817
8	Ibadan North East	34	2058	1814	3872
9	Ibadan South East	36	2159	2816	4975
10	Ibadan South West	30	2631	2684	5315
11	Ibarapa North	8	355	392	747
12	Ibarapa Central	10	573	662	1235
13	Ibarapa East	11	500	535	1035
14	Ido	26	1180	1122	2302
15	Irepo	6	464	476	940
16	Iseyin	23	1515	1708	3223
17	Itesiwaju	11	353	345	698
18	Iwajowa	9	375	370	745
19	Kajola	16	753	848	1601
20	Lagelu	26	1829	2195	4024
21	Ogbomoso North	15	1704	1580	3284
22	Ogbomoso South	26	947	1020	1967
23	Ogo Oluwa	13	629	447	1076
24	Olorun Sogo	4	342	353	695
25	Oluyole	29	2489	2547	5036
26	Ona Ara	33	2177	2512	4689
27	Oorelope	8	389	376	765
28	Oriire	18	534	522	1056
29	Oyo East	11	876	979	1855
30	Oyo West	11	805	714	1519
31	Saki East	11	313	351	664
32	Saki West	22	1771	2047	3818
33	Surulere	23	773	713	1485
		635	39,612	41,471	81,083

Source[1]

3.3 Sample and Sampling Techniques

Table 3.2 Sample and Sampling Frame

S/N	Local Government	Total No of Schools in the Local Government	No of Schools in the Sampled LG	Gross No of SS2 students in the sampled LG	No of Sampled Students
1	Afijio	17	5	2528	100
2	Ibadan North	42	5	6012	100
3	Ibadan South west	30	5	4398	100
4	Ogbomoso South	26	5	2121	100
5	Oluyole	29	5	4278	100

Source: Fieldwork, 2024

Five hundred (500) respondents formed the sample for this study. Simple random sampling technique was used to select five (5) Local Government Areas (LGA) out of the 33 LGA in Oyo State.

Purposive sampling technique was employed to select 5 secondary schools which had been in operation for the past ten years and who would have a minimum of 20 students each in the science class offering Biology, making 5 schools from each LGA. Therefore, the total schools used for the study were 25 secondary schools altogether. Then 20 students were selected using the disproportionate stratified random sampling technique to arrive at the 500 respondents which formed the sample for the study. The document describes the Sample and Sampling Techniques. The sampling process was carried out in three stages to ensure a representative and well-stratified sample.

The first stage involved the selection of Local Government Areas (LGAs) using a simple random sampling technique. Out of the 33 LGAs in Oyo State, five were randomly selected: Afijio, Ibadan North, Ibadan South West, Ogbomoso South, and Oluyole. In the second stage, secondary schools were chosen through purposive sampling. From each of

the five selected LGAs, five secondary schools were identified, making a total of 25 schools. The schools were selected based on two specific criteria: they had been in operation for at least ten years, and they had a minimum of 20 students in the science class offering Biology. The final stage involved selecting students using a disproportionate stratified random sampling technique. From each of the 25 schools, 20 students were selected, resulting in a total of 500 students. This approach ensured that students from different strata, specifically those in the science class offering Biology, were adequately represented in the sample. Overall, the sample consisted of five LGAs, 25 secondary schools (five from each LGA), and 500 students (20 from each school). This structured approach ensured that the sample was both representative of the population and sufficiently stratified to account for the variability within the schools.

3.4 Description of Research Instrument

The instruments of this study were an adopted 80 -Practical Biology test items of West Africa Senior Secondary Certificate Examination (WASSCE) and with 45 items on a likertscale. The instrument was Instructional Resources and Teacher related factors Questionnaire (IRTRFQ). Hence, the instrument consisted of three sections. Section A consisted of the students' bio-data, sections B, C and D consisted of 45 items on Likert scale measuring Instructional Resources and Teacher Related Factors (IRTRF) while section E consisted of the 80 Practical Biology Test (PBT) items from GCE WASSCE items, adopted from the series of past GCE practical Biology items of the West African Examinations Council approved for publication by the West African Examinations Council, obtained from the head office in Ibadan, Oyo state.

3.5 Validity of Research Instrument

Validity is the ability of the research tools to measure what it is required to measure. A measurement procedure cannot be valid unless it is reliable. Without reliability and validity, it will be very difficult to decide which research should be trusted and which should be completely disregarded.

The process of the Biology content and face validation involved a discussion with three experienced teachers regarding the items of Biology Practical items test that were adopted from the items Bank of the West African Examinations Council alongside the secondary school curricula for Biology. Several criteria were employed during the process. The criteria included: (i) the coverage given in the curriculum specifications, (ii) the suitability of the topics for Biology practical item format (iii) the rating of the topics by the panel. Topics with the weight of 3 were considered to be important topics since they will be given the widest coverage in the curriculum specification of the Ministry, WASSCE and NECO.

After the adoption of the items, those items were given again to the same panel of experienced teachers. It was equally verified by the researcher's supervisor, two WASSCE's chief examiners, two university Biology lecturers and two graduate Biology teachers who confirmed the face validation of the items on the questionnaire and the Practical Biology items. This was necessary to ensure both the content and face validity of BPT and IRTRF instruments.

3.6 Reliability of the Instrument

The instrument, Biology Practical Test (PBT), was used and scored by two independent raters on 30 Biology students who are not part of the selected sample for the

study. Inter-rater reliability was then estimated using Scott's Pi's. The inter-rater reliability index obtained was 0.830 (p<.001), 95%. An inter-rater reliability analysis using Kappa statistics was equally performed to determine consistency among the raters. The inter-rater reliability for the raters was found to be Kappa=.803 (p<.001), 95%. These two values showed that the instrument is reliable for use. The Reliability coefficient of the questionnaire was estimated using Cronbach Alpha method which gave the reliability coefficient value of 0.78. Hence, the reliability coefficient of IRTRF was considered reliable for the study.

3.7 Method of Data Collection

To facilitate data collection, an introductory letter was prepared and sent to all the selected schools in the five LGAs. The letter sought permission from the school authorities to administer the practical Biology test and provided detailed information about the study's objectives, significance, and methodology to promote transparency and cooperation. To ensure the smooth administration of the test, research assistants, primarily Biology teachers from the selected schools, were recruited due to their familiarity with the students and the test content.

The practical Biology test items were adopted from an approved series of past question banks published by WASSCE and administered to the 500 students across the five LGAs in Oyo State. The students were thoroughly briefed by their teachers regarding the purpose of the test. The test, which lasted one hour, was conducted under favorable examination conditions with the assistance of the Biology teachers. The teachers also assisted in administering and collecting the data. Each item on the students' answer sheets was scored dichotomously, with a correct answer receiving a score of 1 and an incorrect answer receiving a score of 0. Additionally, for the analysis of the Item Response Theory

Reliability Function (IRTRF), the options were scored as follows: the first option was allotted 4 marks, the second option 3 marks, the third option 2 marks, and the fourth option 1 mark.

3.8 Method of Data Analysis

In analysing the data that was collected for the study, the research questions were analysed using the descriptive statistics method of mean and standard deviation. Also, the multiple regression was used in testing the stated hypotheses formulated for this study at 0.05 level of significant.

Endnote

1. *Ministry of Education, Science and Technology, Secretariat,* Agodi, Ibadan, 2023.

Chapter Four

Results and Discussion of Findings

The purpose of this study was to find out the influence of Instructional Resources, Teacher Related Factors and Senior School Students' Academic Achievement in Practical Aspect of Biology in Oyo State, Nigeria. For this reason, the opinions of students were sought. This chapter therefore deals with the presentation of data analysis for the study. The results were presented in tables on the basis of the research questions and null hypotheses formulated for the study. Descriptive statistics of mean and standard deviation were used to answer the research questions while multiple regression statistics was used to test the null stated hypotheses at a 0.05 level of significant. The findings were outlined and discussed accordingly.

4.1 Demographic Data Analysis

Gender of the Students

The study sought information on the gender of the respondents. Table 1 presents a summary of the gender distribution for all the categories.

Table 4.1: Demographic Characteristics of Respondents' Gender

Gender	Frequency	%
Male	297	59.4
Female	203	40.6
Total	**500**	**100.0**

Source: Fieldwork, 2024

Out of the 500 respondents, 297 respondents representing 59.4% of the sample represented male while 203 respondents which constitutes 40.6% represented the female participants.

Age of the Respondents

The study sought information on the age of the respondents. Table 2 presents a summary of the age distribution for all the categories.

Table 4.2: Demographic Characteristics of Respondents' Age

Age Group	Frequency	%
11-14 years	55	11.0
15-18 years	439	87.8
19-Above years	06	1.2
Total	**500**	**100.0**

Source: Fieldwork, 2024

For the respondents in table 4.2, majority (87.8%) were aged between 15 and 18 years, while the least (1.2%) were between 19 and above and only (11.0%) were below 15 years.

Class Type of Respondents

The study used 500 SS2 students as the class type of the respondents. The data are presented in the Table 4.3 below.

Table 4.3: Demographic Characteristics of Respondents' Class Type

Class type	Frequency	%
SS2	500	100
Total	**500**	**100.0**

Source: Fieldwork, 2024

4.2 Presentation of Answers to Research Questions

Research Question One: What is the level of academic achievement of Biology practical among secondary school students in Oyo state?

Table 4.4: Descriptive Statistics of Academic Achievement of Students

Items	N	$\bar{x}$	SD	min	max
Biology Practical Achievement Test	500	23.76	11.29	5.00	42.00
Average Total	**500**	**23.76**	**11.29**	**5.00**	**42.00**

Source: Fieldwork, 2024

From the table 4.4 above, it was seen that the mean score is 23.76 while the standard deviation of 11.29 indicates a moderate spread of scores while the minimum scores is 5 and the maximum scores is 42 out of the total score of 80. Overall, the data suggest that there is a moderate level of achievement in Biology practical in Oyo State, with a wide range of scores. This could be due to a variety of factors such as instructional resources and teacher related factors among others.

Research Question Two: What is the availability level of instructional resources for teaching Biology practical in Oyo state?

Table 4.5: Descriptive Statistics on Availability of Instructional Resources

S/N	ITEMS	A(%)	S(%)	O(%)	N(%)	$\bar{x}$	SD
1	Audio/tape recorder and player to facilitate learning in the laboratory.	0.0(0)	0.0(0)	0.0(0)	500(100)	1.00	.000
2	Visual/video recorder is available in the school for field studies.	0.0(0)	0.0(0)	0.0(0)	500(100)	1.06	.391
3	Software, such as slides and films are available for Lesson	6(1.2)	6(1.2)	6(1.2)	482(96.)	1.07	.403
4	The school library is well equipped with recent books.	15(3.0)	6(1.2)	0.0	479(95.)	1.10	.522
5	Projector and television are available in the school	6(1.2)	26(5.2)	6(1.2)	462(92.4)	1.11	.443
6	Computer set as instructional material is available in the school	15(3.0)	7(1.4)	6(1.2)	472(94.4)	1.13	.562
7	Biology practical chemicals such as Iodine, Benedict's solution, Fehling's Solution, Sudan III Solution are available for food tests.	3(0.6)	63(12.)	6(1.2)	428(85.6}	1.17	.447
8	Practical instrument such as pooter, raingauge, thermometer, sweep nets and quadrats are available for teaching Ecology.	9(1.8)	127(25.)	0.0	364(72.)	1.31	.567
9	Biology laboratory is available.	43(8.6)	116(23.)	6(1.2)	335(6.7)	1.51	.889
10	The chalkboard is conducive to write on	49(9.8)	149(29.)	19(3.8)	283(56.)	1.67	.942
11	Instructional materials such as the microscope, potometer, clinostat are available in the laboratory.	23(4.6)	363(72.)	40(8.0)	74(14.)	2.02	.642
12	Charts of various biological activities are well available in the laboratory.	59(11.)	136(27)	175(35.)	130(26.)	2.32	.989
13	The desks and chairs in the classrooms are conducive for learning.	131(26.2)	116 (23.)	84 (16.)	169 (33.)	2.35	1.199
14	The staff room is available and comfortable for lesson planning	138(27.6)	6(1.2)	296(59.)	60(12.)	3.02	.877
15	Models of various organs of the body such as the heart, eye, skeleton, lungs are available to enhance learning	401(80.2)	34(6.8)	0.0	65(13.0)	3.47	1.081
	Average Total					**1.69**	**.662**

A: Always S: Seldom O: Often N: Never
Decision Rule; VH: Very High (3.50 – above); H: High (3.00-3.49); M: Moderate (2.50-2.99); L: Low (Below 2.50)
Source: Field Work, 2024

In Table 4.5, the average mean grade of the questionnaire instrument on the availability of instructional resources scale was **1.6889** which fell within the mean range of below **2.50** which was to a low extent (LE) while the average standard deviation was **0.66** indicating that the respondents were not far from the mean and from one another in their responses. However, the table above revealed that 'models of various organs of the body such as the heart, eye, skeleton, lungs are available to enhance learning' had the highest mean of **3.47** while the least mean was that' Audio/tape recorder and player to facilitate learning in the laboratory' with a mean value of **1.00**. Therefore, the availability level of instructional resources for teaching Biology practical in Oyo state is of a low extent with the average mean of **1.69.**

Research Question Three: What is the level of utilization of instructional resources for teaching Biology practical among secondary schools in Oyo state?

Table 4.6: Descriptive Statistics on Utilization of Instructional Resources

S/N	ITEM	VHU(%)	HU(%)	LU(%)	VLU(%)	$\bar{x}$	SD
1	Software such as slides and films to enhance learning	6(1.2)	0(0.0)	26(8.2)	468(93.6)	1.09	.391
2	Projector And Television are available in the school	0.0(0)	6(1.2)	71(14.2)	423(84.6)	1.17	.403
3	Biology Practical Chemicals such as Iodine, Benedict's Solution, Sudan 111 Solution for food tests	9(1.8)	34(6.8)	6(1.2)	451(90.2)	1.20	.637
4	Visual/video recorder for field studies	33(6.6)	0(0.0)	6(1.2)	461(92.2)	1.21	.750
5	Computer set as instructional material	12(2.4)	27(5.4)	22(4.4)	439(87.8)	1.22	.653
6	Audio recorder and player to facilitate learning	0.0(0)	43(9.4)	38(7.6)	415(83.0)	1.26	.619
7	Practical instrument such us Pooter, Rainguage, Thermometer, Sweep nets and Quadrats for ecological studies	49(9.8)	39(7.8)	9(1.8)	403(80.6)	1.47	.997
8	The Biology Laboratory for Teaching Practical Lessons	21(4.2)	138(27.6)	12(2.4)	329(65.8)	1.70	1.007
9	The school library equipped with recent text books	64(12.8)	18(3.6)	151(30.2)	267(53.4)	1.76	1.012
10	Desks, Chairs, and Stools in Classrooms and Laboratory	49(9.8)	172(34.4)	38(3.6)	241(48.2)	2.06	1.103
11	Instructional materials such as the microscope, potometer, clinostat	50(10.0)	139(27.8)	244(48.8)	67(13.4)	2.34	.834
12	The staff room is comfortable for lesson planning	95(19.0)	148(29.6)	101(20.2)	156(31.2)	2.36	1.113
13	Charts of various biological activities	9(1.8)	447(89.4)	16(3.2)	28(5.6)	2.87	.508
14	Models of various Organs of the body such as the heart, eye, skeleton, lungs	376(75.2)	15(3.0)	13(2.6)	96(19.2)	3.34	1.197
15	The chalkboard is well used by the teacher	330(66.0)	97(19.4)	39(7.8)	34(6.8)	3.45	.902
	Average Total					**1.90**	**.813**

VHU: Very High Use HU: High Use LU: Low Use VLU: Very Low Use
Decision Rule; VH: Very High (3.50 – above); H: High (3.00-3.49); M: Moderate (2.50-2.99); L: Low (Below 2.50)
Source: Field Work, 2024

In Table 4.6, the average mean grade of the questionnaire instrument on the utilization of instructional resources scale was **1.9006** which fell within the mean range of below **2.50** which was to a low extent (L) while the average standard deviation was **0.812**

indicating that the respondents were not far from the mean and from one another in their responses. However, the table above revealed that 'the chalkboard is well used by the teacher' had the highest mean of **3.446** while the least mean was that' software such as slides and films to enhance learning' with a mean value of **1.088**. Therefore, the utilization level of instructional resources for teaching Biology practical in Oyo state is of a low extent with the average mean of **1.901.**

Research Question Four: What is the status of Teacher-related factors on teaching of Biology practical among senior secondary schools in Oyo state?

Table 4.7: Descriptive Statistics on Status of Teacher – Related Factors

S/N	ITEMS	SA(%)	A(%)	D(%)	SD(%)	$\bar{x}$	STD
1	Teacher gives students' input into things and decisions that affect us.	59(11.8)	166(33.2)	99(19.8)	176(35.2)	2.22	1.054
2	Inquiry method infuses fun and engagement by allowing students explore topics on their own, creating their own learning process	85(17.0)	72(14.4)	309(61.8)	34(6.8)	2.42	.849
3	Teacher shows no favouritism	76(15.2)	251(50.2)	120(24.0)	53(10.6)	2.70	.853
4	Students learn transferable skills which reinforce initiative and self-direction	70(14.0)	322(64.4)	102(20.4)	6(1.2)	2.91	.621
5	Teacher knowledge of the subject affect student's achievement in Biology	135(27.0)	303(60.6)	6(1.2)	56(11.2)	3.03	.854
6	Teacher's frequent use of continuous assessment makes him know our progress	200(40.0)	202(40.4)	72(14.4)	26(5.2)	3.15	.855
7	Teacher enjoys working with students	196(39.2)	232(46.4)	36(7.2)	36(7.2)	3.18	.849
8	Teacher's manner of presenting lesson influences students' performance	155(31.0)	315(63.0)	30(6.0)	0	3.25	.555
9	Inquiry method improves the learning ability of the student.	146(29.2)	342(68.4)	6(1.2)	6(1.2)	3.26	.536
10	Inquiry method encourages the learners to explore and share ideas	148(29.6)	352(70.4)	0	0	3.30	.457
11	Teacher has broad knowledge in biology which motivates my learning	217(43.4)	245(49.0)	38(7.6)	0	3.36	.618
12	Teacher makes effort to listen to student's views.	238(47.6)	222(44.4)	34(6.8)	6(1.2)	3.38	.667
13	Teacher's presentation of the instructional materials influences my ability to learn	269(53.8)	203(40.6)	28(5.6)	0	3.48	.602
14	Teacher accepts students' individuality.	328(65.6)	137(27.4)	9(1.8)	26(5.2)	3.53	.773
15	My teacher uses inquiry method which is a scientific practice that allows students to participate in problem solving	362(72.4)	99(19.8)	3(0.6)	36(7.2)	3.57	.831
	Average Total					**3.12**	**.735**

SA: Strongly Agree (4); A: Agree (3); D: Disagree (2); SD: Strongly Disagree (1)
Decision Rule; VH: Very High (3.50 – above); H: High (3.00-3.49); M: Moderate (2.50-2.99); L: Low (Below 2.50)

Source: Field Work, 2024

In Table 4.7, the average mean grade of the instrument on the status of teacher-related factors on teaching of Biology practical among senior secondary schools in Oyo state was **3.116** which obtained a mean score above 2.50 which was to a high level (H) while the average standard deviation was **0.732** indicating that the respondents were not far from the mean and from one another in their responses. However, the table above revealed that 'my teacher uses inquiry method which is a scientific practice that allows students to participate in problem solving' had the highest mean of **3.574** while the least mean was that' teacher gives students input into things and decision that affect us' with a mean value of **2.216**. Therefore,the status of Teacher-related factors on teaching of Biology practical among senior secondary schools in Oyo state is of a high level with the average mean of **3.116**.

Table: 4.8 Summary of Results

S/N	Items	N	$\bar{x}$	SD	Remarks
1.	Availability level of instructional resources	500	1.69	.66	Low
2.	Level of utilization of instructional resources	500	1.90	.81	Low
3.	Status of Teacher-related factors	500	3.12	.73	High
Grand weighted means			**2.24**		**Low**

Source: Fieldwork, 2024

With the above threshold, the independent variables of Instructional Resources and Status of Teachers Factors of 2.24 range below 2.50 which is a low extent.

4.3 Hypotheses

$H_0$1: There will be no significant joint contribution of instructional resources and

Teacher-related Factors on students' academic achievement in Biology practical in senior secondary schools in Oyo state.

Table 4:9 Summary of Regression Analysis showing the Joint Contribution of Teacher- factors, Utilization of Instructional materials and Availability of Instructional Materials on Students' Academic Achievement in Biology Practical

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.171[a]	.029	.023	11.1469

a. Predictors: (Constant), Teachers factors, utilization of instructional materials and Availability of Instructional Materials on students' academic achievement in Biology practical

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1867.209	2	933.605	7.514	.000[b]
	Residual	61751.023	497	124.248		
	Total	63618.232	499			

a. Dependent Variable: Practical Biology Achievement Test

b. Predictors: (Constant), Utilization & Availability of Instructional Materials and Teacher Factors

Source: Field work, 2024

Table 4.9 shows the regression correlation (R) among instructional resources and teachers factors on students' academic achievement in Biology practical. The results show that the regression correlation (R) is **0.171**, R square equals **0.029** and Adjusted R square equals **0.023**. This implies that the combination of the variables (independent variables) contributed **2.3%** to the variation on students' academic achievement in Biology Practical in Oyo State.

Further verification using analysis of variance (ANOVA) produced $F_{(2, 497)}$ equals 7.514; $p<.05$. Therefore, by implication, the stated hypothesis is rejected. This implies that the linear relationship among the combined variables and students' academic achievement in Biology practical is significant. This means that there is a significant joint

contribution of instructional resources (Biology laboratory, physical facilities and electronic materials) and Teachers-Related Factors (Teaching methods, interpersonal relationship and Teacher's on students' academic achievement in Biology practical in senior secondary schools in Oyo state.

Table 4.10: Summary of Regression Analysis showing Relative Influence of Instructional Resources and Teacher-Related Factors on Students' Academic Achievement in Biology Practical in Senior Secondary Schools in Oyo State

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	43.750	5.370		8.146	.000
	Teachers Factors	-.284	.107	-.119	-2.653	.008
	Instructional resources	-.125	.053	-.106	-2.380	.018

a. Dependent Variable: Practical Biology Achievement Test

Table 4.10 presents the coefficients that indicate the influence of the factors (Instructional Resources and Teacher related factors) on students' achievement in Biology practical in Oyo state. The result shows contribution of the variables factors as indicated by standardized Beta (B) weights in order of magnitude; teachers factors contributed most to students' achievement in Biology practical with **B=.-119, t=-2.653; p<.05** while Instructional resources was next with **B=.-106, t= -2.380; p<.05**. The analysis of the result shows that the independent variables of Instructional materials and Teachers Factors have significant influence on students' achievement in Biology Practical.

4.4 Discussions of Findings

This section presents discussion on the findings of the study with respect to the influence of instructional resources and teacher related factors on the academic achievement of student in the teaching and learning of Biology practical in Ibadan, Oyo state. The two hypotheses were derived from independent and dependent variables of the study.

The hypothesis which sought the significant joint contribution of instructional resources and teacher-related factors on students' academic achievement in Biology practical in senior secondary schools in Oyo state revealed that there existed a joint influence of all the variables on student achievement in Biology practical. From the result of hypothesis one, it was clear that significant joint influence of all the independent variables on students' achievement existed. This means instructional resources and teacher related factors jointly influence students' achievement in Biology practical in secondary schools in Oyo state. This is in line with the opinions of some scholars who said that instructional resources and environment play a positive role in student achievement [1,2,3,4,5].

The analysis of hypothesis two which sought the significant relative influence of instructional resources and teacher – related factors on students' academic achievement in Biology practical in senior secondary schools in Oyo state revealed that it existed. This means that instructional resources and teacher related factors has singular influence individually on students' achievement in Biology practical in secondary schools in Oyo state. This is in congruent with scholars' views that individual factors such instructional resources, teacher related factors have positive relationship with students' achievement in schools [1, 2,4,5,6,7,8]. This was substantiated by some scholars findings' too[10,11,12,13]. These were of the opinion that those factors had level of impact on students' achievement in Biology. They said that the academic achievement of a school child in any school subject can be attributed to many factors[10,11]. It was stressed by a scholar that the factors responsible for this low achievement could be associated to socio-economic, gender, school environment, poor teaching strategies and minimum equipment as well as fund[9,12]. These factors as expressed by these researchers could contribute positively or negatively to the academic attainment of a school child in Biology practical.

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Chapter Five

Conclusion

This chapter presents summary of the major research findings and conclusions of the study. The chapter also presents recommendations, contribution to knowledge and suggestions for further researches.

5.1 Summary of the Findings

The study investigated the influence of instructional resources and teachers related factors on students' academic achievement in Biology practical in secondary schools in Oyo state. Four research questions were posed and answered, and two hypotheses were tested at a significance level of .05. The ex post facto research design was employed, with a sample of 500 students. Data collection was conducted using the "Instructional Resources and Teacher-Related Factors Scale" (IRTRFS) and the Practical Biology Test (PBT). Both instruments underwent face and content validity checks. The reliability of the PBT, determined through inter-rater reliability, was 0.830 ($p<.001$), 95%, and Kappa statistics indicated rater consistency at Kappa=.803 ($p<.001$), 95%. The Cronbach's Alpha index for the questionnaire was 0.78. Multiple regression analysis revealed an R value of .171, R^2 of .029, and Adjusted R^2 of .023, indicating that the independent variables accounted for 2.3% of the variance in students' Biology practical performance. ANOVA results showed $F(2, 497) = 7.514$; $p<.05$. Standardized Beta (B) weights indicated significant contributions of teacher-related factors ($B = -0.119$, $t = -2.653$; $p<.05$) and instructional resources ($B = -0.106$, $t = -2.380$; $p<.05$) to student achievement. The

findings demonstrate that both variables significantly influence students' performance in Biology Practical. It is recommended that the government enhance support for schools through the provision of instructional resources and materials and offer teachers hands-on training opportunities. Thus, the following are the summary of the finding of the study; there is a significant joint influence of Instructional materials and teacher related factors on students' academic achievement in Biology in Secondary Schools in Oyo State. Similarly, there is a significant relative influence of Instructional materials and teacher related factors on students' achievement test in Biology in Secondary Schools in Ibadan.

5.2 Conclusion

The study reviewed all revealed a noteworthy correlation between instructional resources and teacher related factors of teaching on students' academic achievement in Biology practical in Oyo State. It is believed that adequate instructional resources which are accessible and utilizable for the teaching will guarantee effective teaching and learning process as well as academic achievement of students in Biology practical. On the basis of these research findings, the study has proven that there existed a joint influence of all the variables on student achievement in Biology practical. It also established the fact that there existed the relative influence of the independent variables on students' achievement in Biology practical. This means that instructional resources and teacher related factors has singular influence individually on students' achievement in Biology practical in secondary schools in Oyo state. Consequently, there is the ardent need for the government and relevant stakeholders in the educational system to intensify efforts towards creating instructional resources and teacher related factors that are learners-centered, knowledge-centered and assessment-centered.

5.3 Recommendations

The instructional resources and teacher related factors are supposed to be promoting students' achievement in schools. In the light of this and on the basis of the conclusion stated above, the researcher wishes at this juncture, to make the following recommendations.

1. In order to enhance students' achievement, government should provide resources and support for schools in terms of instructional resources and materials.
2. There is need to appropriately fund educational sectors to enable the sector acquire the necessary facilities to make the learning attainable in order to meet the educational goal in Oyo state.
3. Teachers should be trained and retrained on the use of Hands-on equipment in the laboratories. This will help to familiarize them and the students with the innovative trend in the STEM world which will enhance quality assurance in the educational system in Oyo state.
4. The teachers who are the link between teaching and learning in our school systems should be encouraged the more by all stakeholders on the teaching of Biology Practical.

5.4 Contribution to Knowledge

This study makes a significant contribution to knowledge by demonstrating that both instructional resources and teacher-related factors play crucial roles in influencing students' academic achievement in Biology practicals, both independently and collectively. The study specifically examines the impact of resources such as Biology laboratories, physical facilities, and electronic materials, as well as teacher-related factors like teaching methods, interpersonal relationships, and teachers' subject matter expertise.

By addressing gaps in the existing literature that previous studies did not, this research provides new insights.

The findings reveal that the instructional resources commonly available for teaching Biology in secondary schools in Oyo State are generally inadequate. Furthermore, the study shows that the utilization of these resources in enhancing students' academic achievement in Biology practicals is limited. In contrast, the influence of teacher-related factors on students' academic performance in Biology practicals is found to be significant. This indicates that while instructional resources are lacking, the role of the teacher remains a critical factor in determining students' success in Biology practicals.

5.5 Suggestions for Further Studies

Based on the findings and conclusions of this study, and acknowledging that not all aspects were covered, several recommendations for further research are proposed. Firstly, a similar study should be conducted in other southwestern zones to determine whether the independent variables, such as instructional resources and teacher-related factors, influence students' achievement in Biology practicals and other subjects in secondary schools. Secondly, research could be carried out on the impact of school physical facilities in enhancing students' achievement. Lastly, a study assessing the effectiveness of the inquiry method of teaching by teachers in primary schools is also recommended.

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Appendix I

Questionnaire for students

Dear Respondent,

This Research tends to examine the Instructional Resources, Teacher-related Factors and Students' Academic Achievement in Practical Aspect of Biology in Oyo State. This research work will only be used for academic purpose. Responses will absolutely be made confidential.

Please, tick the space (√) provided in front of the option that best fits your responses to the questions below.

Section A: Bio- data

1. Gender: Male ( ) Female ( )
2. Age: 11 - 14 ( ) 15 - 18 ( ) 19 and above ( )
3. Class type ……SS2…….

Section B.

Availability of Instructional Material Questionnaire (AIMQ)

Please, tick the space (√) provided in front of the option that best fits your responses to the questions below.

Key: Always= A, Often = O, Seldom=S, Never =N

S/N	Items	Always	Often	Seldom	Never
1.	**Biology Laboratory Facilities** Charts of various biological activities are well available in the laboratory.				
2.	Instructional materials such as the microscope, potometer, clinostat are available in the laboratory.				
3.	Practical instrument such as pooter, raingauge, thermometer, sweep nets and quadrats are available for teaching Ecology.				
4.	Models of various organs of the body such as the heart, eye, skeleton, lungs are available to enhance learning.				
5.	Biology practical chemicals such as Iodine, Benedict's solution, Fehling's Solution, Sudan III Solution are available for food tests.				
6.	**Physical Facilities** Biology laboratory is available.				
7.	The desks and chairs in the classrooms are conducive for learning.				

8.	The school library is well equipped with recent books.				
9.	The chalkboard is conducive to write on.				
10.	The staff room is available and comfortable For lesson planning.				
11.	**Electronic facilities** Projector and television are available in the school.				
12.	Audio/tape recorder and player to facilitate learning are in the laboratory.				
13.	Computer set as instructional material is available in the school.				
14.	Visual/video recorder is available in the school for field studies.				
15.	Software, such as slides and films are available for lesson.				

Section C

Utilization of Instructional Material Questionnaire (UIMQ)

Please, tick the space (√) provided in front of the option that best fits your responses to the questions below.

Key: Very High Utilization-VHU, High Utilization-HU, Low Utilization-LU Very Low Utilization-VLU

S/N	Items	UHU	HU	LU	VLU
1.	**Biology laboratory facilities** Charts of various biological activities.				
2.	Instructional materials such as the microscope, potometer, clinostat				
3.	Practical instrument such us Pooter, Raingange, Thermometer, Sweep nets and Quadrats for ecological studies				

4.	Models of various Organs of the body such as the heart, eye, skeleton, lungs				

S/N	ITEMS	UHU	HU	LU	VLU
6.	PHYSICAL FACILITIES **Physical facilities** The Biology Laboratory For Teaching Practical Lessons.				
7.	Desks, Chairs, and Stools in Classrooms and Laboratory				
8.	The school library equipped with recent text books				
9.	The chalkboard is well used by the teacher				
10.	The staff room is comfortable for lesson planning				
11.	**Electronic Facilities** Project And Television as Instructional Materials				
12.	Audio recorder and player to facilitate learning				
13.	Computer set as instructional material				
14.	Visual/video recorder for field studies				
15.	Software such as slides and films to enhance learning				
5.	Biology Practical Chemicals such as Iodine, Benedict's Solution, Sudan 111 Solution for food tests				

Section D

Teacher Factors Questionnaire (TFQ)

Please, tick the space (√) provided in front of the option that best fits your responses to the questions below.

KEY: Strongly Agree = SA, Agree = A, Disagree = D, Strongly Agree = SD

N/S	Items (My)	SA	A	D	SD
1.	**Teacher knowledge of subject matter** Teacher knowledge of the subject affect student's achievement in biology				
2.	Teacher's presentation of the instructional materials influences my ability to learn				
3.	Teacher has broad knowledge in biology which motivates my learning				
4	Teacher's manner of presenting lesson influences students' performance				
5	Teacher's frequent use of continuous assessment makes him know our progress				

N/S	Items (My)	SA	A	D	SD
6.	**Interpersonal Relationship** Teacher makes effort to listen to student's views.				
7.	Teacher gives students' input into things and decisions that affect us.				
8.	Teacher enjoys working with students.				
9.	Teacher shows no favoritism.				
10.	Teacher accepts students' individuality.				
11.	**Teaching Methods** My teacher uses inquiry method which is a scientific practice that allows students to participate in problem solving.				
12.	Inquiry method encourages the learners to explore and share ideas.				
13.	Inquiry method infuses fun and engagement by allowing students explore topics on their own, creating their own learning process.				
14.	Inquiry method improves the learning ability of the student.				
15.	Students learn transferable skills which reinforce initiative and self-direction.				

Appendix II

Section E: Biology Achievement Test (BAT)

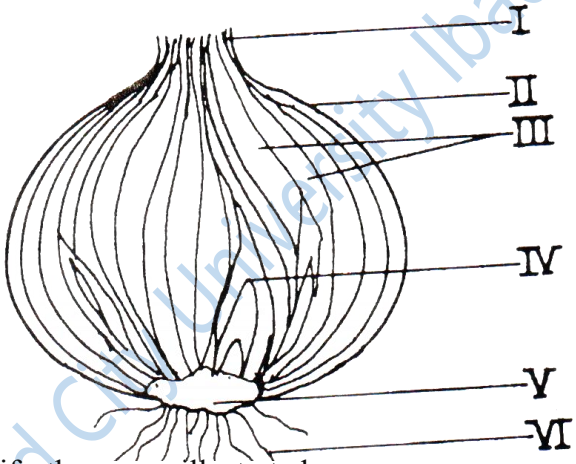
Duration: 90 minutes

Introduction on Biology Achievement Test (BAT)

Answer all the questions

1. The diagram below is an illustration of the longitudinal section of a plant organ.

a) Study it carefully and answer questions 1(a)(i) to 1(a)(vi).



(a) (i) Identify the organ illustrated……1 mark

(ii) Name the class to which the plant organ belongs ……1 mark

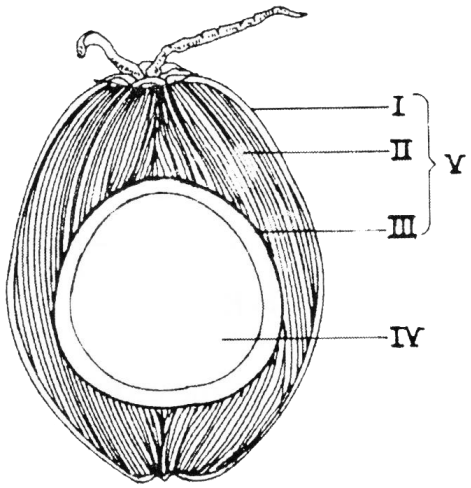
(iii) State two reasons for the answer in (a)(ii)……2 marks

(iv) Name the parts labelled I to VI ……3 marks

(v) In which of the labelled parts is food stored?.....1 mark

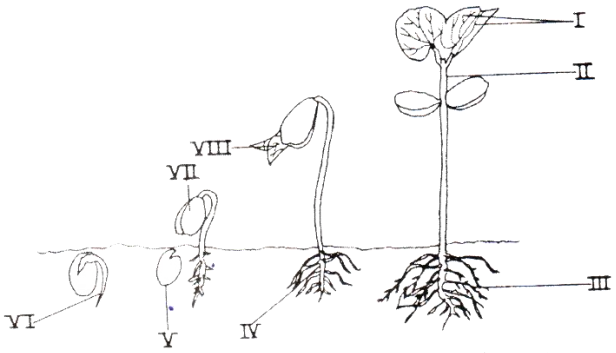
(vi) State one function each of the parts labelled II, III, VI ?.....3 marks

(b) The diagram below is an illustration of a fruit
Study it carefully and answer questions (b)(i) to (b)(vii)



(i) Name the parts labelled I to IV ……2 marks
(ii) State one function each of the parts labelled I and II……..2 marks
(iii)Name the type of fruit illustrated……1 mark
(iv)State two reasons for the answer in (b) (iii)……2 marks
(v) Name two examples of plants having fruit similar to the one illustrated.2mks
(vi)Suggest two agents of dispersal of the fruit……2marks
(vii) State three ways in which the fruit is of Importance to humans……..3marks

2. The diagram below is an illustration of a process in flowering plants.
Study it carefully and answer questions 4(a) to (d)



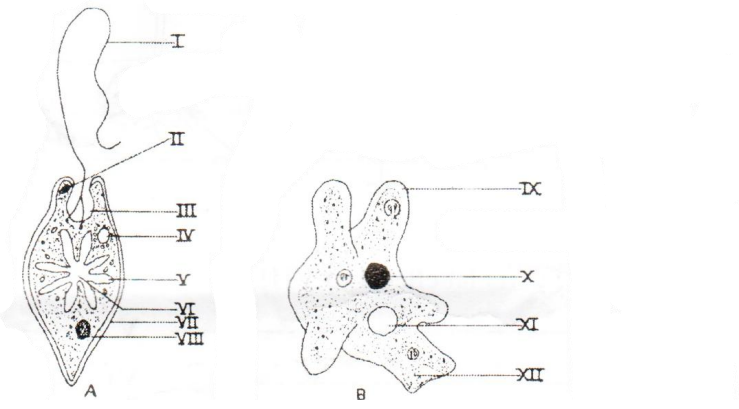
(a) (i) Name the parts labelled I to VIII……4 marks
(ii) State one function each of the parts labelled I, IV, VI, VII……..4 marks

(b) (i) Name the type of germination illustrated……1 mark
(ii) Name three examples of seeds that can give rise to the type of germination illustrated …….3 marks
(iii) explain briefly the process of germination illustrated in the diagram…….7 marks

(c) (i) Which labelled part in the diagram stores food?.....1 mark
(ii) Suggest the food substance likely to be present in part named (c) (ii)…….1 mark

(d) State four conditions necessary for the process illustrated by the diagrams to take place……4 marks

3. The diagrams below illustrate simple microscopic organisms.
Study them and answer questions 3(a) to (f)



(a) Identify organisms A and B ……2 marks

(b) (i) Name the parts labelled I to XII…….6 marks

(ii) State one function each of the parts labelled III, IV, V and X……..4 marks

(iii) Which of the labelled parts is used for movement by each of organisms A and B…2 marks

(c) Name the habitats of each of organisms A and B…….2 marks

(d) (i) Name the kingdom and phylum of each of organisms A and B…….4 marks

(ii) Give one reason each for the answers in (d) (i)……4 m

(e) State one method of :

1 Asexual reproduction……1 marks

(ii) Sexual reproduction in organism A……1 marks

2 (i) State two differences between organisms A and B……2 marks

(ii) State two similarities between organisms A and B……2 marks

Rating Scale

BIOLOGY ACHIEVEMENT TEST (BAT)

Prosodic	0	1	2	3	4	5	Total
Q1							
Q2							
Q3							
Q4							
Q5							
Q6							
Q7							
Q8							
Total							80

Inter-rater Reliability Coefficient of Scott's Pi

Statistics

rater_diff

N	Valid	80
	Missing	0

rater_diff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-1.00	15	5.6	5.6	5.6
	.00	35	**83.3**	**83.3**	88.9
	1.00	15	5.6	5.6	94.4
	2.00	15	5.6	5.6	100.0
	Total	80	100.0	100.0	

Inter-rater Reliability Coefficient of Kappa

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Measure of Agreement	Kappa	**.806**	.104	8.871	.000

N of Valid Cases	80			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

rater1 * rater2 Cross tabulation

Count

		rater2										Total
		10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	
rater1	10.00	1	0	0	0	0	0	0	0	0	0	1
	11.00	0	1	0	0	0	0	0	0	0	0	1
	12.00	0	0	2	0	0	0	0	0	0	0	2
	13.00	0	0	0	1	0	0	0	0	0	0	1
	14.00	0	0	0	0	3	0	0	0	0	0	3
	15.00	0	0	0	0	0	2	0	0	0	0	2
	16.00	0	0	0	0	1	0	3	1	0	0	5
	17.00	0	0	0	0	0	0	1	0	0	0	1
	18.00	0	0	0	0	0	0	0	0	1	0	1
	19.00	0	0	0	0	0	0	0	0	0	1	1
Total		8	10	7	5	6	12	14	8	5	5	80

Frequencies

Statistics

		Gender	Age	class type
N	Valid	500	500	500
	Missing	0	0	0
Mean		1.4060	1.9020	2.0000
Median		1.0000	2.0000	2.0000
Std. Deviation		.49158	.33559	.00000

Frequency Table

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	297	59.4	59.4	59.4
	FEMALE	203	40.6	40.6	100.0
	Total	500	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	11-14yrs	55	11.0	11.0	11.0
	15-18yrs	439	87.8	87.8	98.8
	19-above yrs	6	1.2	1.2	100.0

Total	500	100.0	100.0	

class type

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid SS2	500	100.0	100.0	100.0

DESCRIPTIVES VARIABLES=AIM1 B2 B3 B4 B5 PFB6 B7 B8 B9 B10 CEF11 B12 B13 B14 B15

/STATISTICS=MEAN STDDEV

/SORT=MEAN (A).

Descriptives

Descriptive Statistics

	N	Mean	Std. Deviation
Audio/tape recorder and player to facilitate learning are in the laboratory.	500	1.0000	.00000
Visual/video recorder is available in the school for field studies.	500	1.0600	.39078
Software, such as slides and films are available for lesson.	500	1.0720	.40391
The school library is well equipped with recent	500	1.1020	.52167

books.			
Projector and television are available in the school.	500	1.1120	.44255
Computer set as instructional material is available in the school.	500	1.1280	.56236
Biology practical chemicals such as Iodine, Benedict's solution, Fehling's Solution, Sudan III Solution are available for food tests.	500	1.1680	.44741
Practical instrument such as pooter, raingauge, thermometer, sweep nets and quadrats are available for teaching Ecology.	500	1.3080	.56726
Biology laboratory is available.	500	1.5140	.88960
The chalkboard is conducive to write on.	500	1.6680	.94210
Instructional materials such as the microscope, potometer, clinostat are available in the laboratory.	500	2.0240	.64207
Charts of various biological activities are well available in the laboratory.	500	2.3260	.98878
The desks and chairs in the classrooms are conducive for learning.	500	2.3540	1.19647
The staff room is available and comfortable	500	3.0240	.87690

for lesson planning			
Models of various organs of the body such as the heart, eye, skeleton, lungs are available to enhance learning.	500	3.4740	1.08058
Valid N (listwise)	500		

Descriptives

Descriptive Statistics

	N	Mean	Std. Deviation
Software such as slides and films to enhance learning	500	1.0880	.39059
Project And Television are available in the school	500	1.1660	.40345
Biology Practical Chemicals such as Iodine, Benedict's Solution, Sudan 111 Solution for food tests	500	1.2020	.63719
Visual/video recorder for field studies	500	1.2100	.75035
Computer set as instructional material	500	1.2240	.65321
Audio recorder and player to facilitate learning	500	1.2640	.61893
Practical instrument such us Pooter, Raingange, Thermometer, Sweep nets and Quadrats for	500	1.4680	.99748

ecological studies			
The Biology Laboratory For Teaching Practical Lessons	500	1.7020	1.00758
The school library equipped with recent text books	500	1.7580	1.01266
Desks, Chairs, and Stools in Classrooms and Laboratory	500	2.0580	1.10321
Instructional materials such as the microscope, potometer, clinostat	500	2.3440	.83370
The staff room is comfortable for lesson planning	500	2.3640	1.11265
Charts of various biological activities.	500	2.8740	.50857
Models of various Organs of the body such as the heart, eye, skeleton, lungs	500	3.3420	1.19662
The chalkboard is well used by the teacher	500	3.4460	.90150
Valid N (listwise)	500		

Descriptives

Descriptive Statistics

	N	Mean	Std. Deviation
Teacher gives students' input into things and decisions that affect us.	500	2.2160	1.05431
Inquiry method infuses fun and engagement by allowing students explore topics on their own, creating their own learning process.	500	2.4160	.84875
Teacher shows no favoritism.	500	2.7000	.85291
Students learn transferable skills which reinforce initiative and self-direction.	500	2.9120	.62050
Teacher knowledge of the subject affect student's achievement in biology	500	3.0340	.85458
Teacher's frequent use of continuous assessment makes him know our progress	500	3.1520	.85461
Teacher enjoys working with students.	500	3.1760	.84998
Teacher's manner of presenting lesson influences students' performance	500	3.2500	.55508
Inquiry method improves the learning ability of the student.	500	3.2560	.53576
Inquiry method encourages the learners to	500	3.2960	.45695

explore and share ideas.			
Teacher has broad knowledge in biology which motivates my learning	500	3.3580	.61855
Teacher makes effort to listen to student's views.	500	3.3840	.66741
Teacher's presentation of the instructional materials influences my ability to learn	500	3.4820	.60200
Teacher accepts students' individuality.	500	3.5340	.77333
My teacher uses inquiry method which is a scientific practice that allows students to participate in problem solving.	500	3.5740	.83060
Valid N (listwise)	500		

Bio-data

A. Personal Data

- **Full Name:** Olumide Temitayo AKINPELU
- **Address:** SW9/1003F Emiola Street, Babalola Estate, Odo-Ona Elewe, Orita Challenge Ibadan
- **Email:** Olumideakinpelu12@gmail.com
- **Phone Number:** 08055933448
- **Date of Birth:** 26th December, 1967, Oyo State
- **Nationality:** Nigerian
- **Marital Status:** Married
- **Name of Next of Kin:** Kathryn Akinpelu
- **Address of Next of Kin:** SW9/1003F Emiola Street, Babalola Estate, Odo-Ona Elewe, Orita Challenge Ibadan.

B. Educational Background

1. Educational Institutions Attended with Dates and Qualification:

i. Primary Education

1974-1978 Government Primary School, Owo, Ondo State

ii. Secondary Education

1978 -1983 St Louis Girls Grammar School, Ikere Ekiti, Ekiti State, Nigeria

iii. Higher Educational Institutions Attended with Dates & Qualification

1983-1987 University of Ife, Now Obafemi Awolowo University, Ile Ife, Osun State (B.Sc. Botany)

2004 PGD University o Ado-Ekiti

C. **Work Experience with Date**

1989-2024 Oyo State Teaching Service Commission (TESCOM)

Secretariat, Ibadan

D. Awards and Fellowship: NIL

E. Membership of Academic Professional Bodies

TRCN	Teachers Registration Council of Nigeria

F. **Publication(s):** NIL

G. **Major Conferences Attended with Dates**

2024	Mental Wellness: Cure for Nigeria's Challenges
2024	Dynamics of a Good Research Problem: Statements and Plausible Recommendations for New Knowledge

H. **Names and Addresses of Referees**

1. Professor P.O Yara
   Head of Department **of Science Education**
   Faculty of Education
   Lead City University, Ibadan, Oyo State

2. Ass. Professor U.E Akuche
   Science Education
   Faculty of Education,
   Lead City University, Ibadan, Oyo State

I. _____ _____

Signature **Date**

The University Compliance Certification

This is to Certify that this Thesis written by: Olumide Temitayo AKINPELU with Matric No: **LCU/PG/003013** in the Department of Arts and Social Science Education, Faculty of Education, Lead City University, Ibadan is in compliance with the approved University format and style.

…… …….

Signature Date

Olumide Temitayo, AKINPELU LCU/PG/003013 LCU Library

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