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EFFECTS OF BIOLOGY PRACTICAL ACTIVITIES ON THE ACADEMIC ACHIEVEMENT OF O LEVEL BIOLOGY STUDENTS: A CASE STUDY OF MUDZI SECONDARY SCHOOL IN MUDZI DISTRICT.

BY

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DEDICATION

I dedicate my dissertation work to my family and friends. A special feeling of gratitude, to my loving parents whose words of encouragement always ring in my ears. My loving husband Victor Mhembere for his unwavering support as well as my lovely children McMillian and Malcolm for being my source of strength.

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The success of this project is in the hands of the father who art in heaven **GOD**.

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ABSTRACT

The aim of the study was to examine the effects of biology practical activities on the academic achievement of O level Biology students at Mudzi secondary school. The research used a mixed method approach design. The study direction was provided by three research questions and one hypothesis. A random sample of 40 students , two teachers and one H.O.D were taken from the entire form 4 biology class. Pre and post test for students , as well as interviews with teachers and the H.O.D were used as data collection tools. The senior H.O.D and two other teachers validated the equipments. Mean and standard deviations were used to answer the study questions, and the 2 sample z test at 5% significant level was used to test the hypothesis. The findings of the study demonstrated that biology students who were taught through hands on approach activities outperformed those who were instructed through lecture method. Inoder to improve leaner performance , the researcher advised teachers to incorporate practical exercises into their biology lessons. This study also implies a need to provide schools with necessary equipment for doing practical work; to appoint sufficient teachers with higher studies and training that includes practical work in biology , to set up classrooms with a smaller number of students; and to develop awareness of the value of practical work among school administration and among Biology teachers.

LIST OF ACRONYMS

O' level	Ordinary level
ZIMSEC	Zimbabwe Schools Examination Council
EG.	Experimental group
CG.	Control group

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CHAPTER 1:

INTRODUCTION.

1.0 Introduction

This chapter of the research provided an overview of the study, background of the study, statement of the problem. Also under discussion in the section were the research objectives, research questions, significance of the study, assumptions, delimitations, limitations and definition of terms.

1.1 Background of the study.

Every nation must maintain its social, economic, and technological development in order to remain competitive in the modern world. People lacking science literacy find it extremely difficult to live in modern society because the advancement of science has influenced and controlled every element of human activity throughout the years (Chinyere, Bedia, David, Amba and Hope 2014). A required subject for many academic professions is biology, one of the science education subjects. It makes a significant contribution to a country's technical advancement. These professions include nursing, biotechnology, bioinformatics, agriculture, and medicine. The study of biology also aids in the search for scientific remedies for a number of issues the world is currently facing, such as diseases, medication resistance, pollution, climate change and global warming.

Biology concepts, subjects, and processes are seen to be challenging for secondary school pupils, which has an impact on their motivation to learn and academic success (Cimer, 2012). The lack of practical activities and experiments in biology lectures, according to the author, is one of the reasons why students struggle in the subject of biology. Researchers like Millar and Abrahams (2009) and Ude and Ebuoh (2019) have suggested that students' comprehension levels are increased when science (Biology) lessons are taught through hands-on activities and experiments. The topic of practical exercises in Biology and student involvement is still up for debate, despite a few studies about their impact on student performance and attainment having been conducted internationally.

The necessity to investigate student engagement arises from the fact that it is a crucial concept in the teaching and learning process. According to Chapman and Elaine (2003), students who are engaged put more effort into carrying out learning tasks, and it is highly challenging for an educational system that doesn't respect student engagement to achieve successful outcomes (Gunuc & Kuzu, 2016). The writers emphasized the importance of student engagement for learning, performance, and academic success.

Teaching involves more than just talking, as L. Onah (1994) emphasized. When used properly to illustrate the subject matter, resources like diagrams, field studies, and actual objects are as good as or even better than lectures. The laboratory is the ideal setting for successful practical activity. Without practicals , biology, one of the science courses, cannot be taught or learned properly. According to Iloeje (2005), the sense of sight is the highest functioning of the five sense organs and is employed the most frequently in biology practical activities. Kildare and Okoro (2007) found that students comprehend concepts more fully when they participate in practical experiments and analyze the outcomes, since this helps them to retain the information as well Kildare and Okoro (2007) found that students comprehend better when they participate in practical experiments and get their findings. This helps students remember the steps needed and also makes them feel good of themselves for getting the right answers highlighting the requirement to align theory with practice. According to Chukwu (2009), practical experience is insufficient for a successful study of biology. He emphasizes how important it is for students to participate in a variety of practical tasks. Biology's theoretical and applied aspects don't need to be taught separately; rather, they should be taught as integral parts of a subject.

The definition of biology as a science discipline is "the study of life and structure of living things." Biology is the study of living things, and it is concerned with the structure, behavior, origins, distribution, and interactions between living things and their environments. According to Abugu (2007), biology is a natural science where we study living things like plants and animals. Iloeje (1981) further viewed biology as the field of study for living things. According to the aforementioned assertion, man lives in a unique planet with a variety of nearby flora, animals, rivers, oceans, mountains, and deserts. Being a naturally curious being, man enjoys learning about and understanding the world around him. Man is a curious creature who enjoys discovering new things. He strives to have a comprehensive understanding of the universe and

investigates the origin, nature, traits, and other features of everything around him. Man asks many questions in his quest for knowledge, so he must be methodical and objective in his approach. He uses experimentation and observation, which are essential to science, to accomplish his purpose. Biology is a practical subject taught in secondary schools like other science courses. In order to improve effective training and understanding of the subject, biology simplified the theoretical content more than any other science. According to Allan, Rob, and Jonathan (2000), the emphasis on practical biology activities stems from the notion that actual science knowledge is preceded by practical activity. Knowledge gained through practical work and experience promotes long-term memory, which theory alone cannot do. For this reason, it is evident that a learner acquired more in any science lesson, if given the opportunity to do activities, ranging from manipulating apparatus, classifying, designing, experimenting, and hypothesizing. Practical work stimulates learner interest in the science subject they are studying. Therefore, there is an urgent and significant requirement to support the disclosure of the students' biology practical activities and research their impact on students' biology achievement. Unfortunately, the bulk of our secondary schools and pupils exhibit an awful condition where children are not exposed to practical tasks. This is a factor in biology students' ongoing performance issues.

According to Eze (1995), biology is one of the science subjects that helps students develop their capacity for accurate observation. However, some teachers purposefully avoid using practicals in their biology lessons, despite the fact that they are vital to the subject's instruction. They do this because using laboratory tools takes a lot of time. Biology practical work helps students use their knowledge and skills acquired in the real world outside of the classroom. Biology education should be based on the skills, knowledge, and experiences that students develop through participation in practical. According to Opul, Ezeh, and Ezemagu (2008), practical work has received a lot of attention because there is no substitute for it. Therefore, it is now essential to determine the level of academic achievement in biology practical activities. Researchers have accused a number of factors of being to blame, and a key one is the teacher factor. The lack of the school administration to provide resources and equipment for practical work, as well as teachers' failure to realize the significance of practical work in science teaching, have all been cited as reasons for the neglect of the practical part of biology in schools. A thorough theoretical and practical understanding of biology is required for the management of our natural resources,

the provision of good health facilities, an adequate supply of food, and a favorable living environment, according to Aniodoh (2001). As a result, biology instruction and learning must be promoted in the classroom.

A timetable for Ordinary Level Biology in Zimbabwe must include at least two theory hours and four practical periods per week, according to a Ministry of Education Circular. Science subjects should be taught in a way that enables every student to frequently engage in direct practical experimentation, according to the Science, Innovation and Technology Policy (2012), which also states that practical experiments should exploit the background experiences of students and encourage interest across gender. However, compared to Papers 1 and 2, which are theory test papers, the majority of students nationwide have continued to do poorly on Biology Paper 4, which is a practical assessment paper (ZIMSEC Examiners Reports, 2014)The Science Education In-Service Teacher Training Programme for Ordinary Level Science Teachers under the Better Schools Programme Zimbabwe has been established by the Ministry of Primary and Secondary Education (MOPSE) as a solution to the issue. Additionally, to educate teachers on novel methods of teaching science subjects, yearly conferences on science and mathematics education have been held (Mwenje, 2012). The ZIMSEC Report for 2012 reported the lowest pass percentage of 38.38% in Ordinary Level Biology, which has raised growing concerns among students and parents despite the actions done by MOPSE to improve the teaching of biology practical courses in secondary schools. In the previous five years, this was the lowest pass rate.(2013) Ruparanganda, Rwodzi, and Mukundu Concern was also expressed in the ZIMSEC Examiners' Report for 2014 on the poor results of students nationwide in Biology Paper 4. (ZIMSEC, 2014). It is unclear how Biology practical lessons are taught in secondary schools in light of the aforementioned issues and observations. This means that, despite the fact that MOPSE has implemented some measures to provide teachers with the information and expertise necessary to conduct Biology practical sessions, it is unclear how teachers really teach these lessons.

The government's inability to provide schools with the necessary teaching and learning materials due to a lack of funding has had a particularly detrimental effect on biology teaching and learning. This has further impacted student performance, which has an impact on both national

development and O level results. However, this study aims to show how biology practical lessons affect O level pupils at Mudzi Secondary School's academic performance.

1.2 Statement of the problem.

The performance of students in O levels secondary school subjects, especially biology, is not given much consideration. The lack of practical biology instruction in schools is attributable to both teachers' and school administration's failure to recognize the value of practical work in science instruction and their failure to supply the necessary resources and equipment for practical work.

A solid theoretical and applied understanding of biology is required, according to Anidodoh (2001), for the management of our natural resources, the provision of high-quality healthcare, enough food supplies, and a favorable living environment. Therefore, it is important to promote biology education in schools. Failure is a significant issue because it will affect secondary students' O-level performance. For this reason, researchers have chosen to investigate how biology practical activities affect academic achievement. Given the aforementioned, it should be everyone's concern, including the researchers, to take this backwardness seriously. Examining the topic of biology teaching and learning through practicals is extremely important. Biologists typically research all kinds of life, including our own, those of other animals and plants, as well as microscopic organisms like bacteria that are too small for human eyes to perceive. In medical, nursing, pharmacy, and food technology, biology is essential.

1.3 Research aim.

The main aim of the study is to find out the effect of biology practical activities on academic achievement of O level students at Mudzi secondary school.

1.4 Research objectives.

1. To determine the students’ academic achievement in biology for proper, effective, and sound science programs in the secondary school.

2. To examine the factors that influence students’ academic achievement in biology.

3. And also identify solutions to the problems that hinder students' performance in biology subject.

1.5 Research questions on reference to Mudzi Secondary School.

1 Is there any significant difference between the mean scores of students taught biology with practical activities and those taught using the theoretical way?

2.What are the impact of biology practical activities on the students' academic performance in biology?

3 What are the impact of teacher's related factors on students' performance in biology practical?

4.What are the impact of school management factors on the practice of biology practical towards the academic performance of students in biology?

1.6 Assumptions

It is assumed that:

Participants will respond effectively and truthfully to the questions asked in the questionnaire and interviews. The measurement scale used in the questionnaire is adequately pre_tested to minimize measurement error. The researcher sought permission from the School headmaster before conducting the research.

1.7 Significance of the study.

The results of this study would be extremely helpful to students, teachers, curriculum developers, and the general public. The results of this study will assist the pupils in developing fundamental scientific abilities and in enhancing their performance and accomplishment. Additionally, it would give students the tools they need to get hired in STEM-related industries, which in no small part would enable them to make more significant contributions to society's advancement. The study would help pupils understand the value of honing their own critical thinking and manipulating abilities. Students would benefit from the study by becoming more interested in doing actual work. The study's conclusions would serve as a foundation for instructors to decide

which effective teaching strategies to implement in Zimbabwe's educational system in order to make biology lessons more relevant and engaging for the pupils. Additionally, it would allow biology professors to modify their lesson plans, place more focus on practical exercises, and acknowledge student ownership of concepts that are discussed in class. It will open the teachers' eyes to their true responsibility in teaching and learning, which is to facilitate, direct, and guide students in participating actively. The research study would encourage parents to provide their kids the fundamentals of practical lessons. The results of this study will aid curriculum designers in creating biology lessons that are filled with activities that teachers and students can complete together. It is anticipated that by involving students in hands-on activities (laboratory activities), they will not only learn science concepts but also acquire science process skills and develop scientific attitudes toward problem solving. This will help the nation's goal of producing students who can function well in the modern world. As it is anticipated that the results of this study will be useful in their pursuit of enhanced technology and industrialization, the findings of this study will aid in promoting the spirit of entrepreneurship among national development among the general public. The discovery would also serve as a wake-up call for the government to release sufficient cash to outfit schools with suitable laboratories for hands-on learning.

Government, educators, and students will all profit from the study's findings. The study will encourage the government to provide secondary schools with the practical tools required for biology teaching and learning. Teachers will help the classroom organize practicals that will aid in the students' skill and knowledge development. A skilled teacher will also be able to adopt the teaching and learning strategies that will help them organize their subject matter for the students. Students who comprehend the value of biological practical skills are better prepared to find jobs, which will in no small part improve their employability meaningfully contribute to the societal progress. The interest of the students in doing practical work can also be increased by using practical teaching approaches.

1.8 Delimitations.

The scope of the study was to investigate the effects of biology practical activities on academic achievement of O level Biology students at Mudzi secondary school. This study will also solely focus on the case study of Mudzi secondary school in Mashonaland East Province.

1.9 Limitations of the study.

The study is limited to one secondary school and only in one subject (Biology) because biology is the researchers main subject of specialization. The researcher does not have freedom to choose what is to be taught but has to follow the outline of the subject curriculum provided by the school and the syllabus.

- **Time constraints**

The time available for the research was not adequate to fully exhaust the various aspects of the research under normal hours. Thus the researcher had to work after hours.

- **Financial constraints**

The constraint was greatly exacerbated by the cost of supplies and transportation. Some online information required subscriptions, making it inaccessible to some people. The researcher was forced to sacrifice some of his requirements in order to pay for the costs of the research.

- **Confidentiality**

To protect the organization's reputation, some respondents were hesitant to divulge sensitive information. The writer, who was a member of the organization's staff, was able to get around this restriction using minutes and circulars, so it was not a big deal. The following constraints of the study were encountered: Self-Reported Data; Absence of Key Respondents; and Point of Saturation. To start, the first restriction that the researcher encountered during the research is Self-Reported Data. The researcher was unable to verify and check the accuracy of the information that the respondents were providing during interviews or through questionnaires, which had an impact on the data analysis procedure .Another drawback was that significant respondents, whose knowledge would have been crucial for the research to be successful, were either not present owing to work obligations or withdrew at the last minute for personal reasons. Key respondents' absence decreased the depth of information that gave the study its integrity. Reaching the point of saturation, which results in the same responses from the study participants

and limits the outcomes of the data collection undertaken by the researcher, was the third and last restriction that the researcher had to cope with.

1.10 Definition of key terms.

Biology practical is the scientific study of life and the structure of plants and animals and their environments in real or experimental setup rather than dwelling in the theory and ideas.

Biology is the study of living organisms divided into many specialized fields that cover their morphology, physiology, anatomy, behaviour, origin and distribution.

Academic achievement describes performance outcomes that indicate the extended to which a student has achieved their learning goals.

1.11Summary

This chapter provided background information to the study, statement of the problem and did spell out the objectives to the study, research questions, assumptions, delimitations, limitations and definition of terms. The next chapter presented the literature review.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter will be discussed under the following headings , Conceptual framework, Theoretical framework and Related Empirical Studies.

2.1 Conceptual Framework

7 Conceptual framework

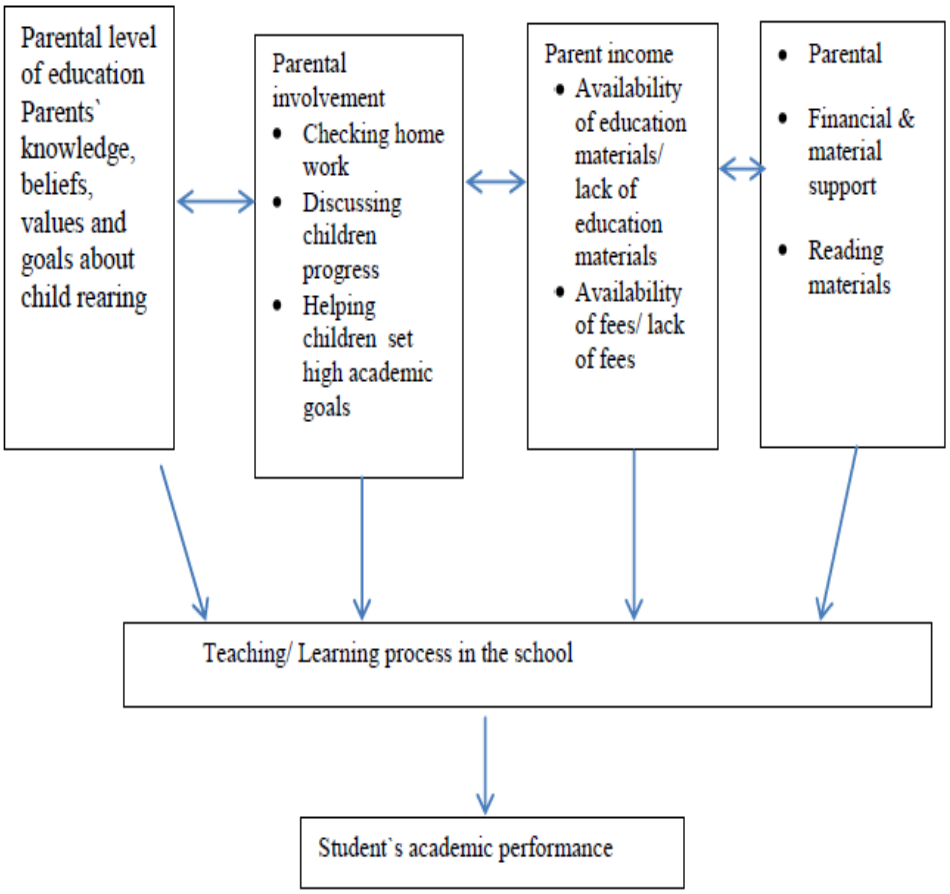

Figure 2.1 Conceptual framework

From the framework above, student's academic performance is conceptualized as an outcome of interrelated factors which originate from within the family and its community. These factors interaction mean that the student is affected by four set of factors as he /she goes through the education system as indicated by the teaching and learning process. The factors and the teaching and learning process bring out the impact they have on the students' academic performance in biology.

2.1.1 Biology as a Branch of Science

The definition of science is the method of learning about natural phenomena. Science is a methodical, logical, and repeatable endeavour to comprehend the laws and forces at work in the natural world. Science is not dogmatic but should be viewed as an ongoing process of testing and evaluation. The word science is derived from the Latin word "scientia," which means to know. T.O. Adeyemi (2018) claims that the three main branches of science taught in secondary schools are physics, chemistry, and biology. These subjects make up the majority of the secondary school curriculum. Learning more about the scientific method is one of the intended advantages of taking a biology course for students. According to Nworgu (2015), science has a dual nature, meaning that the corpus of science may be defined in terms of both its techniques and processes and its products. Science is studied and understood through observation, hypotheses, experiments, data analysis, inference, and conclusions. The scientific method is made up of all of them. Nworgu (2015) described science as an organized body of knowledge obtained via research and experimentation, taking into account the dual character of science. As a result, science is viewed in terms of both "processes" and "products". The nature of science, according to Okeke (2007), is that it looks for explanations using investigative techniques that are impartial and even repeatable. The entire process calls for rigor, dedication, honesty, and patience, all of which must provide credible results. In our society, superstition is very common. This is in opposition to science education, which encourages people to look for explanations that are grounded in logical, impartial principles scientific theories and precepts that can be tested. The truth is that explanations based on superstition and supernatural abilities are founded in cultural beliefs and don't require people to think critically, which makes them more popular than scientific ones. Because of this, science is in a less advantageous position to advance utilitarian goals. According

to Ukoli (2013), the scientific knowledge that a person gains through science education should, among other things, accomplish the following.

- Develop a questioning intellectual attitude toward traditional belief among an increasing number of people such that matters that were formerly accepted without consideration are now the subject of methodical and critical examination.
- Remove superstition from people's brains. The national teachers association in the United States of America holds the same opinions about the intellectual benefits of science.

The formation of scientifically literate individuals with the required intellectual resources, values, attitude, and inquiry abilities to support the growth of a man as a rational human being is one of the most crucial objectives of science education. Such is the science's enormous benefit when taught properly. Speaking of the essence of science, Osogbonye (2012) said that children should be taught the skills and attitudes of science that are utilized to seek for scientific knowledge rather than simply studying more and more of it. This will provide the kids the skills they need to deal with challenges they may encounter in the future (Osobeonye, 2012). The nature of science as a tentative, dynamic, and objective endeavor, however, has broader consequences for how science is taught and learned. It entails a shift from instructing pupils in science to engaging them in science-based learning. Abugu (2015) defined science education as any systematic instruction and training that, upon completion, enables the learners to, among other things, gain the capacity to use scientific apparatus, understand, and create maps, graphs, and charts and a table suited to the issue. Along with the capacity to exhibit problem-solving abilities such as observing, testing, inferring, defining problems, formulating hypotheses, conducting investigations, laying out scientific methods to test hypotheses, controlling and manipulating variables, creating models, drawing reliable conclusions, and predicting. All of these, according to Adey and Harlen (2011), support the adoption of a process approach rather than a content approach when teaching science, highlighting the importance of science process skills.

2.2 Biology Teaching and Learning

The study of biology has a special place in the school curriculum. Numerous science-related courses, including those in medical, pharmacy, agriculture, nursing, biochemistry, and other fields, heavily emphasize biology. It goes without saying that no student planning to study these

subjects needs biology. Biology, according to the Longman Dictionary of Modern English from 2018, is the scientific study of living things. The study of life and living things, including their structure, function, growth, origin, and evolution, is the focus of biology, another branch of natural science. Odigie (2011) emphasized that biology is a required subject for several disciplines of study that significantly advance the nation's technological development, as has already been mentioned. This covers biotechnology, forestry, and medicine.

According to Onwuka (2012), teaching is the process of guiding students' efforts toward worthwhile educational objectives. According to Ngwoke (2010), learning is a process that results in a change in an individual's behavior. The individual's experiences or interactions with his surroundings are what lead to this shift in behavior. He added that learning is an activity that the student undertakes rather than something the teacher does on their behalf. Students learn more effectively when they can connect what they are learning to real-world situations. Although biology is important and well-liked among Zimbabwean students, performance at the secondary school level has been subpar. (Ahmed, 2018). Low scientific professors, overcrowded classrooms, and a lack of sufficient and enough science equipment are among the most common causes of poor performance in science (Fafunwa and Ugwu, 2015). Biology instruction and learning are significantly influenced by the teaching methodology.

Regarding this, Ajaja (2015) claimed that the laboratory is sadly underutilized and teaching is predominantly teacher-dominated. In his research on the "assessment of scientific education in secondary schools in Delta State," he took notice of this. All of these and many more elements play a role in how poorly biology is taught and learned. Nworgu (2015) emphasized the characteristics of a strong biology lecture and included the following

- Lessons in biology should contain a set of explicit learning objectives.
- utilize pertinent activity-oriented vocabulary
- assist in spreading information throughout society.

The biology curriculum's objectives for teaching and studying biology serve to support this. It originated from the national education policies (1977, 1981, 2013, and 2013), which comprise

- adequate biology laboratory and field skills.
- biologically meaningful and pertinent knowledge.

- the capacity to use scientific information in daily life, particularly in relation to agriculture and issues of personal and communal health.
- logical and practical scientific perspectives.

It follows that biology instruction must be student-centered and supplemented by practical activities in order to be effective.

2.3 Biology practical activities

Biology practical activities, according to Opuh, Eze, and Ezemagu (2018), are the scientific study of the life and structure of plants and animals and their surrounding environment in a real or experimental setup as opposed to focusing on theory and ideas. According to UNESCO (2015), children are most likely to learn about the nature of science when they conduct their own experiments and make observations. Similar to this, Onah (2013) thought that if the development of experimental research has shown anything, it is that true knowledge and fruitful comprehension are the best things. This is the lesson that all educators must learn from the laboratory. According to Emmanuel and Eze (2007), a Chinese saying goes: "We hear, we forget; we see, we remember; but that which we participate in, we understand." They continued by explaining that students must participate in doing (practical) during biology lessons and that this is how students learn. According to Lunette (2018), the laboratory has been given a crucial, distinct position in science education, and science educators have claimed that learning through laboratory activities has many advantages.

Conducting set experiments and developing models for understanding other practical tasks, according to UNESCO (2015), offer opportunities for developing many of the essential learning skills, such as understanding and appreciating the need to change for a new audience, finding new knowledge from the work already done that can be used to build new scenarios, transferring knowledge and understanding new situations, and contributing to the development of a culture of learning. From the aforementioned, it has been concluded that practical lessons are largely necessary for the efficient teaching and learning of biology. According to Emmanuel and Eze (2007), who quoted the Nigeria Council on Science Education's annual report on secondary schools' science instruction, many schools taught students in science subjects, including biology, without using laboratories. In her research, Udeh (2014) found that a shortage of laboratory

equipment and a lack of resources are two issues that hinder the successful teaching of biology with practical activities in secondary schools in Enugu East L.G.A. of Enugu state a lack of time for the biology practical Eze and Ezemagu (2018) concurred that conducting experiments with lab equipment is the only effective way to learn science, and particularly biology, from a book. Emmanuel and Eze (2007) underlined that biology must be studied with the help of laboratory classes due to its highly empirical nature. According to Okoye (2014), laboratory activities should take an investigative approach to give students the chance to learn process skills. He firmly believes that laboratory work, when done with rigorous study or research, aids students in learning the fundamentals of managing lab activities. However, Lunette (2018) departed from the norm by stating that at this time, some instructors have begun questioning theIn stark contrast, Lunette (2018) deviated by stating that the justification for laboratory education is no longer as self-evident as it previously seemed and that some educators have begun to question the usefulness and function of laboratory work.

When teaching materials such laboratory practical exercises, diagrams, charts, models, field works, and real objects are effectively used to communicate the subject matter, teaching is considered to be effective. Nwagbo (2016). (2016). Biology practical exercises are crucial for putting the theoretical lessons learned in class into practice and piqueing students' interest in the subject. In order to ensure that students develop holistically and thoroughly, it also gives them the chance to interact with materials and ideas, stimulating the development of the affective and psychomotor learning dimensions in addition to the cognitive dimension. Agbowuro (2006). In contrast to the theoretical or abstract presentation of principles, facts, and concepts, experimental activities in biology could be considered as a way that could be used to make the process of teaching biology more tangible or real to students. Biology students' academic performance benefits from experimental activities because they are a teaching strategy that involves the practical application of scientific ideas, concepts, theories, and laws. After participating in an experiment, the students ultimately Increase your potential to learn new information, to build ideas, principles, and abilities, and to establish a scientific mindset and way of life. Onyegegbu (2006). (2006). Students can gather pertinent information and conceptualize the suitability of the theories relating to photosynthesis and carbon (IV) oxide, for example, through a practical activity on the impact of carbon (IV) oxide on photosynthesis. Nwagbo (2016) stated that "the use of practical activities approach to the teaching and learning of Biology concepts should

therefore be made mandatory, instead of an option, to Biology teachers, if we hope to produce students that would be able to acquire the necessary knowledge, skills, and competence needed to meet the demands of the nation." This is in light of the aforementioned.

This suggests that both theoretical and practical knowledge are directly tied to how well students succeed academically in any science-based topic, such as biology. According to Alison (2013), since biology is focused on problem solving and the laboratory is the most convenient setting for careful observations, accurate calculations, and logical inferences, practical activities should be viewed as the primary instructional procedures in which cause and effect of any concept is determined. In his research on a good teaching model for high school science instruction, Rughill (2011) found that pupils demonstrated a significant high score for this cognitive attribute. According to Ajevalemi (2011), a lack of lab facilities is to blame for students' poor performance in biology.

However, Nnamonu (2013) and other proponents of biology practical activities contend that the most effective way to teach biology is through the efficient use of a properly kept biology laboratory. The aforementioned makes it very evident how important practical biology is to the teaching of biology. Because laboratory (practical) activities are biology's lifeblood and without which it loses its scientific nature, the value of practical biology classes cannot be overstated.

2.4 Laboratory Facilities and Students Performance in Biology

According to Hofstein and Lunetta (2014), a laboratory is a suitable learning environment for fostering meaningful learning, improving students' comprehension of scientific knowledge and the nature of science, and allowing them to engage with materials and/or models to observe and comprehend the natural world. According to Nworgu (2015), a laboratory is a space or structure utilized for scientific investigation and experimentation. The laboratory, she continued, serves as the hub of science-related activity. She continued by saying that in order for biology instruction to be effective, lab activities must be included. Using the phrase "in the laboratory, individuals conduct out measurement, check circumstances, collect fundamental information, manipulate instruments, and learn to know the equipment and materials by name," Akpan (2012) summarized the setting for laboratory operations. .According to Akpan (2012), "people do measurements, verify conditions, get fundamental information, manipulate instruments, learn to

know the equipment and materials by name, are exposed to the actions of scientists, and are trailed in experimental operations in the laboratory. By learning the fundamental ideas and abstractions involved in the process in the lab, students can better understand the information offered in the textbook or in lecture classes. The learner is the primary focus of all instruction. If students are not participating in the lab activities, the importance of the lab is not genuine. Unfortunately, the majority of laboratory tests are conducted using objective, paper-and-pencil equipment rather than hands-on methods (Hofstein and Lunetta, 2014).According to Tobin (2011), students can engage in meaningful learning in the lab if they are given the chance to work with tools and materials in a setting that allows them to build their understanding of scientific phenomena and related ideas. Numerous schools don't utilize the laboratory to its fullest extent while teaching biology, as was mentioned before in this book. Teachers and parents start to hope that kids will work some sort of magic and ace the Senior Secondary School Examinations since they only schedule practical for students when the one short-end of course examination (SSCE) starts. In support of this, Ahmed (2018) has emphasized that an inadequate biology lab may be to blame for part of the observed low achievement of biology students in SSCE. . In support of this, Ahmed (2018) has emphasized that an inadequate biology lab may be to blame for part of the observed low achievement of biology students in SSCE. This is not the intention; in order for students to get the essential abilities, the lab must be furnished and used frequently by them for experiments. Scientific laboratories provide a crucial part in the instructional process for science students, claims Lunetta (2007). He emphasized once more how this planet is now incredibly technologically and scientifically sophisticated thanks to these laboratories. Osogbonye (2012), The main purposes of the laboratory, according to recent science curriculum changes, are to teach students the process and spirit of scientific inquiry and to give them the chance to conduct their own independent research. According to Osogbonye (2012), the laboratory is the best setting for teaching students how to do research using the same methods as scientists, using their scientific thinking and inquiry skills. They practice the scientific abilities and attitudes they have developed to become independent in the future in the lab. The purpose of laboratory instruction in contemporary science courses, according to Osogbonye (2012), is to "focus upon the inquiry/discovery process or methodological phase of science and upon its intellectual components." In addition, laboratories are crucial for the teaching of science-related courses because it heavily depends on the laboratory provisions made

for it. According to Osogbonye (2012), students rely on the laboratory as a place where they may both observe lecturers demonstrate and engage in practical work on their own. In terms of science, biology is mostly an experimental field.

According to Osogbonye (2012), higher quality laboratory programs can elicit the critical thinking abilities and student motivation required to produce a skilled group of scientists, engineers, biologists, and citizens capable of addressing the environmental and scientific challenges of the present and the future. Based on the foregoing, Dienye and Gbananje (2011) reported that the functions and merits of the laboratory are divided into five major categories that represent significant objectives in biology education and also show how teaching biology in the laboratory is appropriate in light of scientific and technological advancement.

2.4.1 Merits of Teaching with the Laboratory

- The learner in this method gains knowledge about the nature of science and technology in order to encourage knowledge of human scientific endeavors and thereby improve the child's intellectual and aesthetic understanding.
- Developing problem-solving abilities: The fundamental aim of science Teaching is to provide pupils with knowledge and abilities that they can use in future situations.
- Through the development of manipulative abilities, the student learns to respect and imitate the role of scientists.
- Develop interests, attitudes, and values. When students have the opportunity to interact directly with real objects, their interest in science grows as they yearn to learn more about their surroundings.
- They also learn the key theories, models, and principles of science and are made aware of how provisional they are. Students get opportunities to learn about scientific truths through laboratory experiences.

2.4.2 Demerit of Teaching with the Laboratory

The two major setbacks encountered in the use of laboratory are as follows;

- It is time consuming in terms of planning and preparations.
- It is expensive due to the materials and equipment that will be used.

2..5 Practical Biology and Effective Teaching

UNESCO (2015) states that many teachers instinctively and for a long time incorporated the fundamental learning into their instruction. They understood the importance of having knowledge and abilities in a certain area. Opportunities offered by the specific or in the classroom are acknowledged and utilized. The study deduced from the available literature that there are several components to good biology instruction, including teacher qualification instructional methodology effective utilization of the lab, and subject matter mastery. According to Opuh, Eze, and Ezemagu (2018), it is difficult to imagine efficient biology instruction without a pool of skilled teachers. Eze (2012) expressed regret over the shortage of skilled teachers in secondary schools, particularly in the practical subjects. It is frequently stated that instructors are the center of every educational system because there is no one better at a school than their teachers. This means that pupils will receive education of a higher caliber from highly qualified professors. Orjika (2014) Education experts have stated that science instructors should have good professional training, and biology teachers are not special, according to Ajaelu in Opuh (2018). Many scholars believe that effective biology instruction is greatly influenced by the teaching strategies used in science classes. According to Nnamonuh (2013), the laboratory approach is the one used in efficient biology instruction and learning. It includes any actions taken by an individual or a group with the intention of learning. Okoye (2014) has previously stated that the laboratory method of instruction should be looked into as a strategy so that this activity can give students the chance to develop process skills. According to Meregini (2015), recent classroom observation studies have revealed that teachers' instructional materials and approaches diverged from those suggested by scientific curriculum. Nnamonu (2013) asserted that laboratory and outdoor work are essential components of scientific instruction. The teaching of science will be ineffective without the laboratory technique. Laboratory work should be viewed as a way to connect scientific concepts, the research method, observation, and data analysis. The majority of teachers, according to Fafunwa in Ugwu (2015), use the lecture method without giving it much thought. Fafunwa maintains that the best learning comes from purposeful practical activity. Ugwu (2015) advocated for educators to employ as many strategies as they can to capture students' interest and attention. Any form of incentive should be used by the teacher to boost the pupils' spirits.

The laboratory technique must be used when teaching biology. Nnamonu (2013) argued that in order to prevent biology from becoming primarily a memory exercise, teachers should primarily teach utilizing the laboratory method. He also noted that schools with effective laboratory use outperformed others in terms of scientific performance. According to Uche (2014), who cited Okri in his own work, the methods used to influence how knowledge is conveyed to students may have an impact on whether or not they have a positive or negative perception of biology. Mastery of the material is another element that determines how biology is taught. According to Ugwu (2015), students' confidence will be restored by professors whose demeanor conveys a wealth of information about the material they are teaching at their fingertips. According to Okoye (2015), another element that contributes to effective teaching and learning is the subject-matter expertise of the teachers. A knowledgeable instructor will speak to his students in his own language and provide tangible examples to support his teachings. Killdara (2007) argued that in order for teaching to be effective, the instructor must be extremely educated about the topic matter, which will allow for great usage of specialized terminology throughout the class. Similar to this, Opuh, Eze, and Ezemagu (2018) claimed that a good mastery of the subject matter is a quality of a bad instructor. The teacher must be fully knowledgeable in the subject. Some inexperienced teachers abuse the use of instructional techniques, according to Eze (2015). Keldare (2007) went on to emphasize that new information should be connected to prior learning and that past lesson material should be continued. In light of the aforementioned, Ude (2014) suggested that the essential laboratory serve as the setting for teaching biology. Every biology instructor must be certified in a teaching strategy that will enable his pupils to meet their learning goals. In conclusion, instructors influence societal development. Similar to this, Opuh, Eze, and Ezemagu (2018) asserted that a strong command of the material is a sign of a poor teacher. The instructor needs to be an expert in the field. Eze claims that some untrained teachers abuse the usage of teaching tactics (2015). Keldare (2007) continued by highlighting the need of continuing previous lesson material and connecting new knowledge to old learning. In light of the aforementioned, Ude (2014) proposed that biology instruction take place in the fundamental laboratory. Every biology teacher must be qualified in a method of instruction that will help his students achieve their learning objectives. Finally, educators have an impact on societal evolution.

2.6 Biology Practical and Effective Learning

It has already been determined that effective teaching is necessary for effective learning. In this paper, it has also been noticed that biology practical's play a key role in the efficient teaching of biology. Therefore, it follows logically that biology practical's aid in the efficient learning of biology. Many students showed their passion and interest in practical learning, according to Kuren, Zonntja, Navelle and Jeanne (2015).exercise. It is common knowledge that kids who excel in science also excel in scientific practical. Ude (2014) acknowledged the beneficial relationship between biology practical's and efficient biology learning. She cited the education ministry as saying that as biology is a science subject, an effort should be made to maintain reasonable extensive science equipment along with an appropriate way of teaching to support her point of view. According to the experts, a student's attitude and motivation in practical classes play a significant role in how effectively they study biology. In 2015, Karental, Ime, Smi, and Henry expressed a similar opinion. They believed that strengthening student-based courses was important. According to Karase, Hartley, James, and Mclus (2015), it's crucial to address these difficulties (students' interest in and attitudes toward practical work). effective biology education. In 2015, Karental, Ime, Smi, and Henry expressed a similar opinion. They believed that strengthening student-based courses was important. According to Karase, Hartley, James, and Mclus (2015), it's crucial to address these difficulties (students' interest in and attitudes toward practical work). They added that laboratory practice ranked highly as a contributing factor to successful learning in biology in particular and science in general. According to Nnamonu (2013), student attitudes toward laboratory work are important for effective science teaching and learning as well as for raising students' academic achievement. Therefore, Cosbourne, Simon, and Collins (2013) concurred that, if available, the laboratory and practical experience should have a significant impact on students' attitudes and academic performance. In fact, it may determine how well pupils succeed.

In actuality, it can determine how well pupils achieve in science. Hofstein and Lunette (2013) noted that the recipe-book approach, which restricts students' opportunities to feel ownership, creativity, and the creation of effective learning, is a critical factor that continues to lower learning in the laboratory. According to Uzel, who was quoted by Eze (2013) and Orjika (2007), practical agriculture (which is related to biology) has a favorable impact on students' motivation. Additionally, he argued that hands-on learning improves learning quality and skill acquisition because it allows students to discuss their work and add to their understanding. According to

Somi and Henry (2013), giving students a useful laboratory experience increased their attention, enthusiasm, and awareness of what they were studying as well as their mean grade.In order for children to be educated, Anichebe (2007) stressed in his study that teachers must comprehend each of their pupils as unique individuals who have different learning styles. Last but not least, biology is distinctive in that it allows students to engage directly with the material through actual laboratory experiences. It unmistakably gives pupils the chance to actively participate in the learning process and enhances their academic achievement.

2.7 Biology Practical and Academic Performance

Students who skip out on practical activities frequently struggle with tasks that need for deductive reasoning, accurate observation, and data interpretation. Additionally, Sandbarey, Armstrong, and Wischusen (2015) emphasized that inquiry-based practical offers students a more realistic experience because the solution is not always given and because it necessitates that students develop their own theories based on their own observations. Allan, Rob, and Jonathan (2013) claimed that students who skip practical sessions are always terrified by graph numbers during exams, which prevented them from understanding the figures for accurate interpretations. Adeleye helped Eze and Ezemagu (2018) make the observation that schools that participate in practical classes score better in the SSCE than schools that ignore practical work. According to Sandberg (2015), educators were first reluctant to alter their approaches to teaching biology, but with positive outcomes (better academic achievement) and assistance from national science and educational organizations, progress has been made (Myer and Burgess 2013). From the foregoing, it is clear that biology practical classes benefit students' academic success on biology examinations.

2.7.1 Problems Associated with Conduct of Biology Practical

Inadequate Laboratory Facilities: Biology teaching and learning have been hampered by the lack of adequate laboratory space in secondary schools. Ani and Eze (2007) found that students comprehend concepts more fully when they have practical experience. When students conduct their own experiments in order to get the right answer, they not only retain the steps involved but also feel proud of themselves. As a result, it is crucial that the lab is appropriately set up for biology-related activities, and students should be encouraged to use the lab since it is well-

known that When students participate in the activities, they perform better. According to Lunette (2018), the laboratory aids students with making precise observations, formulating hypotheses, determining the causes of outcomes, organizing controls, and refraining from passing judgment.

- **Time management:** This has a negative impact on students since it causes many applicants to get exam fever out of anxiety and worry. At the expense of other pupils, some students take a long time reading and formulating their responses to a particular question. In an effort to impress their teacher, students become verbose, adding extra information to some answers and skipping over other questions. According to Tan (2018), students should be aware that practical biology questions typically call for or require clear and direct answers. Comparing and contrasting the characteristics of one specimen with another is a crucial aspect of biology research methodologies. Due to a lack of knowledge or abilities, students typically perform badly on these tasks. The use of tabulation is the fastest and most accurate way of comparison. When comparing or contrasting features of one specimen with those of another, the similarities and contrasts between the two specimens must be noted.
- **Drawing and Labeling:** In practical sessions, biologists place a high value on creating diagrams with accurate labeling of the specimens being studied. According to Tan (2018), diagrams used in biology differ from those used in fine art, where artists are required to create vibrant, creative diagrams. Size, proportionality, title, and view or viewpoint are all taken into consideration while drawing and identifying a biological specimen.
- **Observation:** is a crucial component of applied biology. It is impossible to overstate the value of careful specimen observation during a practical biology exam. Candidates must thoroughly and critically examine the specimens they are given because doing so is necessary for accurate specimen identification, complete depiction in drawings, and realistic comparative analysis. The difficulties associated with laboratory work have been attributed to a variety of causes (Tan 2018). According to Benze and Hodan (2015), issues with laboratory work occur when students slavishly adhere to lecturers'
- instructions. On the other hand, other academics contend that the laboratory has changed from being a place for science experiments and practicals to a location where students do

tasks assigned by their lecturers. During laboratory work, just the predetermined tasks are completed; neither the method nor the purpose are given any thought (Hurtegal 2012). Wikinson, Wand, and Jimenz Alexander (2014) have linked the issue with laboratory work to a subpar assessment of the objectives of the tasks carried out in the lab. The varied functions of laboratory work have long been a topic of debate across the globe. These objectives have been broken down into many lists for various educational levels. While many of theselist place a significant emphasis on conducting experiments using scientific methodology and technical expertise, others have lingered on other purposes (Johnstone and Al-Shuali 2011; Reid and Shah 2007). When university biology labs are taken into account, the primary goal of laboratory activity may be:

- Adding to or bolstering theoretical knowledge
- Taking delight in learning and enhancing one's psychomotor abilities
- teaching about practical applications of science.
- Developing capacity for original thought
- improvements in scientific thought and working methods
- Increasing communication abilities
- Using tools and equipment will help you improve your manual dexterity.
- allowing students to use their skills rather than memorize (Bayraktar 2014).

2.8 Theoretical Framework

The General System Theory (GST) served as the theoretical foundation for this investigation. System theory was described by Higgs and Smith (2018) as a general science of wholeness and organization. It is also possible to think of it as a philosophy that holds that existence is a system, of which we are all a part. The main tenets of system theory are that everything, including people, is a system of some kind and that all systems have a purpose and a goal (Higgs and Smith 2018). The components of a system must all cooperate with one another and their surroundings in order for the system to achieve its goals. A biologist named Von Bertalnffy created the General System Theory (GST) for the first time in 2018. His underlying assumptions focused primarily on living things, machines, organizations and galaxies. He proposed the idea that components of a system operate together rather than alone. His hypothesis was in opposition to the widely held scientific belief that a system could be understood first by being dissected into its constituent parts, each of

which could then be investigated and examined separately. And that a system's overall structure may be described by adding its parts in a linear method. A system, according to Bertalnffy (2018), is a collection of pieces that are connected. System can be opened or closed. The school is an illustration of an open system where two or more people collaborate in a coordinated manner to achieve shared objectives (Norlin 2015). Although the level of contact with the environment can vary, all schools operate under an open system.

The following elements make up the system that is the school: the environment inputs, the transformation process, the output, and the feedback. The term "open system" refers to a system that accepts input from its surroundings and releases output back into those surroundings. Any environmental change has a significant impact on the open system. some of the systems must work together for the educational system to be successful or to identify the problem's root and, consequently, its remedy. Because the school is an illustration of a social open system with objectives to achieve excellence in all areas, this theory has been selected for this study. One of the main objectives of biology instruction and learning in secondary schools is to provide students with the knowledge, abilities, and attitudes of scientists that will motivate them to enroll in university professional programs in fields like medicine, dentistry, pharmacy, and nursing, among others (Abugu 2015). However, this is not possible until the theory and application of biology come together as intended to generate the desired result. According to this study, every facet of biology instruction and learning may have an impact on how well children perform on tests. If one component of the system is weak, the result will be negative, but if all the components operate together, meaningful learning will be accomplished with an improvement in the kids' academic achievement.

2.8.1 Piaget's Theory

The theory of cognitive development by Piaget provides a thorough explanation of the origins and growth of human intelligence. Jean Piaget, a Swiss developmental psychologist, invented it first (1896–1980). The theory addresses the nature of knowledge as well as how people acquire, create, and use it across time. Piaget's theory is mostly recognized as a hypothesis of developmental stages. Piaget "found it fascinating that children of different ages made different sorts of errors when solving tasks." He also held the view that kids don't think and speak in the same way as "small adults," who might know less. Because Piaget believed that children

possessed excellent cognitive capacities, he developed four phases of cognitive development and tested them. He was able to classify them into those four categories according to their ages. He observed how children's cognitive skills evolved at each level. For instance, he thought that kids perceive the world through doing, putting things into words, reasoning, and thinking logically.

Piaget believed that cognitive growth was a gradual rearrangement of the processes brought on by biological development and environmental exposure. According to him, kids develop an awareness of the world around them, encounter gaps between what they already know and what they learn from their surroundings, and then revise their views as necessary. The human organism, according to Piaget, is centered on cognitive development, and language development is dependent on the knowledge and understanding that are acquired through cognitive growth. The initial works of Piaget attracted the most attention. Direct implementations of Piaget's ideas include "open education" and child-centered classrooms. Despite its enormous success, Piaget's theory has significant flaws that he himself acknowledged: for instance, it favors abrupt stages over continuous growth (horizontal and vertical décalage).

2.9 Related Empirical Studies

In Enugu State secondary schools, Henry (2018) conducted research on the impact of biology practical's on students' academic performance in biology (a case study of Nsukka Local Government Area). This study focused on biology lab work that was done in secondary schools. It looked at whether or not students' participation in practical experiences and the manner they were presented to them helped them achieve their practical work's objectives. The methods for carrying out practical biology courses were a major concern, particularly the skills that were emphasized throughout these lessons. The survey also looked at how students and teachers felt about biology lab work. All of these actions are taken with the intention of detecting issues and providing suggestions that could inform practical solutions. All of these actions are taken with the goal of identifying the issues and providing solutions that could inform practical work in biology specifically and biology generally. A descriptive survey research design was used for the investigation. The 47 public secondary schools in the local government that made up the study's population were divided into 9 sample schools using a combination of stratified, purposeful, and systematic sampling techniques. The participants included 309 biology students, including 170 boys and 139 girls, and 29 biology teachers. The study's key finding suggested that secondary

schools in the Nsukka local government region had science labs that were generally better furnished with equipment, chemicals, and materials, and that students there did actually engage in a range of practical activities in biology. However, pupils were found to lack several fundamental scientific abilities, such as designing experiments and forming hypotheses. The study suggested that NECO evaluate students on as many abilities as possible throughout the NECO biology exam, including basic principles of experimental design.

Nwagbo, Chukelu, and Uzomaka (2015) conducted research on the impact of biology practical activities on secondary school students' development of process skills in the Abuja Municipal Area Council. The study was quasi-experimental in design, using a non-equivalent control group for the pretest and posttest. For the study, samples of 111 senior secondary one (SS1) biology students were randomly selected from two coeducational institutions. Data were gathered using a tool called the Science Process Skill Acquisition Test (SPSAT). Mean, standard deviation, and analyses of covariance (ANCOVA) were used to examine the data at the 0.05 level of significance. The findings showed that the practical activity mode of instruction was superior to the lecture technique in promoting students' learning of science process abilities. Method and gender had little effect on how well students learned to comprehend information.

2.10 Summary of Review of Literature

Science was defined in this study as a method of learning about natural events. Additionally, it serves as a rational, unbiased, and reproducible effort to comprehend the forces and principles at work in the natural world. Science derives from the verb scientia, which means to know. Although it should be considered as a continual process of testing and assessment, good science is not dogmatic. The scientific study of living things was viewed as the focus of biology, on the other hand. The study of life and living things, including their structure, function, growth, origin, evolution, and distribution, as well as their taxonomy, is the focus of biology, another branch of natural science. Odigie (2011) emphasized that biology is a required subject for several disciplines of study that significantly advance the nation's technological development, as has already been mentioned. Other numerous elements that were also fully studied under the conceptual framework included medicine, forestry, biotechnology, etc. Theoretical framework was built on Von Bertalnffy's General System Theory, which was created in 2018. According to the notion, everything, including people, is a system of some kind, and all systems have a

purpose and a goal. The components of a system must all cooperate with one another and their surroundings in order for the system to achieve its goals.

CHAPTER THREE:

- RESEARCH METHODOLOGY

3.0 Introduction

This chapter outlined the research design that was employed in the study with the help of different authorities, the target population, sample,research instruments, validity and reliability of the instruments employed by the researcher and ethical considerations. It also explained data presentation and analysis procedures to follow.

3.1 Research design

A research design is explained as a strategy of how researchers plan to conduct the research in order to address the research questions. It is essentially a plan aimed at enabling answers to be obtained from the research questions MacMillan & Schumacher (2009). Panneersekvam (2004) defined a research design as the researcher's plan of how to proceed with the research. The research design can either be qualitative, quantitative or mixture of the two. This study adopted the mixed methods approach design. Quantitative research involves numbers, statistical manipulation and analysis. This method uses numbers or quantifies to describe phenomena by measuring and quantifying. In the research quantitative research was done through questionnaires and written pre and post test. Quantitative approach was adopted in this research because it has some advantages such as the use of numbers which ensures precision in measurement. It also has well established statistical methods for analyzing data. Quantitative approach facilitates comparison ,one can collect data from several participants, settings and time and can compare the findings.

Qualitative research describes phenomenon in words. Some of the advantages of qualitative research includes that it brings out data on peoples experiences, their feelings and emotions. It also enable the researcher to do studies in depth and detail (Bailey 1987) The study also adopted

qualitative method because it allows the researcher to play a central role in giving clarity and interpretation of the data.

This research design allowed the researcher to answer the research questions and attain its objective. The mixed method approach was conducted with reference to Mudzi secondary school. The research aimed to find out the effects 0f biology practical activities on students academic achievement of O level biology students at Mudzi secondary school.

3.2 Research instruments

Leedy and Ormrod (2012) define research instruments as data gathering methods. These are the tools that were used to gather relevant data surrounding the effects of biology practical activities on student academic performance of O level biology students at Mudzi secondary school. In this study pre and post test for students , questionnaire for students and interview guide for biology teachers and the H.O.D were used for data collection and were attached as Appendix one, Appendix two and Appendix three respectively.

3.2.1 Pre _ test and post test for students

Data was collected through pre and post-test over two weeks by two dependent variables. Firstly, both the experimental group (EG)and control group (CG) took a pre-test to determine the homogeneity in academic calibre. The two week involved Activity I; testing leaves for startch and activity 2 conditions needed for the leaves to carry out photosynthesis. In EG, the learners were taught by practical learning approach where they could handle the apparatus, performed experiments, collected data, analysed data and drew conclusions. Meanwhile, the CG was taught using conventional, for example, lecture approach and giving notes. Both groups took identical post-test after two weeks of the learning period.

The practical work that students did in the school's lab served as the study's independent variable, and the participants' academic performance served as the study's dependent variable. The factors (assigned time, curriculum material, activities, tests) were all the same. The independent variable is the only one that can be changed. The control and experimental groups were regarded as two portions of the same class. On the weekly teaching schedule, they each received the same number of instructional hours. On the other hand, both groups were seen as belonging to the

same class and treated as such. As a result, all groups received the same instructional materials, handouts, and class time from the same teacher. The conventional/traditional teaching approach, which is "when pupils learn through memorization and recitation procedures thereby not developing their critical thinking problem-solving and decision-making skills," was used to instruct the students (Sunal, Smith, Sunal & Britt, 1998). The experimental group students, on the other hand, were instructed in the same curriculum using a modern/practical teaching approach, which is defined as "the intentional process of diagnosing problems, critiquing experiments, and distinguishing alternatives, planning investigations, researching conjectures, searching for information, constructing models, debating with peers, and forming coherent arguments" (Linn, Davis & Bell, 2004).

A pre-test and post-test were used to measure the dependent variable before and after the participants engaged in the scientific practical activities (post-test). The effectiveness of the intervention was then determined by comparing the pre-test and post-test results (practical activities). The researcher was concerned with the obtained scores since they served as a gauge of the knowledge that was learned and reflected in the figures. Questionnaires given to the students served as the second dependent variable's data collection method.

3.2.2 Questionnaire for students

According to McLeod (2018), a questionnaire is a research tool made up of a list of questions used to collect data from respondents. One way to think of questionnaires is as a type of written interview. They can be conducted in-person, over the phone, online, or by mail.

A tool was created by the researcher to gather data from the respondents. The tool was a systematic, closed-ended questionnaire. According to the four research questions posed for the study, the questionnaire was created using a modified four-point Likert scale of Strongly Agreed (SA), Agreed (A), Disagreed (D), and Strongly Disagreed (SD). Two components made up the questionnaire; brief personal information on the respondents is contained in section A, while part B is composed of 15 statements that ask the respondents to tick (√) the appropriate answer for them. Two professionals validated the research tool. The department's head and a biology senior teacher. They were asked to assess the items' appropriateness and sufficiency in assessing the things they were intended to measure, the clarity of the instructions given to the respondents, and

the correct warding of the items. The questionnaire's final version was created using the validator's errors and suggestions. Reliability of the Instrument Test - Retest Method was used to determine the instrument's reliability. The identical group of 40 students received the instrument on two separate times from the researcher. The questionnaire was filled out by the students in their classes in the researcher's presence, and they had 20 minutes to finish it. The researcher personally handed out the questionnaire to the students, and she had the opportunity to explain the study's goal to them and answer any questions they had about certain portions of the questionnaire.

Some of the advantages of the questionnaire included that, the upper management, who couldn't be interviewed due to their hectic schedules, found it handy. The anonymity provided by the questionnaires allowed the respondents to answer honestly because there was no fear of being victimized. The fact that the results could be quantified made the data acquired simple to comprehend, analyze, and interpret.

The disadvantages of using a questionnaire included that there is no one nearby to answer some of the questions, which are not always simple to understand. The responders could only tick the predicted responses that the researchers expected them to, and they were not allowed to provide any other type of response. The respondent occasionally shown a general lack of interest, providing inaccurate information or giving a third part to answer who might not be the right person.

Type of questionnaire

Likert Scale

As a psychometric tool, this scale contains a number of statements that represent the study's hypotheses. In the survey, respondents are asked to rate the statements' level of agreement on a scale from strongly agree to strongly disagree. Although the Likert scale's five symmetrical and balanced points were part of its initial design, it has been employed over time with measurement ranges ranging from two to eleven points, . (Simms and others) (2019). Some of the advantages of using Likert scale include that responses are compiled in a consistent manner, information gathering is completed rather quickly, and can be gathered from the majority of a group. It is

simple to use and it gives participants a variety of options, which can help them feel more at ease when responding.

Some of the disadvantages of Likert scale include thatParticipants might not be totally honest, either on purpose or accidentally. Answers may be based on participants' attitudes toward the survey or the topic. Many participants base their responses on what they believe is expected of them as participants and analyzing the data may take a while for example on the number of response alternatives.

3.2.3 Interview guide for biology teachers and the H.O.D

A questionnaire delivered by an interviewer who is not permitted to stray in any way from the provided questions is known as an interview (Haralambos and Holborn, 1991 cited in Tom et al, 2011). Interviews with key informants, including biology teachers and their head of department, were performed for the aim of this study. The researcher had to seek permission from the school administration to interview 2 biology teacher and one H.O.D. Individual face to face interviews were conducted whilst the reseacher was taking notes. The interviews were held in the laboratory were there was minimum noise and interruption from students. Each interview session lasted about 30 minutes as they had to air out their views concerning biology teaching and practical work. Face to face interviews gave the researcher an advantage that there was chance to personally pursue the respondents and explain clearly to them the purpose of the study.

3.3 Population.

According to Chiromo (2009), a population refers to the items, people, units, or events that will be taken into account in a study. A population is any group of people who share one or more traits that are important to the researcher; it includes all individuals who have the feature under study (Cohen & Manion, 2003; Bhattacherjee, 2012). Therefore, a population often includes all of the participants from which the researcher hopes to draw conclusions. Therefore, 40 students from Mudzi secondary school as well as 2 biology teachers and their department heads made up the target group for this study. The sample for the study was taken by the researcher from this demographic.

3.4 Sample and sampling procedure

According to Leedy (2006), a sample is a set of respondents or a group of respondents who, by virtue of possessing the most defining or typical characteristics of the population being researched, are representative of the population. Therefore, a sample is a predetermined number of people chosen from the population based on some shared characteristics. Sampling is the process of choosing a subset of the population that complies with a predetermined set of criteria to be researched (Polit & Beck, 2004). As a result, the sample used in this study was typical of the population being studied. The simple random sampling without replacement was used to select 40 students who participated in the study. The researcher wrote down all names of form 4 students doing biology on tags and placed them in a box with a small hole and the box was shacked so that the tags had to mix up. The researcher picked up the tags at random and wrote down the names. After the name was written down the tag were not put back in the box. Otherwise it was shaken again and the researcher picked a name tag again at random until 40 participants from form four class were selected. All the fourty selected students had to answer the questionnaire on appendix 2. As for the pre and post test the same procedure was used to select 20 students who were name taged as the Control group (CG) and the other 20 were name taged the experimental group (EG) and they all had to answer the pre and post test indicated as Appendix one

3.4.1 Purposive sampling

Purposive sampling is the practice of selecting subjects for a sample with a specific objective in mind. Participants are chosen for a study based on certain desirable characteristics (Blakstad, 2008; Beins & McCarthy, 2012).

The target sample consist of randomly selected 40 O level biology students the head of department (science) and 2 biology teachers .They are the targeted sample because since the primary objective of the study is to investigate the effects of biology practical activities on academic achievement ,the stated authorities provided prerequisite knowledge and information for the question under study. In this study, the opinions of the teachers were of utmost significance because they encounter difficulties when teaching biology. Due to issues with costs, time, and accessibility, it is not always feasible or viable to examine the entire population. As a

result, the researchers gathered data from a representative group, a smaller subset of the population. This indicates that the sample's characteristics fairly and properly reflect those of the population. Consequently, the findings from a representative sample can be extrapolated to the entire population. Because everyone has an equal chance of being chosen, basic random sampling was utilized. In light of this, simple random sampling ensures that all groups are represented in the sample in the same proportions as they are in the population.

3.5 Validity and reliability of research instruments.

Although they are closely connected, validity and reliability have different meanings. A measurement can be valid even if it is not trustworthy. However, a measurement is typically dependable if it is valid.

3.5.1 Validity

Validity, according to Middleton (2019), is the degree to which a method accurately assesses the variables it is designed to. When a study's findings are highly valid, it means that they accurately reflect the genuine features, traits, and variations in the physical or social reality.

3.5.2 Reliability

Reliability, according to Middleton (2019), describes how consistently a method measures something. The measurement is regarded as reliable if the same result can be consistently obtained by applying the same techniques under the same conditions.

3.5.3 Pilot study

The term" pilot study "refers to mini versions of a full scale study as well as the specific pre testing of a particular research instrument such as a questionnaire or interview. Pilot studies are a crucial element in a good study design (Baker 1994) Conducting a pilot study does not guarantee success in the main study , but it does increase the likelihood . Pilot studies fulfill a range of important functions and can provide valuable insights for other reseachers . Inoder to pilot test the research instruments the researcher gave the questionnaire to non participating students to answer and 2 other teachers which were not part of the research were interviewed so as to have the general insight of the study a

3.6 Ethical considerations

Research ethics are moral standards that direct how researchers conduct themselves throughout the process (Punch, 2011). The study found the following ethical principles because ethics involves norms of conduct that specify and govern what behavior is acceptable and unacceptable during the data collection process:

3.6.1 Informed consent

In this study, the researcher asked for the participants' free and informed consent. According to Mungenda (2003), informed consent denotes that the research subjects are aware of the study's procedures and voluntarily consent to them. Participants were informed that the research was conducted for academic purposes and that their participation was voluntary. As a result, taking part in the study was optional (Osondu , 2008).

3.6.2 Anonymity and confidentiality

Tuckman and Monette (2011) contend that anonymity necessitates that names or identities of the respondents should not be disclosed, contrary to Makore (2001), who contends that the researcher must protect the anonymity of the research participants and the confidentiality of their diclosure unless they consent to the release of personal information. In order to comply with these ethical requirements, the researcher assured respondents that their names would not be published in the article and that pseudonyms would be used instead.

3.7 Data Presentation

Is a skill set aimed at finding, locating, manipulating, formatting, and presenting data in a way that best conveys meaning and offers knowledge. Inorder to provide Business Intelligence solutions with the data scope, delivery timing, format, and visualizations that will most effectively support and drive operational, tactical, and strategic behavior. Data Presentation combines the science of numbers, data, and statistics with the arts of data visualization, communications, organizational psychology, and change management.

The responses obtained from the respondents were analyzed using frequency and mean to answer the research questions. Since the questionnaire was designed based on the 4-point Likert scale system of SA, A, D, and SD respectively, numbers were assigned to each of them as follows

Strongly agreed (SA) ----------4

Agreed (A) ----------3

Disagreed (D) ----------2

Strongly Disagreed (SD) ----------1

Mean of response =∑fx /n = 4+3+2+1 /4 =10/ 4= 2.50

Therefore, any item response with mean below 2.50 will be accepted as Disagreed while responses with mean of 2.50 and above will be accepted as Agreed.

3.8 Summary

This chapter provided a background of how the research was conducted. It outlined the research design, the target population, sample, research instruments, concepts of validity and reliability and also ethical considerations.. Chapter 4 looked at data presentation and analysis.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 Introduction

This chapter seeks to present data that was collected from respondents through the use pre and post test, questionnaires and interviews. Presentation and analysis of data is given under this chapter. The chapter presents and analyses the findings of the research on the effects of biology practical activities on the academic achievement of O level biology students. Presentations of results are in form of tables. The last paragraph is the summary, which highlights major issues raised and gives focus of the following chapter.

4.1. Response Rate

The target population of this study were O level biology students at Mudzi secondary school , 2 biology teachers and 1 head of department (H.O.D) sciences. Out of the 40 questionnaires distributed, a total of 32 filled questionnaires were collected by the researcher and used for analysis. This translated to a response rate of 80%. The response rate conforms to stipulations by Mugenda (1999), that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and above is excellent for analysis. The response rate is illustrated in table 4.1

Table 4.1: Response rate

Response rate	**Frequency**	**%**
Response	32	80
Non response	8	20
Total	40	100

The data was presented and analyzed to provide answers to the research questions that guided the study The effects of biology practical activities on the academic achievement of O level biology students was achieved by performing pre-test to both the EG and CG. The purpose of the pre-test was to establish the learners understanding of the subject matter and determine the statistical difference in the academic performance of the groups. Further, the teaching strategies were designed to be independent variables where the learner performance was examined as a dependent variable.

The scores from the pre-tests and post-tests were analysed to find out if there was any statistically significant mean difference between leaners taught the lecture method and those taught using the experimental way. The two sample Z test was used for the analysis of the scores. The difference in the scores for the two tests were calculated for each learner. Mean and standard deviation, for the control group pre and post test were calculated. Also mean and standard deviation for the experimental group pre and post test were calculated.

4.2 Quantitative results.

4.2.1 Is there any significant difference between the mean scores of students' taught biology using the practical activities and those taught using the lecture method?

Scores that were obtained from the pre-test and post-test are presented in this section. The scores were used to find out if there was a statistically significant difference in the performance of learners taught using the lecture method and the experimental way. Fourty learners wrote the pre-test and the post-test (20 for the control group and 20 for the experimental group). The two sample Z test was used to analyse the scores at 5 % significance level.

Table 4.2 : Control group pre and post test scores

Learner	Leaner pseudonym	Pre test	Post test	Difference
1	Solo	4	8	4
2	Juniour	8	10	2
3	Ruth	9	11	2
4	Tambu	6	9	3
5	Norman	7	12	5
6	Zororo	3	7	4
7	Eddy	4	9	5
8	Carol	9	12	3
9	Rumbie	8	11	3
10	Jose	5	9	4
11	Miguel	6	10	4
12	Paty	8	12	4
13	Zviko	7	9	2
14	Tino	6	8	2
15	Ntando	5	9	4
16	Cleo	4	7	3
17	Gari	2	6	4
18	Nhamo	3	8	5
19	Cony	4	7	3

20	Hazvi	6	9	3

Table 4.3: Experimental group pre and post test scores

Learner	Learner pseudonym	Pre test	Post test	Difference
1	Tom	4	8	4
2	Betty	6	12	6
3	John	8	14	6
4	Jane	10	16	6
5	Shalom	7	10	3
6	Vicky	9	11	2
7	Stacy	3	8	5
8	James	5	12	7
9	Paul	12	14	2
10	Katy	10	12	2
11	Praise	8	14	6
12	Pinky	9	15	6
13	Catey	6	10	4
14	Ian	3	7	4
15	George	4	8	4
16	Concy	6	9	3

17	Saru	7	13	6
18	Timmy	9	14	5
19	Paulos	8	10	2
20	Doris	7	11	4

4.2.2 Comparison between control and experimental group pre and post test

From the tables above 75% of the learners in the experimental group passed the post test and 35% of learners in the control group passed the test. There was a 40% increase in the number passes between control and experimental group. In the control group none of the students passed the pre test and 35% passed the post test there after. In the experimental group 15% of the students passed the pre test and 75% passed the post test. Quality of the passes in the control group post test were not very good as compared to passes on the experimental group post test.

Table 4.4: Mean scores and standard deviations for pre and post test

Control group	Mean	N	Standard deviation
Pre test	5.7	20	2.07
Post test	9.15	20	1.78
Experimental group			
Pre test	7.05	20	2.45
Post test	11.4	20	2.62

The result from table 4.4 shows that biology practical has positive effect in academic of O level secondary school biology students. The mean score of the experimental (practical) group was higher than control (theory) group in the post-test. The standard deviation of the experimental group shows better value of 2.62 against 1.78 calculated derivation of the control group.

This finding is in line with the view of Onah (1994); stated that practical accounts for effective hearing of biology. Effective teaching and learning of biology demands practical works and cannot be done only theoretically. Emmanuel and Eze (2007) also agrees with this as they propounded that ,"students hear and they forget, the see and remember but that which they take part in they understand. Explaining further they noted that in biology lessons students have to take part in doing and on the course of doing practical's students learn. Eze and Ezemagu (2018) agreed with the fact that biology cannot be adequately learnt from a book but carrying out experiments using apparatus in the laboratory.

The first research question in this study was: Is there any significant difference in the performance of learners taught using the lecture method and experimental way.

Null hypothesis: There is no statistically significant difference between the mean scores of students taught using biology with practical activities and those taught using the lecture method

Table 4.5 Calculations from the EG and CG post test results

GROUP	MEAN(X)	S.D	NUMBER OF STUDENTS	Z_ cal 3.17	Z_crit 1.96	REMARK Rejected
E.G	11.4	2.62	20			
C.G	9.25	1.78	20			

The performance means of the post-test for CG and EG were 9.25 and 11.4 with the standard deviation of 1.78 and 2.62 respectively. From table 4.5 above, it could be observed that the z-

test calculated 3.17 are greater than z-test critical value 1.96. Hence there is significant difference between the mean academic performance of experimental and control groups. The z critical value obtained using the two sample Z test fell under the rejection region therefore, the null hypothesis (H01)was rejected signifying a significant difference between the performance mean of the CG and EG in the post test score. Going by the decision rule, the null hypothesis was rejected. This implies that there is a significant difference between the performance of experimental and control group. It showed that the practical method teaching biology is superior to the theoretical (lecture method).

Lunetta (2008) had a similar view, he said that practical contribute to greater success and retention in science based courses. Several authors agreed that schools which are involved in practical classes perform better and subsequently achievement higher assessment. Given the fact, it is sufficing to mention that practical work significantly improved the performance of the learners in the EG post test. The results of the hypothesis showed that there is a significant difference on the academic performance of Biology students taught or exposed to practical Biology activities. This confirmed the assertion of Rughnill, (2011) Alison, (2013) Alexander, (2016), Uche, (2018), that students exposed to Biology practical activities (experimentation) tend to learn more of what is taught, retain it longer, appear more satisfied with their practical work and perform better in examinations than when taught with other instructional formats. This is also in line with the empirical investigation reported by Nwagbo (2016), that students learn best when they are actively involved in the learning process.

4.2.3 Impact of biology practical activities on the students academic achievement in biology?

Table 4.6 : Mean responses from the respondents on the impact of biology practical activities on students' academic achievement.

QUESTION	**ITEM STATEMENTS**	**SA**	**A**	**D**	**SD**	**N**	**€fx**	**X**	**REMARK**
1	Practical work	20	5	4	3	32	106	3.31	**Agreed**

	stimulates learners interest in biology								
2	Practical Biology exposes students to acquiring skills	17	8	5	2	32	104	3.25	**Agreed**
3	Practical work makes teaching and learning easy and faster to the students	13	17	8	4	32	93	2.90	**Agreed**
4	Practical work enhances students performance in biology	5	4	18	5	32	73	2.28	**Disagreed**
5	Practical work promotes retention in students	6	2	20	4	32	74	2.31	**Disagreed**

In table 4.6 above, the researcher presents the responses by the respondents to questionnaire item 1 to 5 in relation to first research question which sought to find out the impact which biology practical pose on students' academic performance in biology.

From the calculations made above, the first question has a mean score of 3.31 which is above the criteria mean of 2.50, the second and third questions have a mean score of 3.25 and 2.90 respectively which are also above the criteria mean of 2.50 and as such termed as agreed, then the fourth and fifth questions have the mean score of 2.28 and 2.31 respectively which are below the criteria mean of 2.50 and as such termed as disagreed. From the grand mean calculated which has a mean score of 2.77 which is denoted as agreed, indicated that practical activities has a great impact on students academic performance in biology.

The findings in the table which sought to find out the impact which biology practical pose on the students academic performance in biology showed that practical work makes teaching and

learning easy and faster for the students. This study is in agreement with the findings of Nwaodo (2018), which stated that inadequate laboratory facilities reduces students' interest in practical activities and leads to poor academic performance. The finding also showed that practical biology exposes students to acquiring process skills. It has link with the findings of Ezemagu (2018), that biology practical activities is the scientific study of the life and structure of plants and animals and their relative environment in real experimental set up. The findings revealed that practical work assists students in utilizing their knowledge and skills acquired in real field outside classroom. This also has link with the finding of Ude (2014), that laboratory and field work are central to the teaching of biology. Karen et al (2015) joins the discussion agreeing that by providing students practical laboratory lessons that are academically stipulated, students are more likely to engage meaningfully with task and subsequently achieve higher assessment grades.

4.2.4 Impacts of teacher related factors on students performance in biology practical?

Table 4.7: Response from the respondents on the impact with teacher related factors pose on students ' performance in biology practical.

QSTN	**ITEM STATEMENT** S	**SA**	**A**	**D**	**SD**	**N**	**€fx**	**X**	**REMAR** K
6	Poor teacher relationship affect students performance in biology practical	18	2	5	7	32	95	2.96	**Agreed**
7	Laziness of teachers affect students performance in biology practical	14	8	7	3	32	97	3.03	**Agreed**

8	Preparation of teachers affect students positively during practicals	5	4	5	18	32	60	1.87	**Disagreed**
9	Truancy on the part of teachers affect students performance in biology practical.	7	10	12	3	32	85	2.65	**Agreed**
10	Lack of motivation from the teacher affects students interest in biology	15	6	6	4	32	94	2.93	**Agreed**

In table 4.7 above the researcher presents the response by the respondent to Question item 6 to 10 in relation to research Question three which sought to know the impact which teachers' related factors pose on students' performance in biological practical.

Based on the calculations made above, the first question has a mean score of 2.96 which is above the criteria mean of 2.50, the second question has a mean score of 3.03 which is also above the criteria mean of 2.50, which are then termed as agreed, the third question has a mean score of 1.87 which is below the criteria mean of 2.50 which showed disagreed, then the fourth and fifth questions have the mean score of 2.65 and 2.93 respectively which is above the criteria mean of

2.50 and also termed as agreed. This indicated that among the effect to be considered, teacher related factors has a great impact on students academic performance in biology.

Findings in table 4.7 showed that poor teaching relationship affect students performance in biology practical. This also agreed with the findings of Ugwu (2014). That the use of practical activities to the teaching of biology concept should therefore be a rule rather than an option to biology teachers. The teacher should apply any method of motivation so as to heighten the spirit of the students. The findings also showed that poor preparation of teacher affect students during practical. This has link with the finding of Agaelu in opuh (2018) that science teacher should possess a good professional training and biology teachers are expectations. Nnamonu (2013) advocated that teachers should be using laboratory method mostly in teaching to avoid making biology largely a memory work. Further observations made include that schools were the laboratory is effectively used significantly performed better in biology. From Ugwu (2015) findings it has been noted that another factor that affects biology teaching and learning is the teacher. A teacher who knows pretty well the content of the subject at finger tips can restore confidence on students using a language that motivates them. Similary Opuh Eze and Ezemagu (2018) asserted that the quality of a good teacher is good mastery on the subject matter. In light of the above , Ude (2014) recommended that the place in which biology is to be taught is the indispensable laboratory. It is essential for every biology teacher to become acquitted with teaching method that will help students achieve their learning objectives.

4.2.5 Impact of school management factors on the practice of biology practicals towards the academic performance of students ' in biology?

Table 4.8 : responses from respondents on the impact on which the school management factors pose on the practice of biology practicals towards the academic achievement of students in biology.

QUESTION	ITEM	SA	A	D	SD	N	€fx	X	REMARK

	STATEMENTS								
11	Inadequate provision of infrastructure affect the effective practical activity performance in schools.	5	4	19	4	32	74	2.31	**Disagreed**
12	Lack of proper supervision during practical affect students ' performance in biology	8	14	4	6	32	88	2.75	**Agreed**
13	Inadequate maintenance of laboratory affect students performance	7	4	8	13	32	69	2.15	**Disagree**d
14	Unavailability of instructional materials affects students performance	12	8	7	5	32	91	2.84	**Agreed**
15	Inadequate facilities affect students	15	7	6	4	32	97	3.03	**Agreed**

	performance in biology practical								

From table 4.8 above are the responses by the respondents to items 11 to 15 in relation to research question four which sought to find the impact which school management factors pose on the practice of biology practical towards the academic performance of student in biology.

From the calculations made above, the first question has a mean score of 2.31 which is below the criteria mean of 2.50,the second question has a mean score of 2.75 which is above the criteria mean score of 2.50,the third question has a mean score of 2.15 which is below the criteria mean of 2.50 and then termed as disagreed, the fourth and fifth questions has the mean score of 2.84 and 3.03 respectively which is above the criteria mean score and then termed as agreed. Based on the grand mean calculated, which has a mean score of 2.65 which was denoted as indicated that school management factors on the practice of biology practical has an impact on the academic performance of students in biology.

These finding which sought to know the impact which school management factors pose on the practice of biology practical towards the academic performance of students in biology showed that adequate provision of infrastructure affects student's performance in school. This was made known by the responses of the respondents hence indicating that inadequate provision of infrastructure affects the students' performance in school.

This also has link with the finding of Nwagbo (2018) that laboratory activities help to increase overall quality of education of the student and help the participants actively in learning. The finding also showed that lack of proper supervision during practical affect students' performance. This agreed with the finding of Okonye (2012) that the laboratory activities should be investigated in approach so that they can provide students with the opportunity of acquiring process skill. In a study conducted by Udeh (2014) of Enugu states it was concluded that laboratory equipment is lacking and there is insufficient time for biology practical's. Similary Eze and Ezemagu (2018) agreed with the fact that science particularly biology cannot be

adequately learnt from a book but by carrying out experiments. Lunnetta (2018) also agreed that some of the poor performance in biology is due to ill equipped biology laboratory, of which it is not be so. The laboratory needs to be equipped and students regularly visiting it for experimentation in order to acquire skills. Osogbonye (2012) is of the opinion that the laboratory is the right place where students learn to do what scientist do , that is where they use the skills and attitudes of science to go through the scientific process to seek knowledge. From this discussion it of outermost importance for school management to provide infrastructure that is appropriate for learning.

4.3 Qualitative data

4.3.1 Responses from the interviews

Two teachers who teach Biology and one H.O.D were interviewed. They all showed that they understood the topic under reaseach and they even noted that it is one area of interest in the teaching and learning of biology. Regarding the challenges encountered in the teaching of Biology practical lessons, all participants stated that lack of resources, facilities, lesson time and large classes as the main challenges faced when teaching practical lessons. The first teacher to be interviewed said that,

"Managing large groups is a challenge. We are forced to deal with large groups because of limited resources. Another challenge is time. There are many subjects and activities done by students".

The second teacher to be interviewed response was,

" The first challenge is abnormally large classes. It is difficult to control a large number in a practical lesson and most of the time is spent on distributing the apparatus to large classes. Another challenge is sharing of apparatus. Some of the students are slow learners they really need time with the apparatus such that practical lesson ends whilst they have not completed their task". The shortage of apparatus and large classes are the main challenges we face.

The H.O.D. cited lack of knowledge as the biggest challenge. Most teachers have degrees but do not have the teaching qualification. They know the content but may not know how to put it

across to the students. Due to that fact, they may not give a proper Biology practical lesson because they do not know how to conduct the practical lesson at the level of the student.

This goes in line with findings made by Owino, Ahmad and Yungungu (2014).The teaching of Biology practical lessons is not spared from drawbacks which inhibit the achievement of set goals. The factors such as unavailability of science teachers in schools, lack of materials, lack of funds and time have constrained the teaching of Biology practical lessons. Consequently, many students fail to perform well in Biology because of inadequacy of instructional material such as laboratories, chemicals, models, apparatus, local specimens and shortage of textbooks. Lack of allocated practical lesson time and irregularity of carrying out practical Biology lessons by teachers affect student performance and understanding .

However, it has been observed that inquiry-based instruction requires the most expert teachers and there is need to prepare novice teachers in several domains of teaching, including pedagogic content knowledge, students' knowledge, and classroom management knowledge. In Zimbabwean secondary schools, the majority of Biology teachers are not experts, they are degree holders who have deep knowledge in content but lack teaching methodology (Mulkeen, 2010). A study conducted by Obiekwe and Chinwe (2012) in Nigeria on the teaching of biological concepts using the 5E (Engagement, Exploration, Explanation, Elaboration and Evaluation) model revealed that students who were exposed to the 5E method achieved better results than those whose teachers used the lecture method. Some teachers laid too much emphasis on content and the use of 'chalk and talk' approach which does not enhance the teaching and learning of Biology. This slackness and 'shy- away' attitude from activity based-approach of instructional delivery has led to abstraction, which makes the students passive and more inclined to rote memorization (Obiekwe & Chinwe, 2012). Such teacher-centered method that puts the students as passive recipients of knowledge and the teacher as the only source of knowledge might not improve

4.5 Summary

Chapter 4 presented , analyzed and interpreted the findings of the study in an attempt to answer the research questions. From the findings it has been noted that biology practical activities have positive effects on students' academic achievement ,and it is true that there is a significant

difference between students taught using the lecture method and those that are taught using the experimental way. Factors which contributes to this involve teacher related factors fac the school management factors.

CHAPTER FIVE

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

.5.0 Introduction

This chapter concludes the research study. It provides a summary of the previous chapters and covers findings of the study and gives recommendations based on research findings.

5.1 Summary

The purpose of the research was to investigate the effects of biology practical activities on the academic achievement of O level biology students at Mudzi Secondary School.

Chapter one covered the introduction of the research, the background to the study, research problem, main research question, research objectives, significance of the study, delimitation of the study, limitations to the study, definition of terms. Chapter two **c**overed the literature review of this research study. Equally, the theoretical frameworks used for the dissertation were discussed noting the justifications for using them. Chapter three covered the research design, population, sample design, research instruments and validity and reliability of research instruments. The population used were head teachers, teachers and students who were given questionnaires to fill. The mixed method approach was used as the research design.Chapter four has looked at data presentation and analysis. The data was obtained from pre and post test, questionnaires and interviews. A total of 40 questionnaires were sent out and 32 were responded to representing 32/40(80%) response rate.

In addressing the research questions, data were generated from pre-test, post-test, questionnaire and interviews The findings are presented according to the four research questions of the study.

The study's conclusions showed that there was a statistically significant difference in how well learners performed. Following the experience, the students did better on the post-test. When compared to students who passed the pre-test in the EG, there was an increase in the proportion of students who passed the post-test. Even if the performance was better, several students felt that the quality of the performance was lacking.

Positive student-teacher interactions undermine biology class performance. Students that study practical biology have exposure to learning process skills. Practical assignments let students apply the knowledge and abilities they have learned outside of the classroom. During practicals, pupils are impacted by professors' lack of preparedness. The availability of infrastructure and good supervision during practical's both improve student academic achievement in the classroom. Biology practical student academic performance is impacted by school management-related factors.

However, even though the research questions were answered constraints were encountered during the compiling of this project . The amount of time provided for conducting the research was insufficient. This is so that the teacher might teach students while also attending classes. Additionally, the data was only collected at the beginning of the third term, leaving insufficient time for a complete analysis. This constrained the project's scope. Since the number of students used as a sample for this study was constrained by the cost of the materials, they might not accurately reflect the entire population being examined. Also the study was limited to Mudzi Secondary School only and biology students. In addition, the researchers did not have the freedom to choose what was to be taught but had to follow the outline of the subjects' curriculum provided by the school. The number of lessons per week also had to be limited to what was scheduled and planned by the school. It may suffer from factors such as being too population-specific.

5.2 Conclusions

The conclusions are based on the biological findings.

Students that are given the opportunity to participate in practical activities in Biology perform better than their counterparts who have lesser practical activity. These students have helped to identify the problems of poor academic performances of students in biology and other science subjects.

The study concludes that biology practical lessons enhanced active interaction and immense support from teachers. Student engagement was higher and their performance was much better in practical than in non-practical options as proved by the pre and post test marks. Practical sessions

yielded better learning achievement than the nonpractical sessions as far as student performance is concerned. The reseacher concluded that students generally performed better during biology practical sessions compared to the nonpractical sessions. Therefore, practical classes yielded better learning outcomes than the nonpractical classes.

The study also coclydes that the student in the EG taught using a practical learning approach performed better than those in CG who were instructed using the traditional lecture technique, suggesting that integrating of experimental work into biology teaching would improve performance of learners. Also, improvement is collective for both boys and girls. Experimental teaching strategy, therefore, has a positive effect on the' achievements of learners in biology compared to the conventional teaching method such as lecturing which is ineffective in achieving better outcomes.

When learning resources are available in the classroom, secondary school students are interested in learning. When teacher-student relationships are strengthened, student academic performance is increased. When students are properly supervised during practicals, academic performance improves.

5.3 Education Implication of the Findings

The following discussion outlines the significant educational implications of the study's findings for parents, teachers, guidance counselors, and school administrators.

Parents are urged to work on their parenting skills at home in order to help their children grow in personality and academic ability. In addition, parents should provide some learning resources for their kids at home in order to boost academic achievement.

Teachers are sufficiently trained to be able to offer invaded children and activities on student academic performance their full focus. As a result of their knowledge of the inherited importance of achievement, guidance counselors at all levels are now in a better position to advise school administration to create an environment that is conducive to learning and will help students gain a deeper understanding of themselves. They also know how to help students who are experiencing emotional depression.

Because they are aware of the practical job, school administrators are in a good position to request that the pupils receive essential educational supplies.

5.4 Recommendations

The following recommendations were made in light of the findings:

- Teachers should encourage students to develop interest in practical activities by engaging them in practical work.
- Teachers should attain workshops and conferences regularly to improve on their performance in science.
- Biology concepts should be taught with practical activity so that students will be engaged in hands on activity and reduce rote learning
- Because biology is a topic that emphasizes application, the government should assist in setting up biology laboratories in all schools to broaden the scope of biology instruction. Instead of waiting for the government to provide everything, teachers can work to enhance the equipment that is hard to obtain.
- The government has to end the ban on hiring teachers and send enough scientific teachers to schools in both urban and rural areas.
- Buildings at schools, particularly laboratories, should be provided with assistance from the government and local communities to ensure that there is enough time for practicals.

- To keep scientific educators' expertise current, the ministry of education should host seminars.
- The condition of scientific instructors' services should be enhanced, and more financial incentives should be provided, as this would encourage them to teach the topic very well.
- Parents should be informed about how the students' academic performance is impacted by practical activities.

5.5 Suggestions for future studies

The following recommendations are made for further research.

1. It is imperative to conduct a thorough replication of a historical study in a more untamed locale with a larger sample size.

2. Research should be conducted to identify additional factors that might affect students' academic performance.

3. Since Mudzi Secondary was the only school included in the study, the researchers recommend looking into other schools in the district to see if the findings are related for the purposes of future research.

4.New designs, statistical methods, or a broader scope should be used in future studies. One option is analysis of variance (ANOVA).

REFERENCES

Abugu, E.C (2007*). Intermediate Practical biology with alternative to practical*: Volume 2, Count Publishers Limited Enugu Nigeria

Allan, J. Rob and Jonathan .W (2000) *Practical Skills Education in Biology:* Longman limited: England

Amichebe, H.J (2007). Measuring, Improving and Sustaining Healthy learning environments in

H.J Freberg (Ed) School climate: measuring improving and Sustaining healthy learning environment (Philadelphian, PA. Falmes press) p.11.

Aniodoh, H.C.O (2001) *History and Philosophy of Science:* Enugu Nigeria: Hacofam Educational Books.

Benze, J., and Hudson, R. (2015*). Asking the Right Question About leadership*, America psychologist, 62(1), 43-47.

Chinyere, I., Bebia, David, M., & Amba, Hope, N. (2014). *The Effect of Biology Practical Activities on Academic Performance of Secondary School Students in Cross River State, Nigeria academic Performance of Second*ary School Students in Cross River State, Nigeria. IOSR Journal of Humanities and Social Science, 19(3), 12-19.

Çimer, A. (2012). *What Makes Biology Learning Difficult and Effective: Students' Views. Educational Research and Reviews*, 7(3), 61–71. https://doi.org/10 .5897/ERR1 1.205.

Chapman, & Elaine. (2003). *Assessing student engagement rates.* ERIC Digest, 1–7.

Cresswell, J. W. (2003). *Research design qualitative, quantitative and mixed methods Approaches.* Thousand Oaks. Sage Publications.

Eze, P. and Emmanuel P. (2007). *An investigation into the qualification on the biology laboratory assists and its effect on their performance in laboratory work in our*

secondary school in Isi-Uzo LGA, Enugu State Unpublished N.C.E thesis; Federal College of education (FCE) Eha-Amufu.

*Eze, S.O. (1995). A study of methods used in teaching Agric ScienceinSenior Secondary School in Ohaukwu LG*A Unpublished B.sc thesis UNN. First Edition

Fafunwa, E. and Ugwu, G. (2015). Learning to Notice Scaffolding New Teaching Interpretation of Classroom.

Gunuc, S., & Kuzu, A. (2016). *Assessment &Evaluation in Higher Education Student engagement scale : development, reliability and validity*. Assessment & Evaluation in Higher Education, 2938(December)

Haralambos, M. and Holborn, M. (1991). *Sociology: themes and perspectives*. London: Collins Educational Publishers.

Henry, S. (2015). *A Comparison of Exemplary, Recognized and Accepted Schools rated or the taxes. Assessment of academic skills and climate*: Dissertation abstracts international, AAT 3008 1481 (doctoral dissertation, the university of histone).

Hofstein, M. and Lunette, L. (2013). *Enhancing Leadership Effectiveness* (Lenexaks. Joshas publishing).

Iloeje, S.O. (2005) *Certificate Practical Biology.* Longman Group Limited. Second Edition

Iloeje, S.O. (1981*) Certificate Practical Biology.* Longman Group Limited. First Edition

Johnstone, R.H., Al-shuili, G.A (2011). *School Culture and performance:* Testing the Invariance of an Organizational Model School Effectiveness and School Improvement 9,(1), 76-96.

Karental, Ime, E., Somi J., and Henry, S. (2015). *Developing Principals as Instructional Leaders.* Phidelta kappan, 82,598-606.

Killdare, E. (2007*). High School: a Report on Secondary Education in America.* (New York Harper and Row) e, F.O (2015). Planning and Organization of Practical Work in Biology in Secondary School Journal of the science teachers association of Nigeria: 19 (2): 49-60

Kuren, E., Zonnetye, D., Navelle, B., and Jeanne, K. (2015). *Shaping School Culture, the Heart of Leadership* (San Francisco, CA Jossey Bass)

Kuruse, R., Hurtely, B., James, P., and McInnis, R. (2015) *Professional Learning Communities of Work.* (Bloomington in: National Education Service).

Leedy, P. D. and Ormrod, J. E. (2005). *Practical Research: planning and design*, (8th edition). New Jersey: Pearson Merrill Prentice Hall.

Lunetta, N.V. (2018). *The Role of Laboratory in Science Teaching:* Neglected area of Research. Werzmanm Institute of Science; University of Lowa.

McLeod, S. A. (2018). Q*uestionnaire: definition, examples, design and types. Simply Psychology*. www.simplypsychology.org/questionnaires.html

Macmillan, J. & Schumacher, G. (2009) *Research in education. A* conceptual Introduction, New York, Wesley.

Millar, R., & Abrahams, I. (2009). *Practical work -Research Database, T*he University of York. School Science Review, 91(334), vol 91, no. 334, pp. 59-64.

Mwenje, E. (2012). *Mathematics, Science and Technology Conference.* Bindura: Bindura: University of Science Education.

Nnamonu, E.I (2013). *Planning and Designing a Standard Biology Laboratory to enhance effective teaching and learning of Biology in secondary school in Isu-Uzo LGA in Enugu State* Unpublished NCE Thesis FCE Eha-Amufu.

Nwagbo, C.R. (2016) *The relative afficacy of guided inquiry and expository methods on achievement in biology students of different levels of scientific literacy* : Journal of Nigeria 34(1&2) 66_73.

Onah, R. (2013). *A Techniques for the Measurement of Attitudes Archives of Psychology, 1*40 1-55.

Onah, A.M. (1994). *Teaching Biology Effectively:* Ilorin Nigeria: Joes publish LTD.

Okeke, E.A.C.(2007) *Making science education accessible to all 23rd inaugural lecture:* University of Nigeria. Nsukka.

Okoro, B.N & Ewelukwa G.O (2007) : *A Handbook of practical Biology for senior secondary school*: Niger- Wins publishers Ltd.

Opuh, T. I., Ezeh, U. P. and Ezemagu, J. C. (2008). C*auses of Students Problems and Weaknesses in Biology Practicals of Secondary School in Nkanu-West LGA, Enugu State*. Unpublished N.C.E thesis: Enugu State College of Education (Technical) Enugu.

Orjika, H.J (2015). *School Climate*: Measuring Improving and Sustaining Healthy Learning

Osondu, E.H. and Abugu, E.C. (2008), *Research Methodology.* Enugu-Nigeria: Lano publishers.

Panneersekvam, R. (2004). *Research methodology, Prentice Hall India, New Delhi.*

*Ruparanganda, F., Rwodzi, M. & Mukundu, C.K. (2013).Project Approach as an Alternative to Regular Laboratory Practical Work in the Teaching and learning of Biology in Rural Secondary Schools in Zimbabw*e. International Journal of Education and Information Studies, 3(1), 13-20.

Simms, L. J., Zelazny, K., Williams, T. F., & Bernstein, L. (2019). *Does the Number of Response Options Matter?* Psychometric Perspectives Using Personality Questionnaire Data. Psychological Assessment, 1-9.

Simon, M., and Collins, E. (2013). *Organization Problem Solving*: An Organization Improvement Stratagem (Fayheville, AK Organizational Health Diagnostic and Development corp.)

Tan, W.K. (2018). *Organization Climate and Culture, a Conceptual Analysis of the School Work.*

ZIMSEC (2014) *Biology examination report.* Harare: Government printers.secondary school in other area.

APPENDIX 1

THE PRE_ TEST /POST TEST QUESTIONS FOR STUDENTS '

Answer all questions

Circle the correct answer

	What three things do plants need for the process of photosynthesis a) sunlight , oxygen and sugar. b) water, soil and oxygen c) carbondioxide , oxygen and soil d) sunlight, carbondioxide and water. (2)
	I**f plants breath in Carbondioxide, what do they breath out?** a) nitrogen b) oxygen c) carbonmonoxide

	d) hydrogen (2)
	What color is chlorophyll? a) red b) blue c) yellow(2) **d)** green **What name is given to structures inside plant cells that contain chlorophyll ?** a) nucleus b) ribosomes c) chloroplast d) mitochondria (2)
	Which of the following substances is an end product of photosynthesis? a) carbondioxide b) chlorophyll c) carbohydrates d) carotenoids (2)
6	**Which one is the correct word equation for photosynthesis** a) carbondioxide + water __ sunlight/chlorophyll ..... glucose + oxygen b) oxygen+ carbondioxide __ sunlight/chlorophyll.....glucose + water c) carbohydrates+ oxygen __ water/ chlorophyll.....sunlight + glucose d) sunlight+water _ glucose/ chlorophyll.....oxygen + carbondioxide (2)

7	When carrying out an experiment of testing leaves for startch, after the leaf is removed from the beaker which contains methylated spirit it is put back in boiling water. Why is that done? a) to stop chemical reactions b) to remove chlorophyll. c) to soften it d) to wash it (2)
8	**State any two precautions that need to be taken note of when carrying an experiment on testing leaves for startch.(2)**
9	**Describe what happens to the end products of photosynthesis once they have been manufactured (2)**
10	**Explain the role of water in photosynthesis.(2)**
10	

APPENDIX 2.

QUESTIONNAIRE FOR STUDENTS '

My name is Abigirl Takawira. I am currently studying for a Bachelor of Science Education Honours Degree Biological Sciences (HBScEdBz). I am requesting for your assistance by answering the questions in this questionnaire. Your response will be used for the purpose of my research study only. Responses will be treated with confidentiality.

PLEASE DO NOT WRITE YOUR NAME

SECTION A : (PERSONAL DATA)

Name of school.....

Sex.....

Class.....

SECTION B

In the following items please tick (✓) in the appropriate column. The keys are Strongly Agreed (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD).

Research question two.

What are the impact of biology practical activities on students ' academic performance in biology?

Question	ITEM STATEMENTS	SA	A	D	SD

1	Practical work stimulates learners interest in biology .				
2	Practical biology exposes students to acquiring skills.				
3	Practical work makes teaching and learning easy and faster to the students .				
4	Practical work enhances students ' performance in biology.				
5	Practical work promotes retention in students				

Research question three

What are the impact of teacher's related factors on students' performance in biology practical?

Question	ITEM STATEMENTS	SA	A	D	SD
6	Poor teacher relationship affect students performance in biology practical.				
7	Laziness of teachers affect students ' performance in biology practical.				
8	Preparation of teachers affect students positively during practical				
9	Truancy on the part of the teachers affects students ' performance in biology practical				
10	Lack of motivation from the teacher affects students interest in biology practical.				

Research question four

What are the impact of school management factors on that practice of biology practical towards the academic achievement of students ' in biology?

11	Inadequate provision of infrastructure affect the effective practical activity performance in schools.				
12	Lack of proper supervision during practical affect students ' performance in biology.				
13	Inadequate maintenance of laboratory affect students performance.				
14	Unavailability of instructional materials affects students performance .				
15	Inadequate facilities affect students performance in biology practical.				

APPENDIX 3

INTERVIEW GUIDE FOR TEACHERS

1. Do you have an understanding of the topic under research?
2. Do you think there is a difference between leaners taught using the experimental way and theoretical way in terms of academic achievement in biology?
3. What are the effects of biology practicals activities on leaners?
4. Does the presence or absence of a laboratory have an impact on teaching and learning of biology.
5. Do you usually carry out all the practicals as per the syllabus?
6. What are the challenges that you encounter as a biology teacher?
7. What do you think are the solutions to these problems?

THANK YOU

APPENDIX 4

FORMULA

$$\bar{x} = \sum xi / n.$$

$$s = \sqrt{(xi - \bar{x})2 / (n - 1)}.$$

The test statistic

$$z = \frac{\bar{x}1 - \bar{x}2}{\sqrt{[(\sigma 21 / n1) + (\sigma 22 / n2)]}}.$$