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An investigation on to the impact of improvisation on learner achievement in the teaching and learning of Biology at O level, a case study of Chipangura Secondary School, in Guruve District.

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APPROVAL LETTER

The undersigned certify that they have supervised, have read and recommend to the University for acceptance and examination a research project entitled:

An investigation on to the impact of improvisation on learner achievement in the teaching and learning of Biology at O level, **a case study of** Chipangura Secondary School, in Guruve District Mashonaland Central Province.

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This project is our original work and has not been presented for any award in any university.

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Date : June 2024

Dedication

This project is dedicated to our daughters and sons.

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ABSTRACT

The study aimed to investigate the impact of improvisation on learner achievement in the teaching and learning of Biology at Ordinary Level, a case study of Chipangura Secondary School in Guruve District. Prior research has indicated that students perform better while using hands on approach (improvisation) compared to traditional methods (non-improvised). The study employed a mixed approach, incorporating both quantitative analysis of interviews with learners and teachers and also questionnaires for learners and teachers. Qualitative research was also employed so that the researcher would measure and analyze data in each research study. A population size of 32 learners, Form 3 Biology students were used and only a sample size of 16 were chosen from the population using systematic random sampling . Four teachers were purposively chosen as they were Biology teachers for form 3 students. The study found that improvisation promotes active engagement, facilitates in-depth concept mastery, critical thinking, creativity and discourages rote memorization and passive learning. Based on the findings, the research also identified and evaluated potential interventions to address the issue of professional development from Ministry of Primary and Secondary Education (MOPSE), thus strategies as workshops and training of teachers especially for Biology and other practical subjects to incorporate improvisation techniques. The findings highlighted further study as to assess the long term effects of improvisation so that there is expansion of knowledge base on learner achievement. The findings were expected to provide important insights to educators, policy makers to enhance improvisation as an important tool for learner achievement in Biology teaching and learning.

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CHAPTER 1: INTRODUCTION

1.0 Introduction

Improvisation is a new and highly innovative act of using alternative materials and resources to facilitate instructions whenever there is shortage of specific first-hand teaching aids. This study investigates the impact of incorporating improvisational techniques in the teaching and learning of Biology at 'O' level, a case of Chipangura Secondary School in Guruve district, Mashonaland Central Province of Zimbabwe. As such, this chapter focuses on research background, statement of the problem, research aims, limitations and delimitations of the study as well as key terms used in this study.

1.1 Background to the study

Education commissions and other education reviewers have consistently recommended strategies to improve teaching and learning of science as cited in National Academies of Sciences, Division of Behavioral, Board on Science Education (2020). Science education is considered as a major determinant for any country's industrialization and technological development. This therefore implies that science education is a major driver towards innovation advancements in technology. According to Purnomo, Yulianto, Mahdiannur and Subekti (2023), science is learnt under Biology, Physics, Chemistry and Agriculture and knowledge acquisition of these subjects has made tremendous impact in nearly all aspects of human life. Science learning areas have important applications in research, information communication technology, industrial and agricultural development as propounded by Tiwari, S. P. (2022). In Zimbabwe, the Ministry of Higher and Tertiary Education, Science, Innovation and Technology stresses the essence of science subjects as aligned with Science, Technology, Engineering and Mathematics (STEM) initiative.

The results in science subjects have generally been showing low performance. In the context of Africa, Kenya and Tanzania experienced this poor performance in recent years. In Tanzania, the 2018 form four national pass rate in sciences was substandard. Physics had 43.2 percent which Chemistry and Biology had 43.3 and 43.4 percent respectively. Poor performance trends of such poor performance in science subjects have also been reported by quite a number of scholars in

Zimbabwe, inclusive of the Zimbabwe School Examination Council (2019) results report, andVaraidzaimakondo and Makondo, (2020).

This substandard performance in science subjects is due to a number of challenges including dominant use of traditional teaching practices, laboratory insufficiency and inadequacy, lack of and learning materials and shortage of qualified science practitioners.

As part of solution to these challenges, UNESCO (2016) emphasized the importance of practical-based and hands-on learning as well as encouraging innovative and interactive pedagogical approaches that engage students and foster their critical thinking skills. It encourages educators to employ active learning methods to make science education more inclusive, motivational, flexible, dynamic, and effective. Science teachers are therefore encouraged to migrate from consistently using traditional teaching and learning practices and adopt the modern methods of instruction.

Improvisation as a modern teaching practice, has therefore gained significant attention as it is practical based and promotes hands-on, while having the potential benefits to increase motivation, engagement, facilitates active learning, understanding and concept retention and ultimately improve performance standards in learners. However, the specific impact of improvisation on both teachers and learners is not clearly established, hence the need for this study. This has inspired the researcher to tackle this research gap.

1.2 Statement of the problem

The scarcity of resources and limited capacity of the government to equip schools with the much needed instructional materials has had a particularly negative impact in the teaching and learning of Biology, Physics, Chemistry and Agriculture. Many less informed science teachers have been forced to dominate their teaching and learning using traditional methods of instruction. Learner performance in these science learning areas has further been affected, which has made it almost impossible to progress to higher and tertiary levels as in the case of Zimbabwe. This has caused profound effects on individuals. National underdevelopment has been another resultant effect since poor performance in science subjects is heavily linked to high scientific illiteracy rates, poor healthy, poor hygiene and sanitation, substance abuse, low life expectancy, high mortality

rates, poor agricultural production, lack of innovation, global warming, poor environmental conservation among other effects. The incorporation of improvisation however came as a relief to cushion the deficit of science subject resources. This study therefore, seeks to investigate the merits of incorporating improvisation on learner achievement in science subjects, Biology included, in secondary schools.

1.3 Research Objectives

1. To determine the merits of incorporating Improvisation on students' achievement in Biological Science in secondary and high schools.
2. To determine the limitations of traditional methods of instruction on learner achievement in science education.
3. To determine the challenges faced by learners who are taught Biology using improvisation techniques and suggesting possible solutions to such challenges.

1.4 Research Questions

With respect to Chipangura Secondary School, in Guruve district, Mashonaland Central Province of Zimbabwe, the research questions were as follows:

1. What are the merits of incorporating improvisation in learner's achievement standards in Biology?
2. What are the limitations of traditional methods of instruction on learner achievement in teaching and learning of Biology?
3. What challenges are faced by learners taught Biology using improvisation techniques and how can these challenges be alleviated?

1.5 Significance of the study

The use of the new and highly innovative improvisational technique in the curriculum is very essential for both teachers and learner achievements in science subjects including Biology in secondary schools. The researcher will determine the attitude of both educators and learners towards use of improvisation as a modern method of science teaching and learning. If the benefits of incorporating improvisation on learner achievement are uprooted, recommendations

will be made. Improvisation will then be put into its best usage to improve teaching and learning of science, including Biology. The findings of this research could inspire further investigations into the application of improvisational techniques in various educational settings. It can pave the way for collaborative efforts and interdisciplinary research, promoting a holistic approach to educational innovation and improvement.

1.6 Assumptions of the study

It is assumed that:

- Teachers are willing to incorporate improvisation techniques into their biology lessons.
- Students are open to engaging in improvisational activities as part of their biological science learning.
- Both teachers and students will co-operate and be able to divulge information pertaining to the research.
- Questionnaires will accurately reflect what is expected and respondents will be able to interpret them as expected.
- The information provided by respondents will be true, accurate, unbiased and that inferences drawn from this study will be valid and determined by the above assumptions.

1.7 Limitations of the study

The study only involves a small group of students and teachers, which may limit the generalizability of the results to a larger population. However, the reasonably larger sample size that ensures a more diverse and representative group of participants by the researcher will be necessary so as to get fairly reliable research findings. Limited time negatively affects time available for data collection and analysis, which may affect the depth and breadth of the study. The study will be carried out within a short time frame prescribed by Bindura University of Science Education. In addition, the limited resources, time and financial constraints restricted the researcher to carry out the study in depth. As a result, the researcher was forced to only rely on a single case study that is Chipangura Secondary School. Hence data gathered was potentially inadequate for realistic generalizations.

1.8 Delimitations of the study

Restricting the study to a specific geographical area (Chipangura Secondary School in Guruve District) is a delimitation to control for regional differences in educational environments. This affected the reliability and generalizability of the research findings to a larger population.

1.9 Definition of terms

Biology: is the scientific study of living organisms, their structure, function, growth, evolution, distribution, classifications and interactions with the environment (Bongard and Levin, 2021).

Improvisation : in science teaching and learning, refers to the ability to make the most out of limited resources and find creative alternatives when traditional materials or equipment are unavailable or insufficient (Segu-Essel, 2021).

Teaching: Munna and Kalam (2021) defines teaching as the process of imparting knowledge, skills, and values to students through various instructional strategies and methods

Learning: is the acquisition of knowledge, skills, behaviors, or understanding through study, experience, or instruction as viewed by Alenezi, (2020).

Impact: Mulang, (2021) highlights that impact refers to the influence that something has on a person, thing, or situation.

1.10 Summary

This chapter had been focusing on background of the research study, problem statement, research objectives, research questions, the significance of the study, assumptions and definition of key terms. More importantly, the limitations and delimitations that affected the reliability of conclusions drawn from the study were also highlighted. The following chapter shall focus on review of related literature on improvisation as it applies to teaching and learning of science subjects, biology in particular.

CHAPTER 2 : LITERATURE REVIEW

2.0 Introduction

This chapter intends to review the literature related to the impacts of improvisation on learner achievement in the teaching and learning of biology at O level. Reviewing the literature helps to understand the existing evidence and theories surrounding the effects of improvisation on science education in general and biology's teaching and learning in particular. This can also help in identifying gaps in current knowledge, inform the development of future research studies and possibly provide insights for educators and policy makers in enhancing science instruction. The scope of literature review will involve searching for and analyzing relevant academic articles, journals, books, and other scholarly sources that investigate the use and impact of improvisation in biology education. The main themes that is, the merits of improvisation, limitations of traditional instructional methods (non-improvisation), as well challenges of improvisation in regard to teaching and learning of biology will be ironed out in this chapter.

2.1 Merits of incorporating improvisation on learner achievement in biology as a science subject?

2.1.1 Improvisation captivates students' attention and encourages increased engagement.

Several studies have reported the effectiveness of improvisation on students' achievement in biology. According to Robledo, Aguja and Prudente, (2024) incorporating improvisational activities, such as role-playing or scenario-based learning, captivates students' attention and encourages their active involvement in the learning process. Sand, Forde, Ploger and Poulsen, (2023) postulates that improvisation fosters active participation and engagement among students in biology lessons. On the same view a study by Sibomana and Mukagihana, (2023) found that improvisation encourages active participation and hands-on learning. In other words, instead of passively listening to lectures or just reading text books, students are actively involved in the learning process. They become part of action, making decisions, solving problems, and exploring scientific concepts through their own experiences. Therefore, it can be noted that heightened

engagement through improvisation would lead to improved understanding of biological concepts, which would otherwise be difficult to master.

2.1.2 Facilitation of retention of biological knowledge among students.

Stivers and Russ, (2021) had almost a similar research finding to that of Nguyen and Tran, (2019) as they both argue that improvisation facilitates the retention of biological knowledge among students. A study by Zhao and Jiang, (2022) found that improv-based teaching methods, such as improvisational games or skits, enhance long-term memory retention. Basing on these researches, students who actively engage in improvisation recall information more effectively, leading to improved performance in biology assessments. This active engagement enhances understanding and retention of biological principles. In a biology classroom situation, learners will therefore not be prone to high levels of forgetfulness, basing on this view.

2.1.3 Stimulation of students critical thinking skills and creativity.

In the view Greer and Marsh, (2020) improvisation stimulates students' critical thinking skills by challenging them to think on their feet and make quick decisions. Additionally, as noted by Ramirez and Flores, (2018) improvisational exercises in biology classrooms promote analytical thinking, problem-solving, and decision-making abilities. They both argue that improvisation fosters creativity and superb thinking skills. Chen and Wong, (2021) have the same conclusions from their own study as they cited that improvisation nurtures students' creativity and innovation in biology teaching and learning. They found that improvisational exercises challenge students to think outside the box, explore alternative solutions, and generate new ideas. This creative thinking enhances their ability to apply biological knowledge to real-world situations.

Alves and Oliveira, (2023) say improvisation enables students to apply biological concepts to real-world scenarios, enhancing their understanding and relevance. According to Chen and Wong, (2021) improvisational exercises foster connections between theoretical knowledge and its practical application. Students learn to analyze real-life situations, make informed decisions, and understand the significance of biology in everyday life.

In a nutshell, improvisation techniques trigger students learn to apply their knowledge creatively, leading to a deeper understanding of complex biological concepts. Basing on these findings, improvisation is beneficial as it is used to simulate real-world scenarios, conduct experiments, or engage in scientific debates. This challenges students to think critically, analyze information and apply scientific principles in a dynamic and interactive way.

2.1.4 Promoting confidence, collaboration and communication among learners

A study by Moreno and Vargas, (2022) found that students who engaged in improvisational activities in biology classes reported increased self-efficacy and improved communication skills. Through improvisation, students gain confidence in their abilities to think and communicate effectively. This boost in confidence positively impacts their overall academic performance. Navarro and Ramirez, (2023) assert that improvisation encourages collaboration and effective communication among students. As also highlighted by Zhao and Jiang, (2022) group improvisation activities in biology classrooms promote teamwork, active listening, and effective communication of ideas. Students learn to communicate complex concepts clearly, fostering a collaborative learning environment. It has been noted that improvisation is beneficial since it involves groupwork and collaboration. Students work together to create scenes, solve problems or present scientific concepts in a creative manner. It is through this collaborative environment that promotes teamwork, communication skills and the ability to express ideas effectively. In science learning, effective communication and collaboration are essential for sharing and discussing scientific ideas, conducting experiments and working on biology research projects.

2.1.5 Emotional connection

Singh and Mehta, (2022) says through improvisation, students develop emotional intelligence and empathy, which are essential for understanding biological phenomena. In support of this argument, a research by Oliveira and Ramirez, (2023) shows that improvisational activities enable students to put themselves in the shoes of different organisms or ecosystems, fostering empathy and a deeper appreciation for biodiversity. Basing on these findings, improvisation can create an emotional connection with the subject matter. By providing a more personal and experiential approach to learning, it can help students develop a deeper connection to scientific

concepts. When students actively engage in improvisational activities, they connect emotionally with the content, making it more memorable and meaningful to them.

However it is important to note that while improvisation can offer many merits, it should be balanced with careful planning and consideration of curriculum goals and learning outcomes. It is not a substitute for systematic instruction, but rather a complementary pedagogical approach that can enhance biological science teaching and learning in certain contexts.

The literature review may have omitted other potential benefits of improvisation. An example of a potential benefit, would be that improvisation may bring in an element of fun and enjoyment to biology teaching and learning. This attribute would possibly increase student motivation and enjoyment, leading to greater enthusiasm for the subject. This positive attitude towards biology would then contribute to improved academic achievements. Improvisation-based teaching methods, such as improvisational games or skits, would also enhance long-term memory retention. Students who actively engage in improvisation may recall information more effectively, leading to possible improved performance in biology assessments. Last but not least, the literature review has not shared whether improvisation develops students' adaptability and resilience in biological science teaching and learning. Whether it helps students navigate uncertainties, adapt to changing circumstances, and remain resilient in the face of challenges which are important skills in the ever-evolving field of biology has not been discussed. Hence, a gap which this research also needs to bridge.

As has been highlighted, benefits of improvisation in biology teaching and learning are numerous. Several scholars have cited the effectiveness of improvisation as a modern pedagogical teaching practice. Many findings have revealed a significant difference in the achievement of students who learned science, including biology using improvisational techniques in comparison with those that learnt the subject without improvisation. While literature has talked of enhanced student engagement, critical thinking skills, confidence, collaboration, creativity, emotional intelligence, knowledge retention, adaptability, real-world application as benefits, improvisation may bring about enjoyment which is likely to contribute to improved student achievements. Educators should consider incorporating improvisational

activities to foster an enriching and dynamic biology classroom environment, ultimately leading to better learning outcomes for students.

2.2 Limitations of traditional teaching methods on learner achievements in Biology

Traditional teaching methods, while still widely used, come with several limitations that can impact students' achievement in science teaching and learning. These limitations have been explored in various research studies.

2.2.1 traditional instructional practices lack active engagement

Moreno and Vargas, (2024) reveal that traditional science teaching methods lack of student engagement. Traditional teaching methods often rely on passive learning, such as lectures where students are passive recipients of information. This can lead to reduced engagement, as students may struggle to connect with the material and become disinterested in the subject matter thus according to Nguyen and Tran, (2022). Coincidentally, Zhao and Jiang, (2023) also had the same finding citing that traditional teaching methods limit students' active engagement in the learning process, leading to reduced motivation and interest in science. Basing on these findings, it can be noted that traditional methods of instruction lack active engagement due since they promote passive learning. They do not promote student-centered learning which is expected in science education. Active engagement through hands-on experiments and improvisational techniques motivates learners and fosters a deeper understanding of scientific concepts. All these have a negative impact on learner achievement in biology.

2.2.2 Traditional teaching methods lack hands-on experience

In their study, Ramirez and Flores, (2021) posit that biology is a subject that requires practical application and experimentation. However, traditional teaching methods often prioritize theoretical knowledge over hands-on experience. Chen and Wong, (2022) stresses the importance of hands-on experience, arguing that no course in science can be considered complete without including some practical.

Furthermore, Alves and Oliveira, (2023) revealed that traditional teaching methods tend to rely heavily on teacher-led instruction, which may limit opportunities for students to engage in hands-on experimentation and inquiry-based learning. This approach can hinder students' ability to develop scientific inquiry skills, such as formulating hypotheses, designing experiments, and drawing conclusions as also viewed by Moreno and Vargas, (2024).

Science can meaningfully be taught only by practical demonstrations and improvisation may make this possible. This shows that learners must learn both theory and practicals and not depending on theory lessons only. By only using traditional science teaching methods, it implies that students may not have sufficient opportunities to conduct experiments, observe biological phenomena firsthand, or engage in interactive activities. As a result, their understanding of biological concepts may actually remain superficial.

2.2.3 Rote memorization and limited understanding

Gupta and Srivastava, (2018) argue that traditional methods often prioritize rote memorization and regurgitation of facts, rather than fostering critical thinking skills. This can hinder students' ability to analyze and evaluate scientific concepts, as well as their capacity to apply these concepts to real-world situations. Lim and Chai, (2019) clearly states that traditional science teaching methods emphasize on rote memorization of facts and formulas and further explains that this teaching approach fails to promote a deep understanding of scientific principles and concepts. This therefore implies that students may memorize information without comprehending its real-world applications, hindering their ability to think critically and apply knowledge creatively.

2.2.4 Limited use of technology.

According to Hernandez and Patel, (2020) technology has revolutionized the field of biology, allowing for interactive simulations, virtual labs and access to vast databases of biological information. They further argue that traditional teaching methods may underutilize these technological resources. Students may miss out on the benefits of visualizations, animations and interactive tools that can enhance their understanding and interest in biology. Nguyen and Feng, (2021) found that integrating technology into science classrooms enhances student engagement,

facilitate data analysis and provide immerse learning experiences, contributing to improved outcomes.

Traditional teaching methods may not effectively incorporate technology tools and resources that can enhance biology teaching and learning. By neglecting to leverage technology, students may miss out on opportunities to access multimedia resources, simulations, and online collaborative platforms that can deepen their understanding of scientific concepts.

2.2.5 Insufficient focus on inquiry-based learning

Bybee and Fuchs, (2016) argue that science education should foster curiosity, critical thinking and problem-solving skills. A research by Sharma and Yarrow, (2019) however, found that traditional methods of instruction often prioritize teacher-directed instruction, leaving little room for inquiry-based learning. Oliveira and Sampaio, (2022) argue that implementing inquiry-based approaches, such as scientific investigations, research projects, and problem-based learning, biology teachers can empower students to explore scientific phenomena, develop hypotheses and engage in authentic scientific practices. Therefore, traditional teaching methods should not dominate science teaching and learning as they have little focus on inquiry-based learning. Modern teaching approaches, with improvisational techniques incorporated should be implemented as they promote critical thinking skills in students. This might lead to enhanced learner achievement.

2.2.6 Homogenous instruction

Tomlinson and Imbeau, (2020) argue that traditional teaching methods often adopt a one-size-fits-all approach, where instruction is delivered uniformly to the entire class. This approach fails to consider individual students' unique learning needs and preferences, potentially leading to gaps in knowledge and understanding as further argued by Pashler, McDaniel, Rohrer and Bjork, (2018). A study by Subban, (2017) had the same finding and cited that traditional teaching methods often ignore individual differences, arguing that students have different learning styles, paces and interests. Subban, (2017) further asserts that teachers follow a fixed curriculum without considering individual differences when they adopt traditional science instructional methods. This can lead to disengagement and frustration among students who have

difficulty keeping up or who may be more advanced in their understanding in biology. Therefore, it can be concluded that traditional teaching methods limit learners basing on these findings. However, if learners are grouped basing on ability, traditional teaching methods maybe useful especially for content coverage.

2.2.7 Traditional teaching methods limit interaction and collaboration

Taber, (2018) posits that traditional methods of science instruction limit peer interaction since they are chiefly teacher centered. Gillies, (2016) in his research had the same findings, and stress that traditional teaching methods prioritize individual work and assessment which can isolate students from their peers. Basing on this literature, there may be limited opportunities for students to interact with each one another, discuss concepts, share ideas and collaborate on projects. This hampers the development of crucial teamwork and communication skills. Doymus, (2018) argues that science education should encompass student-student interaction to facilitate cross pollination of ideas to increase chances of educational achievement.

Taber, (2018) and Gillies, (2016) argued that the hierarchical classroom structure contributes to limited interaction and collaboration among students. They cite that the teacher-student dynamic often follows a hierarchical structure, with the teacher as the primary authority figure. This therefore, implies that open communication and collaboration between students and the teacher is inhibited. For biology learners to sail through, a more collaborative and interactive approach is important as it can create a supportive learning environment that encourages active participation and collaboration.

In conclusion there is concern over issues like student engagement, limited interaction collaboration, insufficient emphasis on critical thinking, inadequate focus on inquiry-based learning, limited individualization, neglect of technology integration, lack of real-world application and reduced focus on metacognition and self-regulation. While various authorities have cited shortcomings of traditional teaching methods, it may not necessarily imply that they should be totally abandoned. Instead, there are situations were traditional instructional practices are essential. No teaching method is exhaustive, but a blending them with modern teaching methods, improvisation included.

2.3 Challenges associated with the use of improvisation in teaching and learning of biology as a science subject.

A number of research projects were conducted and they confirmed the positive potential of improvisation but also identified implementation problems.

2.3.1 Lack of structured guidance and standardized procedures

One primary challenge is the lack of structured guidance and standardized procedures when using improvisation techniques in biology practicals (Kang, 2019). The study further argued that this can lead to confusion among learners, hindering their ability to grasp key concepts effectively. Hmelo-Silver, Duncan and Chinn, (2017) and Hodson, (2021). however, established that educators can develop detailed guidelines and protocols to ensure consistency and clarity in practical sessions to mitigate this challenge. Therefore, in science teaching and learning, there are times when structured guidance and standard procedures are important. Experiments for example, obviously require some structured guidance to ascertain effective teaching and learning.

2.3.2 Resistance to change

Maguire and Ruppar, (2020) reveal that many science teachers adhere to traditional teaching approaches, relying heavily on lectures and textbooks and refuse to adopt the conventional instructional practices. Lombardi, Shipley, Astronomy, and Astronomy2, (2019) had a similar argument that dominating traditional teaching methods may discourage active learning and critical thinking, thus supporting the findings of Maguire and Ruppar, (2020). Menekse, Stump, Krause and Chi, (2017) found that teachers may lack the skills and knowledge needed to effectively incorporate improvisation techniques into their biology lessons. As an intelligent solution to overcome resistance to change, Schneider and Plasman, (2018) highlighted that Educational institutions should organize regular workshops and training sessions. This may help teachers familiarize with innovative teaching methods and provide them with the necessary support to implement these strategies. To alleviate resistance to change there is need to

encourage collaboration among educators to share best practices and experiences. This can help overcome resistance to change and foster a culture of continuous improvement in biology education. Mentorship programs may also be important. Experienced biology teachers can guide and support educators in implementing improvisation techniques, offering advice and of course sharing successful strategies.

2.3.3 Time constraints

Schoenfeld, Persichitte and Ellis, (2017) highlighted that the extensive content in biology curricula can limit the time available for innovative teaching methods and impede in-depth exploration of complex topics. Oliveira, Rivera, Glass, Mastroianni, Wizner and Amodeo, (2019) found that there is generally limited class time for effective teaching and learning of biology. It therefore implies that the limited duration of each class session may restrict the implementation of interactive activities and hands-on experiments. As possible solution to curb time constraints, the research by Subramaniam, Schonfeld and Fredricks, (2022) found that curriculum should be revised. The study emphasized that educational authorities should periodically review and revise the biology curriculum to prioritize core concepts and allow for more flexibility in teaching methods. Auerbach and Andrews, (2018) posits that flipping the classroom by assigning pre-reading or video lectures as homework and then utilize class time for discussions, experiments and problem solving activities can optimize the use of limited class time. Another possible solution for time constraints is by integrating subjects. This simply means collaborating with teachers from other related disciplines such as chemistry, food technology and design or environmental science can actually help integrate biology concepts into other subjects. This could help providing more time for in-depth exploration.

2.3.4 Assessment and evaluation

Wyse, Long & Ebert-May, (2019)'s finding asserts that traditional assessment methods, such as multiple-choice exams may not effectively evaluate students understanding of complex biological concepts and their ability to apply knowledge in real-world contexts. A research by Saucerman, Zuo, Jiang, and Luo, (2021) points out subjectivity in assessment as a challenge. The argument here is that assessing improvisation techniques, such as project-based learning or

student presentations can be challenging due to the subjective nature of evaluation. Other researchers had their findings and noted some possible solutions.

In the study by Mahoney and Zieffler, (2020) it was discovered that educators should incorporate a variety of assessment techniques, including open-ended questions, practical exams and group projects so as to assess students' comprehensive understanding of biological concepts. Brookhart, (2018) concluded that teachers should provide students with clear assessment criteria and rubrics can help mitigate subjectivity and ensure transparency in the evaluation process. Both solutions cited by the researchers are quite helpful in effective assessment and evaluation. Formative assessment should however be part and parcel of the assessment and evaluation criteria to measure the extent to which learners have grasped the concepts taught. Regular formative assessments such as quizzes and class discussions can provide timely feedback to both students and teachers, allowing for both adjustments and improvement in the learning process.

2.3.5 Lack of resources and infrastructure

Kanter and Konstantopoulos, (2019) points out insufficient laboratory facilities as a challenge associated with improvisation. Many schools lack well-equipped biology laboratories limiting hands-on experimentation and practical experience for students. Chiu, DeJaegher and Chao, (2015) argue in their study that limited access to technology, such as computers, software and multimedia resources can impede the integration of innovative teaching methods. Jungić, Kaur, Mulholland, Xin, (2015) have a similar finding whose argument is that scarcity of resources needed for hands-on teaching and learning experiences is a primary challenge in as far as improvisation is concerned. Therefore, lack of resources and infrastructure may make improvisation difficult to incorporate in science teaching and learning.

A research by Oliveira, Wilcox, Angelis, Applebee, Amodeo, & and Snyder, (2013) however revealed that collaboration with external organizations is a lasting solution to challenges to do with serious resource deficit. Schools can partner with research institutions or local industries to provide students with access to well-equipped laboratories and mentorship from experts. Governments and educational authorities should allocate funds to improve infrastructure and provide necessary resources for biology education thus according to Oliveira et al, (2013) and

Jungicet al, (2015). Schools, however, should play their part in alleviating challenges to do with resource scarcity. They may run projects like piggery, egg production, horticulture or fish farming to raise funds for investment in technology resources. Computers, interactive displays and online platforms are technological resources which can enhance the learning experience and provide opportunities for virtual experiments and simulations.

In conclusion, improvisation in teaching and learning of biology is crucial for creating an engaging and effective learning environment. While challenges exist, such as lack of resources, resistance to change, assessment limitations and time constraints, they can be alleviated through collaborative efforts, professional development, integration of technology, curriculum revision, and diversified assessment methods. By addressing these challenges educators can create a dynamic and interactive biology learning experience that can actually prepare students for the ever-evolving field of biology. Schools should not just be passive, but rather active. They may run income generating projects which can help furnishing their science laboratories. They should not only wait for governments grants, instead they can apply for loans. This may also may make useful apparatus available for successful improvisation.

2.4 Summary

This chapter has reviewed literature related to the problem investigated in this study that is, the merits of teaching and learning of biological science using improvisation in secondary schools. Enhanced student engagement, critical thinking skills, collaboration, creativity, emotional intelligence and connection, concept mastery, knowledge retention, real-world application were some identified benefits of incorporating improvisation which may help improve student achievements. Biology teachers should therefore consider incorporating improvisational activities to foster an enriching and dynamic biology classroom environment, ultimately leading to better learning outcomes for students. The challenges associated with improvisation were also looked at in fair detail. Deficit of resources, resistance to change, assessment limitations and time constraints are some of the challenges noted, which can be alleviated through collaborative efforts, professional development, integration of technology, curriculum revision, and diversified assessment methods.

The information gathered in this literature review will be used as the theoretical framework to judge the data collected from the field (Chapters 4 and 5). From that perspective, conclusions will be drawn in order to verify the extent to which the objectives will be achieved and find answers sought for the research questions. The next chapter will highlight the research methodology used in this study, including research instruments, procedures and design used to investigate the problem of the study.

CHAPTER 3 : RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an overview of the methodology used in this research. Both qualitative and quantitative approach were used. Research design, geographical location, population, sample size, sampling procedures, research instruments used for data collection, data collection procedures, research ethics, validity, reliability, data presentation, data analysis were the aspects covered in this chapter. The population was made up of the Chipangura secondary school biology learners and biology teachers who were selected using purposive and systematic random sampling techniques. Data was collected using interview guides and questionnaires. Ethical considerations included informed consent, confidentiality as well as anonymity.

3.2 Research Design

A research design refers to the overall plan or strategy that a researcher develops to guide the process of conducting a study and answering research questions or objectives as argued by Auerbach and Andrews, (2018). The research can require qualitative, quantitative or mixed-approaches.

The research method used in this study is however, a mixed-approach, where both quantitative and qualitative methods were used. The reason for using both methods was that they could complement each other. Duckett, (2021) explains quantitative research as a systematic and objective approach to investigate phenomena and relationships. It involves the collection and analysis of numerical data to test hypotheses, identify patterns and draw conclusions. On the other hand, qualitative research is a method of inquiry used in social sciences and other fields that aims to understand and interpret peoples' experiences, perspectives, and social phenomena as explained by Duckett, (2021). It otherwise relies on non-numerical data such as interviews, observations and textual analysis to generate rich and detailed descriptions of the research subject. Relating this to the study under investigation, qualitative methods are used to enrich the

understanding of the benefits of improvisation on learner achievement in biology as a science subject in secondary schools.

The purpose of the study is to determine the impact of improvisation as a modern method of science teaching and learning, its challenges and also finding ways of how this conventional instructional practice may be put into best usage. The population size was 32 Biology students, from which a sample of 16 participants were selected using systematic random sampling method. 4 science teachers inclusive of the head of department were involved in the study. The research instruments used included questionnaires (for both students and teachers) and interviews (for both students and teachers)

As such a case study research design was chosen for this research study. A case study is an in-depth investigation of a particular individual, group or organization as echoed by Schneider and Plasman, (2018). The case study was necessary as it helped to narrow down the broad research field into a researchable one.

3.3 Population of study

The population of study in research refers to the entire group of individuals or elements that the researcher is interested in studying and drawing conclusions about. It therefore represents the larger target group to which the findings are to be generalized. A target population refers to a specific group of individuals or elements that the researcher or organization aims to study or analyze, as further echoed by Zenk, Hynek, Schreder and Bottaro, (2022).

Chipangura Secondary is a day school which is located in Guruve District, some 4.5 kilometers west of Guruve Centre. It has an estimated enrolment of 500 learners (including 265 males and 235 females) and 20 teachers (including 11 females and 9 males) as presented in the school's administrative records of the year 2024. However, the researcher focused on 16 Biology learners since it is compulsory for all form threes. It has a good population size of 32 biology learners, and 4 biology teachers which made it possible for the study of interest to be conducted.

3.4 Sample

A Sample is a representative portion of a larger group or population that is selected or taken for the purpose of analysis, study or generalization, according to Mweshi and Sakyi, (2020). Therefore a sample is a subset of a population that is used to gain some insights, draw meaningful conclusions and make predictions about characteristics of the entire population as further explained by Zenk et al (2022). On the same argument, Gojny-Zbierowska and Zbierowski, (2021) postulates that it is almost impossible to collect information from the entire population. Therefore, for larger number of items, individuals or locations of a statistical population may, within specified limits of statistical probability, be represented by a small group of the parent population. The researcher selected 16 form three biology students and 4 biology teachers, through a purposive sampling.

A disproportionate sample size of 20 participants was thus, selected for the study. The sample was considered to be truly representative of the target population. The relatively smaller sample size actually made the study manageable.

3.5 Sampling procedure

Zenk, Hynek, Schreder, and Bottaro, (2022) explain sampling as the process of selecting a subset of individuals or items from a larger population to represent and make inferences about that population. Sampling therefore involves choosing a sample that is quite representative of the population of interest to ensure that the findings and conclusions drawn from the sample can be generalized to the back to the population. The researcher made use of a blended approach of both probability and non-probability sampling techniques. Probability sampling involves a random selection process that give every individual in a population an equal chance of being selected for the sample, according to Iyakaremye and Ntakirutimana, (2021). In contrast, non-probability sampling techniques do not rely on random selection and therefore do not guarantee that each member of the population has an equal chance of being included in the sample.

Purposive sampling, as a non-probability sampling was used, as the study focused on the impact of improvisation Biology only, and not any other learning area. Mohammed, Taherb and Hussain, (2020) define purposive sampling as a sampling technique where researchers deliberately choose certain choose certain individuals or groups to be included in a study based

on specific characteristics or qualities relevant to the research. It is therefore a deliberate and subjective selection process. Thus it is against this background that the researcher used this non-probability sampling style. Respondents were selected according to the drive of the study at hand. As highlighted, purposive sampling involves targeting of key informants, and in this case biology teachers and biology students in the school. Zenk et al (2022), contend that that participants are selected on the basis of the research objectives. Purposive sampling had some pros in that it is less rigorous, offers more convenience and is feasible in instances where time and resources are scarce. Therefore the respondents were purposively selected as they were involved in teaching and learning of biological science.

Selection of student participants was however done via a probability sampling technique called systematic random sampling. To select a representative sample from a population size of 32 using systematic random sampling, a list of all the 32 students in the form three biology class was developed. The sample size was then determined as just 16. The sampling interval was then calculated by dividing the total population size (32) by the desired sample size (16) to determine the sampling interval. The result, 2, was the then interval used. The starting point was chosen randomly as 1. So every n^{th} student was selected to be part of the sample. Therefore the 3^{rd}, 5^{th}, $7^{th,}$ $9^{th\ in}$ that order were selected to be participants until the sample size became 16.

3.6 Research Instruments

According to Sukmawati, (2023) research instruments are tools or devices used to gather, measure and analyze data in a research study and these instruments can take various forms, including questionnaires, surveys, interview guides, observation checklists and many others.

In this research however, questionnaires and interviews were used. Using a variety of research instruments enabled the researcher to increase chances to gather more robust and reliable data, enhance the credibility of his findings and gain a deeper understanding of the impact of improvisation in teaching and learning of biology.

3.7 Questionnaires

Buntins, Kerres and Heinemann, (2021) define a questionnaire as a research instrument consisting of a series of questions or other prompts to gather information from respondents. As propounded by Stantcheva, (2023) a questionnaire is designed to collect data on specific topics, attitudes, behaviors, or other attributes of the target population. In this study two different questionnaires were used. One was for learners and one for teachers.

3.7.1 Questionnaire for learners

Questionnaire for learners (shown in appendix I) was used. It had 7 questions which were easier to read, interpret and respond to. The questions among others, asked students if teachers use improvisation during biology lessons and whether students regard improvisation as a better method to grasp concepts. More significantly, the questionnaire asked if learners were able to come up with practical write ups. Questionnaires were used since they are economical. They also ensured consistency across respondents. They as well offered anonymity thus encouraged a more honest and candid responses. However, as research instruments, questionnaires lacked depth. To curb this weakness, student interviews were also done.

3.7.2 Questionnaire for teachers

The questionnaire used for teachers had 7 questions (as shown in appendix II). Some of questions included whether teachers improvise during Biology lessons. They also asked the potential benefits of using improvisation in teaching and learning of science. The type of improvised activities and exercises biology teachers include were also part and parcel of the questions on teacher's questionnaires. As a research instrument, the teachers' questionnaire were merited for saving efforts, time and costs in data collection. They also placed less pressure on the subjects for immediate responses and provided a standardized format for data collection. However, teacher's questionnaire limit the potential of detailed responses from participants. Therefore, triangulation was found useful as the teachers' interviews were also used to complement the shortcomings of the questionnaire.

3.8 Interview Guide

An interview is a data collection method that involves a structured conversation between a researcher (interviewer) and a participant (interviewee). An interview guide is a structured document that outlines the key topics, questions, and flow of an interview (Naz, Gulab, and Aslam, (2022). Carcary, (2020) further asserts that an interview guide serves as a roadmap for the researcher to ensure that all the necessary information is collected during the interview process. Thus, it can be defined as more of a questionnaire which is administered by an interviewer who is not allowed to deviate in any way from the questions that are given. Interviews with key informants particularly, biology students, biology teachers and their heads of department were done for the purpose of this study. Two separate interview guides were prepared, one was for biology students and one for the teachers.

3.8.1 Interview guide for learners

Interview guide for learners, shown in appendix III, were used. Interview questions on it were linked to the research questions stated in Chapter 1. The interview for learners were used since they had an insightful firsthand perspective. Biology students provided direct insights into their learning experiences, challenges, and suggestions for improvement. They were used since they provide an opportunity for clarification. Interviewing students allowed for clarification and further probing of responses, leading to a more comprehensive understanding. However the interview with learners was time-consuming. Conducting interviews with multiple students was too time-consuming. It was for this reason that questionnaires for learners were used to complement them.

3.8.2 Interview guide for teachers

Teacher Interviews were used in this study. Teachers could provide valuable perspectives on the impact of improvisation in Biology education based on their experience and expertise and also offered practical suggestions for implementing improvisation techniques in the classroom based on their teaching experience. However, the interview exercise was time consuming. For this reason, triangulation was used. (Interview guide for teachers, are shown in appendix IV)

3.9 Data Collection Procedure

Firstly, the researcher applied in writing, for permission to carry out the research study on the impact of improvisation in the teaching and learning of biology, to the head of station for Chipangura Secondary School. The purpose of the study was explained verbally in detail to the school head as the chief administrator, who was again asked by the researcher to disseminate this development to fellow administrators, all teachers (including biology teachers), head of departments as well as biology learners and parents. Three days later, permission was granted to the researcher to freely conduct the study, which was scheduled to start a fortnight later. With stakeholders, data collection instruments were thoroughly prepared, ready to start the study. The advice from school authorities and head of department was to conduct the study only during biology lesson times for form 3 students as guided by the school master timetable. The researcher complied.

3.9.1 Questionnaire for learners

The researcher visited form 3 biology students who had gathered in room 3, greeted Biology learners and introduced himself in biology lesson time. The subject teachers were not around and knew very well of the study. Explanation on the purpose of the study was then given, in a free and friendly mood. Emphasis on the confidentiality of students' responses to encourage honest feedback was given. Anonymity was also assured to leaners. Learners were advised not to write their names anywhere on the questionnaire. The researcher provided clear instructions and ensured students understand the purpose of the questionnaire. The research instrument was then distributed during class time so as to maximize response rates. Sufficient time of approximately 30 minutes, for students to complete the questionnaire was given. Collection of all completed questionnaires in a secure manner was then done. Students were thanked for their cooperation. The researcher left the class and went away.

3.9.2 Questionnaire for Teachers

A visit was paid to two biology teachers, who were sitting in science departmental room. This was during their free time and exchanged greetings with them. The aim of the visit was briefed. Detailed explanations on the purpose of the study were given to the concerned teachers in a

jovial mood. They accepted the move. The researcher then distributed the questionnaires by hand.

Clear instructions and communication about the purpose and importance of the questionnaire were made. The confidentiality of responses to encourage open and honest feedback was assured. Sufficient time for teachers to complete the questionnaire was given. A humble follow up with reminders to improve response rates was done. Completed questionnaires were then collected by hand the following day. The researcher expressed his gratitude to the biology teachers for their cooperation and left the departmental base room.

3.10 Interview

3.10.1 Learners' Interview

The researcher asked for consent before interviewing students, from their teachers. The purpose of the interview was clearly explained to the students. Learners were informed that the study simply aims to investigate the benefits of improvisation, limitations of continued use of traditional instructional practices (non-improvisation), their feelings towards both teaching approaches, challenges they face during improvised lessons, and suggestions for improving improvisation techniques. The interview was then scheduled during school hours, capitalizing on free periods. The interviews were done in room 9, which is on the last classroom block, to get rid of the noises and possible disturbances. It offered privacy and provided a comfortable setting, it was quiet. This ensured confidentiality in the study. Active listening techniques and follow-up questions to elicit detailed responses from the students was done. Questions were asked one by one to each learner. Detailed notes were taken down, on paper by the researcher for every response. However, all students denied to be recorded on the camcorder. The researcher had to comply and respected students' demands and opinions. The exercise took approximately 10 minutes with each student. After the exercise, learners were thanked for their time and much needed responses.

3.10.2 Teachers' Interview

The interview focused on the biology teachers' professional experiences, challenges, and perspectives on improvisation and its impact. The interview began by explaining the purpose and obtaining the teacher's consent to participate in the study. This was done at convenience of the teachers and no force or coercion was used at any time whatsoever. It was done only when they were not occupied with other school activities. The interview was conducted in the Guidance and Counselling room since it was free and quiet. The researcher used probing questions to encourage the teachers to share their insights and experiences in depth in line with improvisation related issues. Detailed notes of the interview (with the teacher's permission) were recorded on paper for analysis. The teachers however denied to be recorded on any device, despite the fact that researcher had full kit for filming and videography. Assurance was however guaranteed on teachers that their responses would be kept confidential and used solely for the research purposes. The interview took about 10 minutes for every interviewee. At the end of the interview session, participant teachers were thanked by the researcher.

3.11 Data Presentation and Analysis

Data presentation is the process of organizing and displaying data in a clear, meaningful and visually appealing way (Healy, 2018). This can include creating charts, graphs, tables and other visualizations to effectively communicate the findings from the data analysis. According to Cresswell and Cresswell, (2017) data analysis refers to the process of examining, cleaning, transforming and modelling data to discover useful information, draw conclusions, and support decision making. In this study, tables, graphs were used for presenting data collected.

In this study data was analyzed both qualitatively and quantitatively. This is so because the questionnaire had both closed questions and open-ended questions. The interview guide however necessitated qualitative data analysis. Data interpretation was based on deductive analysis techniques. The discussions of the findings had a link with the empirical evidence of the literature provided in chapter 2.

3.12 Ethical Considerations

Fundamental ethical principles were applied in this study. Ethical considerations refer to the moral principles and guideline that researchers must adhere to when conducting their studies (Suri, 2020)

Chiumento, Rahman, and Frith, (2020) argue that research ethics are essential in that they enable the researcher to develop acceptable research protocols. These protocols are worth the respondents' time and have a sounding chance of producing meaningful findings. More importantly, adherence to these ethics protects the rights of participants and results are reported fairly, with more accuracy as further vowed by Chiumento et al, (2020). In respect to these morals, the researcher obtained a written letter from Bindura University of Science, which was hand delivered to the school authorities, describing the researchers' intentions to be given an opportunity to conduct the study. The researcher also sought a written consent from participants before gathering data. National and school rules and regulations governing school operations and research were also observed by the researcher. All participants were all informed on the purpose, benefits and possible risks of their involvement in the study. Voluntary participation was ensured. The privacy of respondents was ever respected and at the same time all responses were treated with maximum confidentiality. Falsification of data was avoided at all cost so as to maintain the integrity and objectivity of the research study.

3.13 Validity and Reliability

Validity and reliability are two important concepts in research that are used to evaluate the quality and trustworthiness of findings of a study. According to Duckett, (2021) validity refers to the extent to which a research study accurately measures what it is intended to measure. In simple terms validity ensures that conclusions drawn from the research are justified and supported by the data. Reliability, on the arm refers to how consistent and stable are the research findings. Reliable research is believed to produce consistent results that can be replicated under similar conditions. Bearing this in mind, both qualitative and quantitative research methods were used by the researcher so as to complement each other's weaknesses, if any. In order to enhance validity and reliability of the results, an appropriate case study design was used. Additionally, the research ethics such like informed consent, upholding participant rights, voluntary and

involvement were also observed. Data collection instruments were also refined and perfected before they were used in the actual research study.

3.14 Summary

The chapter focused at the research methodology used in the study, sample size, data collection tools as well as data analysis procedures used. Both qualitative research paradigms were used, which were necessitated by the use of questionnaires and interview guides. The research also discussed validity and reliability of the research study. Data collected was processed, analyzed both qualitatively and quantitatively and was displayed in the next chapter.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents, analyses and discusses research findings on improvisation, that is to say the demographic data of participants, benefits of improvisation and its challenges, the state of the biology laboratory and equipment; and solutions to the challenges faced by O' Level learners in biology at Chipangura Secondary School. In the process of analyzing data, the researcher made an effort to establish the relationship linking the research findings to research objectives, and at the same time supporting the findings with some related literature reviewed in Chapter 2 and findings from other studies on the same phenomenon.

Table 4.1 Response rate (n=20)

Category of respondents	Targeted Responses	Actual responses	Response rate %
Interviews	20	20	100
Questionnaires	20	20	100
Total	**40**	**40**	**100**

The table above shows that of the 20 participants sampled, all 20 were reached through either the interview or questionnaires for a 100% response rate.

4.2 Demographic Data

Table 4.2 Age distribution of participants

	Age	Frequency	Percentage %
Teachers	18-30 years	1	5
	31-40 years	1	5
	41-50 years	1	5
	51 and older	1	5
Learners	13-14	2	10
	15-16	10	50
	17-18	2	10
	Above 18	2	10

Total		**20**	**100**

The table matrix above shows that 10% of the learner participants were 13-14 years old while 50% were15-16 years old. Furthermore 10% of the participants were 17-18 years old while 10% was above 18years old. In the case of teachers, 5% ranged between 18-30 years old while another 5% was 51 years or older. Furthermore, 5% was 50 years or older. Data was collected from at least one representative of each age category and most participants were at least 16 old therefore were most likely able to comprehend the questions and articulate or indicate their answers well.

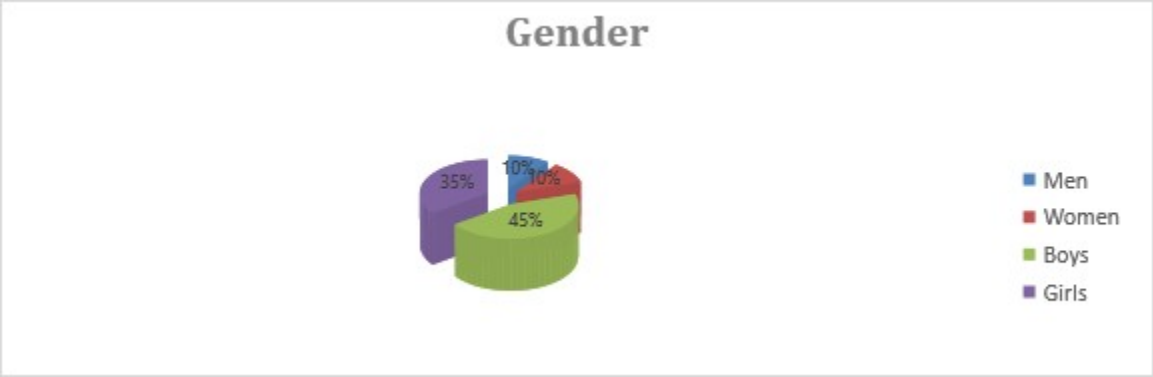

Figure 4.1: Gender distribution of participants

The data above shows that 45% of the participants were boys while 35% were girls. Also, 10% were men while 10% of the participants were women. The study did not seek to even the distribution of genders because most of the sample was random but the researcher was satisfied that data was collected from all gender types of the research population. The data is therefore likely to be representative of the population from where the sample was derived.

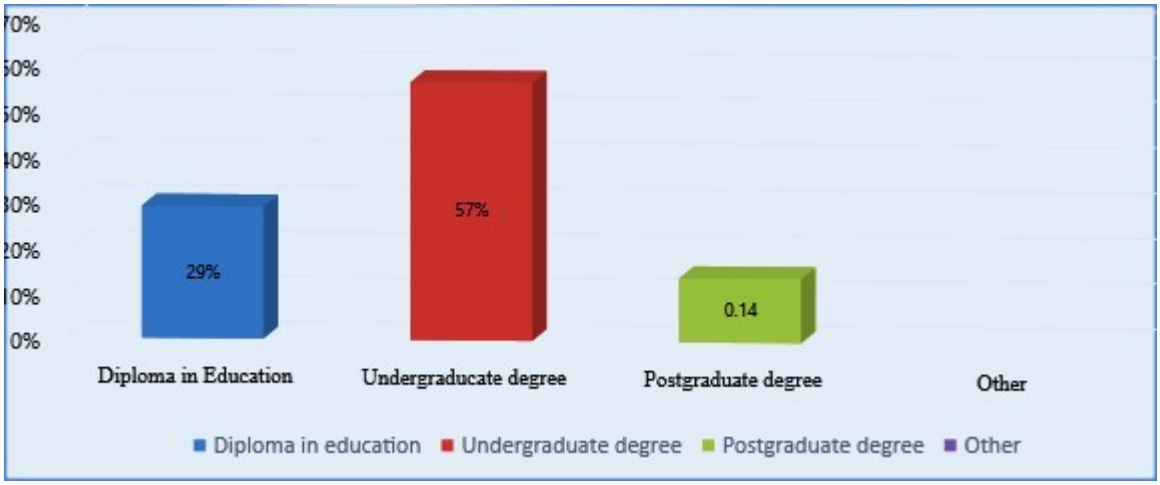

Figure 4.2: Qualifications of teachers

The data in table 4.2 above shows that among the teachers 29% had a diploma in education while 57% had attained undergraduate degrees. Also, 14% had attained a post graduate degree. The researcher was satisfied that data was collected from trained and qualified teachers and school head which added to the credibility of the research.

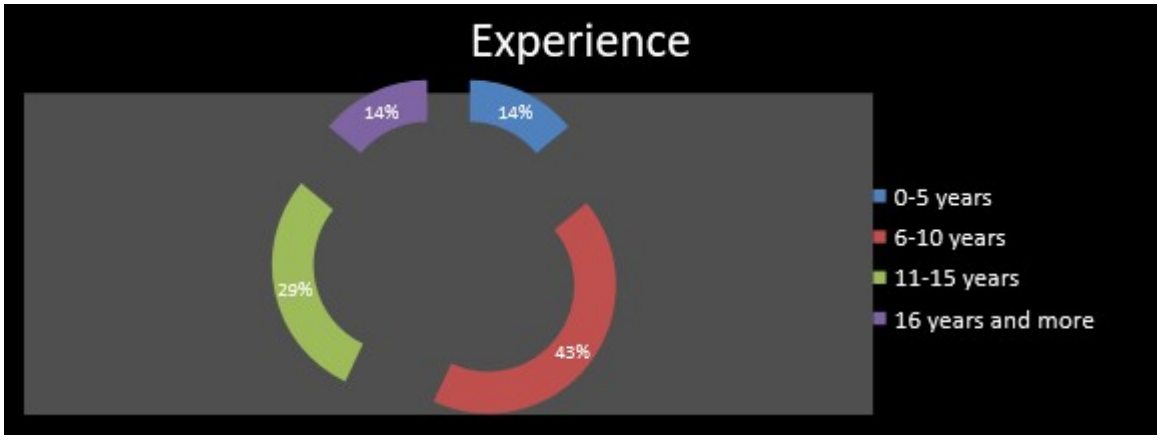

Figure 4.3: Teachers' years of experience

The data above shows that among the teachers and school head 43% had between 6 to 10 years of teaching experience while 29% had attained between 11 to 15 years of teaching experience.

Also, another 14% had attained 16 years or more of experience while 14% more had attained between 0 to 5 years of experience. The study captured data from teachers of varying experience which was beneficial but also that most of the teachers had amassed over 5 years' worth of teaching experience and therefore could provide relevant and in depth data.

4.3 Benefits of improvisation in teaching and learning of biology at 'O' level

Table 4.3: Benefits of improvisation in the teaching and learning of biology at Chipangura Secondary School

Benefit	Frequency	Percentage %
Promotes Active Engagement	**19**	**95**
Develops critical thinking and creativity	**18**	**90**
Facilitates biological knowledge retention	**19**	**95**
Improves confidence, collaboration and communication skills	**19**	**95**
Facilitates emotional connection	**18**	**90**

The data generated shows that the majority of the participants (95%) indicated that improvisation encourages students to actively participate in the learning process. This finding is similar to that of Robledo, Aguja and Prudente (2024), shown in literature review who echoed that incorporating improvisational activities, such as role-playing or scenario-based learning, captivates students' attention and encourages their active involvement in the learning process. On the same note, the findings of this study are not in any way diverging from Sand, Forde, Ploger and Poulsen (2023)’s argument which also postulated that improvisation fosters active participation and engagement among students in biology lessons. Learners have been noted to be part of action, making informed decisions and suggestions and solving problems through their own experiences if improvisation is efficiently used in biology lessons.

The data gathered through questionnaires and interviews reflects that 95% of the participants indicated that improvisation-based learning in biology facilitates retention of biological knowledge amongst the learners. This implies that a significant number of participants agreed that improvisation indeed plays a role of facilitating concept mastery in learners. This finding is relatable to the study by Stivers and Russ, (2021) as shown in the literature review, that improv-based teaching methods, such as improvisational games or skits, enhance long-term memory retention. A research by Nguyen and Tran, (2019) reflected that students who actively engage in improvisation recall information more effectively, leading to improved performance in biology assessments. The same finding was seen in the researcher’s study’s outcomes.

The data collected showed that most participants (90%, as tabled) said improvisation stimulates critical thinking skills and creativity, hence beneficial. This finding is comparable to that of Greer and Marsh, (2020) who postulated that improvisation stimulates students' critical thinking

skills by challenging learners to think on their feet and make quick decisions. Additionally, the researchers' findings closely tally with Chen et al, (2021) and Ramirez et al, (2018) who had the same conclusions that improvisation nurtures students' creativity and innovation in biology teaching and learning. This would mean that improvisational exercises challenge students to think open-mindedly, explore alternative solutions, and come up with new ideas in biology.

The data gathered indicated that a more pronounced number of the participants (95%) agreed that improvisation promotes confidence, teamwork (collaboration) and communication as well amongst learners. Other researchers had already made the same finding, as shown in the literature review.

A study by Moreno and Vargas, (2022) established that students who engaged in improvisational activities in biology classes have increased self-efficacy and improved communication skills. A large number of participants (95%) shared that improvisation actually enables students gain confidence in their abilities to think and communicate effectively. Additionally, Navarro and Ramirez, (2023) had already found that improvisation encourages collaboration and effective communication among students. The same findings were made by the researcher that group improvisational-activities in biology classrooms actually promotes teamwork, active listening, and effective communication of ideas. Students may therefore, learn to communicate sophisticated concepts clearly, fostering a collaborative learning environment. The participants, particularly biology teachers shared their own views as they indicated that learners work together to create scenes, solve problems or present scientific concepts in a creative manner.

Nearly all of the participants (90%), particularly teachers indicated that improvisation on its own facilitates some emotional connection, as shown in the table above. This finding agrees with the

studies already made by Singh and Mehta, (2022) and Oliveira and Ramirez, (2023) which propounded that improvisational activities enable learners to put themselves in the shoes of various organisms or ecosystems, thereby fostering empathy and a broader and deeper appreciation for biodiversity. As such, improvisation can breed an emotional connection with the subject matter. Participants echoed that students who are actively engaged in improvisational activities could connect emotionally with biology content, which makes it more memorable whilst being meaningful to them.

4.4 Limitations of traditional (non-improvisation) teaching methods

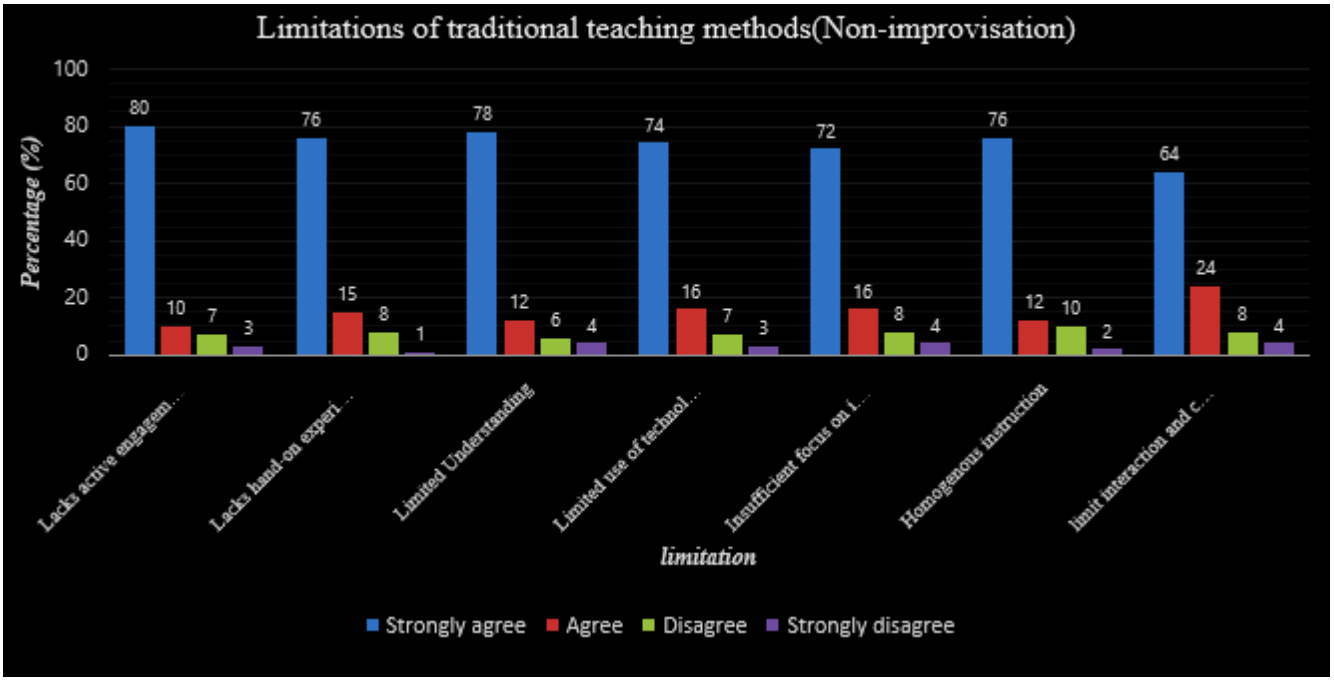

Figure 4.4

The data above shows that most of the participants (80%) of the participants strongly agreed, a smaller number (10%) agreed, another much smaller number (7%) disagreed while the least number (3%) strongly disagreed that traditional teaching methods lack active engagement. This

implies that a significant number of participants that traditional instructional practices lack active participation of learners in the teaching and learning of biology at ‘O’ level. This finding is comparable to the studies by Moreno and Vargas, (2024) and Nguyen and Tran, (2022) which reveal that traditional science teaching methods lack of student engagement. The interviewees pointed out that traditional teaching methods often rely on passive learning, such as lectures where learners are passive recipients of information. The researcher noted that being inactive in biology teaching and learning leads to reduced engagement, as students may find it hard to connect with the material and become disinterested in the learning area. This approach can hinder students' ability to develop scientific inquiry skills, such as formulating hypotheses, designing experiments, and drawing conclusions as also viewed by Zhao and Jiang, (2023).

The data generated from questionnaires and interviews identified that traditional teaching and learning methods lacks hands-on experience. As shown in the graph above, 76% of the participants strongly agreed, 15% agreed, 8% disagreed while 1% strongly disagreed that traditional instructional practices in biology teaching and learning lack hands-on experience on learners. Generally, quite a smaller number of participants disagreed that traditional teaching methods lack hands-on. At the same time, a very big number of participants supported that traditional instructional practices promotes no hands-on experience among learners. This finding is relatable positively to the study by Ramirez and Flores, (2021) in literature review which revealed that traditional teaching methods tend to rely heavily on teacher-led instruction, which may limit opportunities for students to engage in hands-on experimentation and inquiry-based learning. Alves, and Oliveira (2023); and Moreno and Vargas, (2024) in their study stressed the importance of hands-on experience, says that no course in science can be considered complete without including some practical. The participants in their responses argued that ancient teaching

approaches can hinder students' ability to develop scientific inquiry skills, such as formulating hypotheses, designing experiments, and drawing conclusions which are important aspects in the field of biology.

As evidenced by data presented on the graph, out of all the participants, 78% of them strongly agreed, 12% agreed, 6% disagreed while 4% strongly disagreed that traditional teaching and learning methods brings about limited understanding on learners. The trend simply shows that non-improvisation-based teaching and learning results in poor concept mastery in students, as shown by the largest number of participants (78%). This study's findings are similar to that of Gupta and Srivastava, (2018) and that of Lim and Chai, (2019) whose argument was that traditional methods often prioritize rote memorization and regurgitation of facts, rather than fostering critical thinking skills, as shown in literature review. Participants in this study, particularly biology teachers aired out that students' ability to analyze and evaluate scientific concepts, as well as their capacity to apply these concepts to real-world situations is hindered when traditional (non-improvisation) teaching methods dominates in their lessons. In contrast, a research by Stivers and Russ, (2021) revealed that students who actively engage in improvisation recall information more effectively, leading to improved performance in biology assessments. This active engagement enhances understanding and retention of biological principles. In a biology classroom situation, learners will therefore not be liable to high levels of forgetfulness.

The researcher indeed noted that traditional science teaching methods emphasize on rote memorization of facts and formulas and this teaching approach fails to promote a deep understanding of scientific principles and concepts. This therefore implies that students may

memorize information without comprehending its real-world applications, hindering their ability to think critically and apply knowledge creatively.

The graph shows that 74% of the participants strongly agreed, 16% agreed, 7% disagreed and only 3% strongly disagreed that traditional (non-improvisation) based learning has limited use of technology. The information extracted therefore simply attempts to imply that traditional teaching methods does not incorporate use of technology, as represented by the largest number of participants (74%) who strongly agreed that traditional teaching approaches does not promotes incorporation of technology. This finding is comparable to that of Hernandez and Patel, (2020) who propounded that technology has revolutionized the field of biology, allowing for interactive simulations, virtual labs and access to vast databases of biological information as indicated in literature review. Nguyen and Feng, (2021) and Hernandez and Patel, (2020)'s studies found that integrating technology into science classrooms enhances student engagement facilitate data analysis and provide immerse learning experiences, contributing to improved outcomes. The data generated by the researcher indicated that traditional teaching methods underutilize technological resources. Learners may actually miss out benefits of visualizations, animations and interactive tools that can enhance their understanding and interest in biology.

The graph reflects that traditional instructional teaching and learning methods have insufficient focus on inquiry-based learning. Rating in percentages of feedback, 72% of the participants strongly agreed, 16% agreed, 8% disagreed while 4% disagreed that traditional teaching methods have insufficient focus on inquiry-based learning. Generally, the trend on the graph shows that traditional teaching methods mostly ignore inquiry-based learning. Therefore, most participants strongly agreed that traditional teaching methods promotes no inquiry-based learning, which is a

chief driver of innovativeness, creativity and discovery. Comparably, Bybee and Fuchs, (2016) had argued that science education should foster curiosity, critical thinking and problem-solving skills. A research by Sharma and Yarrow, (2019) however is similar to this study's findings as it found that traditional methods of instruction often prioritize teacher-directed instruction, leaving little room for inquiry-based learning. Oliveira and Sampaio, (2022) highlights that implementing inquiry-based approaches, such as scientific investigations, research projects, and problem-based learning, biology teachers can empower students to explore scientific phenomena, develop hypotheses and engage in authentic scientific practices. In the study, the researcher was enlightened and actually appreciated the use of improvisation to counter the disadvantages of non-improvisation traditional-based instruction.

As closer look on the graph shows that 76% of the participants strongly agreed, 12% agreed, 10% disagreed and 2% strongly disagreed that traditional teaching and learning methods dominates with homogenous instruction. The trend on the graph generally shows that the majority (76%) of participants are open-minded, vigilant and very much aware of the homogeneity nature of traditional instructional methods. This finding is related to the study by Tomlinson and Imbeau, (2020) whose argument was that traditional teaching methods often adopt a one-size-fits-all approach, where instruction is delivered uniformly to the entire class. The interviewees highlighted the same conclusion that this approach fails to consider individual students' unique learning needs and preferences, and this potentially leads to gaps in knowledge and understanding among learners. A study by Subban, (2017) cited in literature review, had the same finding and highlighted that traditional teaching methods often ignore individual differences, arguing that students have different learning styles, paces and interests. The research had the same finding also with that of Tomlinson and Imbeau, (2020) which pin-pointed that

teachers follow a fixed curriculum without considering individual differences among learners when they adopt traditional science instructional methods.

The graph indicates that 64% strongly agreed, 24% agreed, 8% disagreed while 4% strongly disagreed that traditional teaching methods limit interaction and collaboration among the biology learners. Generally, the image portrayed by the finding is that quite a large number of participants (64%) realized that traditional teaching methods limit collaboration and communication. Related to this finding is the study by Taber, (2018) whose position was that traditional methods of science instruction limit peer interaction since they are chiefly teacher centered. Gillies, (2016)'s study had the same findings, and stress that traditional teaching methods prioritize individual work and assessment which can isolate students from their peers. Instead, modern teaching methods in biology emphasize teamwork and communication. Improvisation is one such teaching approach that directly and indirectly emphasizes idea sharing and collaboration.

In a nutshell, the graph has indicated the trends on the drawbacks of traditional teaching and learning methods in biology. There is concern over issues like student engagement, limited interaction collaboration, insufficient emphasis on critical thinking, inadequate focus on inquiry-based learning, limited interaction, neglect of technology integration and homogeneous nature of traditional (non-improvisation) teaching and learning methods in biology.

4.5 Challenges associated with improvisation and possible solutions

Table 4.4: Challenges associated with improvisation in the teaching and learning of Biology at Chipangura Secondary School in Guruve District.

Challenge	Frequency	Percentage %
Lack of structured guidance and standardized procedures	**19**	**95**
Resistance to change	**18**	**90**
Time constraints	**18**	**90**
Assessment and evaluation	**15**	**75**
Lack of resources and infrastructure	**18**	**90**

Data in table 4.5 shows that the majority (95%) of the participants indicated that improvisation lacks structured guidance and standardized procedures when incorporated in biology and learning. The study, in other words found that one of the prominent challenges of improvisation is that it is structureless. According the responses from participants, improvisation is non-procedural and often leads to confusion among learners. This finding is similar to that of Kang, (2019) and Hmelo et al, (2017) whose studies discovered that by the virtue of being non-standardized, improvisation hinders the learner's ability to grasp key concepts effectively. As a solution to this challenge, participants suggested that it is imperative that biology teachers and other science related educators may at least come up with some guidelines to ensure improvisation does not confuse learners when incorporated in teaching and learning. This mitigatory measure is relatable to the finding of Hodson, (2021) and Kang, (2019) whose findings established that educators can develop detailed guidelines and protocols to ensure consistency and clarity in practical sessions to alleviate this challenge. In science teaching and learning, there are times when structured guidance and standard procedures are necessary. Experiments for instance, undoubtably require some structured guidance to ascertain effective teaching and learning.

The data in table 4.5 reflects that a significant number of the participants (90%) indicated that resistance to change is one of the vibrant challenges associated with improvisation. The participants clearly indicated that chemistry, agriculture and other science-related teachers stick to traditional teaching approaches, relying heavily on chalking and talking. This finding has strong connections with the findings of Maguire and Ruppar, (2020), Schneider and Plasman, (2018) and Lombardi et al, (2019) which revealed that many science teachers adhere to traditional teaching approaches, relying heavily on lectures and textbooks and refuse to adopt the

conventional instructional practices, as indicated in the literature review.The research, basing on the study, identified that biology and other science teachers need timeous training and workshops to reduce the possibility of resistance to change. This may help teachers familiarize with innovative teaching methods and provide them with the necessary support to implement these strategies. There is also need to encourage teamwork among educators to share best practices and experiences, thus enabling improvisation to be embraced with minimum resistance.

Time constraints, is another challenge raised by the majority the participants having 90% indication, which is significantly a large number. Interviewees highlighted that updated Zimbabwean curriculum is heavily loaded with content and therefore, having enough time to apply improvisation is difficult. This finding is relatable to that of Schoenfeld et al, (2017) and Auerbach and Andrews, (2018) which highlighted that the extensive content in biology curricula can limit the time available for innovative teaching methods and impede in-depth exploration of complex topics. The participants emphasized that educational authorities should periodically review and revise the biology curriculum to prioritize core concepts and give room for more flexibility in teaching methods, inclusive of improvisation.

The data in table 4.5 shows that most of the participants (75%) indicated that improvisation is difficulty to assess and evaluate, hence a remarkably big challenge. The interviewees clearly highlighted that traditional assessment methods, such as ‘true or false’ revision tests or multiple-choice end of term tests may not adequately evaluate students understanding of complex concepts in biology. This finding is relatable to the study by Wyse et al, (2019) and Saucerman et al, (2021) who echoed that traditional assessment methods, such as multiple-choice exams may not effectively evaluate students understanding of complex biological concepts and their

ability to apply knowledge in real-world contexts. However, the biology teachers in particular recommended that there is need to incorporate various assessment strategies such as practical-based tests, pair works or group projects so as to comprehensively measure the level of understanding in learners. Quizzes and class discussions were also suggested as part of effective assessment strategies as it could provide timely feedback to both students and teachers.

The data tabulated reflects the majority 90% of the subjects (participants) indicated that lack of resources and infrastructure is yet another challenge associated with improvisation. The participants highlighted that they lack a well-equipped biology laboratory, and this limits hands-on improvised activities sometimes. This forces them to resort to traditional, non-improvisation learning methods which are teacher-centered. This finding is similar to that of Kanter and Konstantopoulos, (2019) and that of Chiu et al, (2015) whose argument was that limited access to technology, such as computers, software and multimedia resources can impede the integration of innovative teaching methods. Jungic et al, (2015) as indicated in the literature review, had the same finding, similar to the study at hand, arguing that scarcity of resources needed for hands-on teaching and learning experiences is a primary challenge of improvisation.

The interviewees however revealed that collaboration with external organizations is one of the best solution to resource scarcity at the school. They suggested that the school can partner local industries such as the Eureka Gold Mine in Guruve, to provide students with access to well-equipped laboratories. This is relatable to a research by Chiu et al, (2015) as indicated in literature review, which revealed that collaboration with external organizations is a lasting solution to resource deficit challenges and further argued that schools can partner with research institutions or local industries to provide students with access to well-equipped laboratories and

mentorship from experts. The biology teachers also suggested as a possible solution to the challenge of resource scarcity by running projects like piggery, horticulture or fish farming to raise funds to equip their labs.

4.6 Summary

This chapter presented, analyzed and discussed research findings. Demographic data, benefits of improvisation, limitations of traditional instructional practices (non-improvisation), challenges associated with improvisation (and their solutions as well) in the teaching and learning of Biology at O level at Chipangura Secondary School were looked at. The next chapter summarizes the study, lists the conclusions, proffers recommendations and suggests areas for further research.

CHAPTER 5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter focuses on the summary, conclusions and recommendations in the study which explores the investigation on the impact of improvisation on learner achievement in teaching and learning of biology. The chapter's content and conclusions which were made from the study are based on the data analysis conducted in the previous chapter, whilst the objectives and research questions in the first chapter. The chapter begins with the description of the entire study, then moves on to conclusions and recommendations and it finally highlights areas that require more research.

5.2 Summary of findings

The investigation on the impact of improvisation on the teaching and learning of biology was conducted with a sample of sixteen biology students and four biology teachers to make a total of twenty participants. The study aimed to explore how incorporating improvisational techniques

in biology education could enhance student engagement, understanding and retention of concepts in the teaching and learning process. Various improvisation methods and improvisation-based activities were introduced into the biology classroom setting. The outcomes were assessed on both students and educators and data was collected through questionnaires and interviews. The study had three objectives which were to determine the merits of improvisation on student achievement in biology, to determine the limitations of traditional methods of instruction on learner achievement and also to determine the challenges faced by learners who are taught practical work using improvisation techniques. The mixed approach method was employed where both qualitative and quantitative methods were used. Ethical considerations were strictly followed through the entire research.

5.3 Conclusions

The findings of the study suggest that incorporating improvisation in biology teaching can have a positive impact on student learning outcomes. The use of improvisation techniques in teaching biology led to increased student engagement. Students were more actively involved in the learning process and showed higher levels of interest and enthusiasm during lessons.

In addition to improved student engagement, incorporating improvisation encouraged students to think creatively and critically. They were more willing to explore different perspectives and solutions, leading to a deeper understanding of biological concepts.

Improvisation also helped to improve teacher-student interaction. Teachers reported a positive change in their relationship with students as improvisation helped create a more interactive and dynamic classroom environment, fostering better communication and understanding between teachers and students. Interactive and hands-on nature of improvisation helped to make complex biological concepts more accessible and relatable to students.

Additionally, both students and teachers expressed an increase in confidence levels as a result of engaging in improvisational activities. Teachers reported a greater sense of enjoyment and satisfaction in teaching when using improvisational methods, leading to a more dynamic and effective learning environment. They felt more empowered to experiment with innovative teaching methods. Students felt more confident in expressing their ideas.

The main purpose was achieved which sought to explore the use of improvisation as a valuable tool in the biology classroom and its continued exploration and implementation may lead to improved learning experience for both students and teachers. Overall, the study concluded that improvisation is helpful in learner achievement in the teaching and learning of biology.

5.4 Recommendations

Based on the study's conclusions, the following recommendations are proposed:

- The ministry of primary and secondary education needs to provide training and workshops for biology teachers on how to effectively incorporate improvisation techniques into their teaching practices.
- There is need to regularly assess the impact of improvisation on teaching and learning outcomes to ensure its effectiveness and make necessary adjustments.
- The administrators need to encourage collaborative learning activities that involve both students and teachers in improvisation exercises to foster a supportive and creative learning environment.
- The ministry of primary and secondary education to allocate resources for the development of improvisational materials and tools that can be used in biology classrooms to enhance the teaching and learning experience.

5.5 Areas of further research

Based on the research findings of this study, the researcher recommends that the future studies should look into the long-term effects of improvisation. By focusing on this area of further research, there is expansion of knowledge base on impact of improvisation in learners' achievement in biology education and contribute to the development of effective teaching practices that promote student success.

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APPENDICES

APPENDIX I

Questionnaire for learners (Put your responses in the box/spaces provided)

1. Age

13-14 years ☐

15-16 years ☐

17-18 years ☐

19 years and above ☐

2. Gender

Boys ☐

Girls ☐

3. Do you often use improvisation at your school?

☐

Yes

No ☐

4. Which ones are the benefits of improvisation in teaching and learning of Biology at O level?

Promotes active engagement ☐

Develops critical thinking and creativity ☐

Facilitates biological retention ☐

Improves confidence, collaboration and communication skills ☐

Facilitates emotional connection ☐

5. What do you think are the challenges of improvisation in the teaching and learning of Biology?

Lack of structured guidance and standardized procedures ☐

Resistance to change ☐

Time constraints ☐

Assessment and evaluation ☐

Lack of resources and infrastructure ☐

6. What do you regard as limitations of traditional (non -improvisation) teaching methods?

	Agree	**Strongly agree**	**Disagree**	**Strongly disagree**
Lack active engagement				
Lack hands-on experience				

Limited understanding				
Limited use of technology				
Insufficient focus on inquiry- based learning				
Homogenous Instruction				
Limited interaction and collaboration				

7. What are some of the comments on improvisation in teaching and learning of Biology at O level?

APPENDIX II

Questionnaire for teachers (Put your responses in the box/spaces provided)

1. Age

18-30 ☐ **31-40** ☐ **41-50** ☐ **51 and above** ☐

2. Gender

Men ☐ Women ☐

3. Professional Qualifications

Diploma in Education ☐

Undergraduate Degree ☐

Postgraduate Degree ☐

Other ☐

4. Teaching Experience

0-5years ☐

6-10 years ☐

11-15 years ☐

16 years and above ☐

5. Which ones are the benefits of improvisation in teaching and learning of Biology at O level?

Promotes active engagement ☐

Develops critical thinking and creativity ☐

Facilitates biological retention ☐

Improves confidence, collaboration and communication skills ☐

Facilitates emotional connection ☐

6. What do you think are the challenges of improvisation in the teaching and learning of Biology?

Lack of structured guidance and standardized procedures ☐

Resistance to change ☐

Time constraints ☐

Assessment and evaluation ☐

Lack of resources and infrastructure ☐

7. What do you regard as limitations of traditional (non -improvisation) teaching methods?

	Agree	**Strongly agree**	**Disagree**	**Strongly disagree**
Lack active engagement				
Lack hands-on experience				
Limited understanding				
Limited use of technology				
Insufficient focus on inquiry- based learning				
Homogenous Instruction				
Limited interaction and collaboration				

8. Give any comments associated with improvisation (free response)

APPENDIX III : INTERVIEW GUIDE FOR LEARNERS

Investigating the impact of improvisation in teaching and learning of Biology

1 Introduction

a Greetings and personal Introduction (cheerfully)

b The purpose of this interview is to investigate the impact of improvisation, benefits, challenges as well as suggestions of improving this teaching approach with the idea of enhancing learner achievement in Biology. Feel very free to participate !

c Consent and confidentiality

1. The information you will provide is confidential, and will only used for the purposes of the study, as mentioned earlier.
2. right to withdraw the interview at any time

3. Are you comfortable enough to be interviewed?

2 a Background Information of leaners

- educational background and current level of study in Biology.
- participant's general experience with Biology as a subject.

b Perceptions of Improvisation in Biology Teaching

- What is the your understanding of the term "improvisation" in the context of teaching and learning Biology?

- How often have you experienced improvisation in your Biology classes?

- Can the you provide specific examples of improvisation techniques used by your Biology teacher?

- How do you feel about the use of improvisation in Biology lessons?

- What are the perceived benefits and drawbacks of using improvisation in Biology teaching, from your perspective?

3 Impact of Improvisation on Learning

- How do you feel improvisation affects their engagement and participation in Biology classes?

- In what ways, if any, does improvisation impact your understanding and retention of Biology concepts?

- Can you provide examples of how improvisation has facilitated or hindered your learning in Biology?

- What are your preferences regarding the balance between structured lessons and improvisational teaching in Biology?

4. Suggestions and Recommendations

- What suggestions do you have for incorporating more effective improvisation in Biology teaching?

- How can teachers better support you as a learner in adapting to an improvisational approach to Biology instruction?

- Are there any other comments or insights that you would like to share regarding the impact of improvisation on the teaching and learning of Biology?

5. Conclusion

- Thank you for your time and contribution to this study.

- All the responses you have provided are treated with much confidentiality, and will only be used for the purposes of this study, no any other use I assure you.

- If you are comfortable, you may provide your contact information for any follow-up questions or concerns regarding the purpose of this study

Once again, thank you. Good day!

APPENDIX IV Interview Guide for Teachers:

1 Introduction

a Greetings and personal Introduction cheerfully

b The purpose of this interview is to investigate the impact of improvisation, benefits, challenges as well as suggestions of improving this teaching approach with the idea of enhancing learner achievement. Feel very free to participate !

c Consent and confidentiality

- Information you will provide is **confidential**
4. You also have the right to withdraw from the interview at any time
5. Are you comfortable enough to be interviewed?

2 Background Information

- May you briefly share teaching experience, particularly in the field of Biology. ?

- May you share your educational background and any specialized training in Biology teaching methods that you have

3 Perceptions of Improvisation in Biology Teaching

- What is your understanding of the term "improvisation" in the context of teaching Biology?

- To what extent do you incorporate improvisation in your Biology lessons?

- Can you provide specific examples of improvisation techniques they use in their teaching?

- What are the perceived benefits and drawbacks of using improvisation in Biology instruction, from your perspective as a Biology teacher?

4 Factors Influencing Improvisation

- What factors or considerations influence your decision to use improvisation in your Biology lessons?

- How does the curriculum, available resources, or student characteristics affect the your approach to improvisation?

- Are there any institutional or administrative policies that encourage or discourage the use of improvisation in Biology teaching?

5 Impact of Improvisation on Learning

- How do your students typically respond to the use of improvisation in Biology classes?

- In what ways do you believe improvisation affects your student engagement, understanding, and retention of Biology concepts?

- Can you provide examples of how improvisation has either facilitated or hindered student learning in Biology?

- What strategies do you employ to ensure that improvisation supports rather than disrupts student learning?

6 Professional Development and Support

- What kind of training or professional development opportunities have been available to the participant regarding the use of improvisation in Biology teaching?

- What additional support or resources would the participant find helpful in developing their skills and confidence in using improvisation in Biology instruction?

- How do they believe teacher education programs and ongoing professional development could better prepare Biology teachers to incorporate effective improvisation into their teaching?

7 Suggestions and Recommendations

- What suggestions do you have for other Biology teachers interested in incorporating more improvisation in their lessons?

- How can educational institutions and policymakers better support the effective use of improvisation in the teaching and learning of Biology?

- Are there any other comments or insights you would like to share regarding the impact of improvisation on the teaching and learning of Biology?

8 Conclusion

- Thank you for your time and contribution to this study.

- All the responses you have provided are treated with much confidentiality

- If you are comfortable, may you provide your contact information for any follow-up questions or concerns regarding the purpose of this study

Once again, thank you. Good day !