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AN ASSESSMENT INTO THE IMPACT OF IMPROVISED EXPERIMENTS IN THE TEACHING AND LEARNING OF COMBINED SCIENCE. A CASE STUDY OF MANYENYEDZI SECONDARY SCHOOL IN HURUNGWE NORTH DISTRICT IN MASHONALAND WEST PROVINCE. ZIMBABWE

BY

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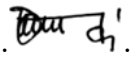
Signed…  ……

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APPROVAL FORM

The undersigned certify that they have read and recommend to Bindura University of Science Education of a dissertation titled “An assessment into the impact of improvising experiments in the teaching and learning of Combined Science in selected schools in Hurungwe North District in Mashonaland West Province. A case study of one selected secondary school in Hurungwe North District in Mashonaland West Province,” submitted by Edwell Kani in partial fulfilment of the requirement of the Honours Bachelor of Science Education Degree in Biology.

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DECLARATION

I declare that this dissertation has been a result of my original efforts and investigations and such work has not been presented elsewhere for the purpose of degree assessment. Sources of information have been acknowledged by means of references.

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DEDICATION

This research is dedicated to my children Tinashe, Tanatswa, Tafadzwa, my wife Jessicah, parents, Mr R Kani and Mrs T Kani for their support during the study.

ABSTRACT

The researcher conducted a study to assess the impact of improvised experiments in the teaching and learning of Combined Science in selected schools (Manyenyedzi secondary school) in Hurungwe North District in Mashonaland West Province. The study sought to establish the strategies that can be used to improve the teaching and learning of Combined Science through improvised experiments. The study was conducted in one secondary school in Hurungwe North district, in Chundu cluster.

The study adopted a mixed-methods research design, integrating both quantitative and qualitative approaches. This design was chosen to provide a holistic understanding of the impact of improvisational practical activities on student learning outcomes and engagement. The quantitative component allowed for statistical analysis of data, while the qualitative aspect provided deeper insights into the experiences and perceptions of students and teachers.

The study sampled 5 teachers teaching combined science and 20 learners also doing combined science. Structured interviews, questionnaires and observations were used to gather data. 10 learners and three teachers were given questionnaires to answer while the other 10 learners and 2 teachers were interviewed. The population of the school is 150 in total with 80 being girls and 70 boys respectively. In terms of the teachers, the school accommodates 11 teachers in total (8 females and 3 males). The researcher chose to focus the study on 'O' Level Combined Science learners.

Sample consisted of 20 students and 5 teachers. Sampling procedure included identification of one school within Chundu cluster. Within the selected school, form three students were chosen. Participants were selected using random selection. For teachers, only science teachers in the selected school were invited to participate in the study.

Data was presented in form of charts, graphs and tables before an analysis of the data ensued. Responses of learners and teachers were thus presented, interpreted, and analyzed in relation to the topic under investigation. All data presented in this research reflected that the shortage of laboratory equipment and materials and equipment in secondary schools in Zimbabwe is an eyesore for many stakeholders.

The study established that there was a lack of appropriate instructional materials, limited resources and congested timetable, lack of study time. The study recommend that school science laboratories should be sufficiently equipped with laboratory equipment to help accommodate all learners and have all learners in pragmatism. The study also advocated for more improvised equipment to help learners during the teaching and learning.

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1.1 INTRODUCTION

This chapter introduces the foundation of the research through vital elements of the study. This comes in the form of the background of the study, problem statement, aims and the objectives. Statement of the problem highlights what actually is the problem behind the study. Background of the study gives an overview on the study. The aim gives a statement on what the study intends to achieve guided by objectives. Other elements which are covered are research questions, assumptions of the study, significance of the study, delimitations, limitations, definition of key terms and finally the summary of the whole chapter.

1.2 Background

Lack of laboratories as well as the materials have contributed to poor performance in Combined Science in rural schools in Zimbabwe, particularly in Mashonaland West Province. This had prompted the researcher to carry out a research on the impact of improvised experiments in the teaching and learning of this learning area in selected schools in Hurungwe North District in Mashonaland West Province.

The teaching of Combined Science in secondary schools plays a pivotal role in shaping students' understanding of life sciences and fostering critical thinking skills. Furthermore, combined science is particularly beneficial in secondary education settings, where it serves as an introductory platform for students who may later choose to specialize in one or more scientific disciplines. This approach aligns with the educational goals of fostering scientific literacy and encouraging students to appreciate the relevance of science in everyday life (Jones, 2020).

In many regions, including Hurungwe North District in Mashonaland West Province, the effectiveness of Combined Science education is often compromised by limited resources and inadequate laboratory facilities. This situation necessitates innovative approaches to practical teaching, particularly through the use of improvised practical activities.

Improvising practical activities involve the use of readily available materials and local resources to conduct experiments as well as demonstrations. This method not only addresses the scarcity of traditional laboratory equipment but also enhances student engagement and learning outcomes.

Research has shown that practical work is essential for deepening students' comprehension of science concepts, as it allows them to apply theoretical knowledge in real-world contexts as advocated for by Education 5.0. Furthermore, practical activities can stimulate interest in science learning, encouraging students to pursue further studies in the field.

Literature provides numerous evidences that there are so many factors affecting students' performance (Muranda, 2012). In the context of Hurungwe North District, where many schools face infrastructural challenges, the implementation of improvised practical activities could serve as a viable solution. By adapting to the local environment and utilizing accessible materials, teachers can create meaningful learning experiences that resonate with students. This approach aligns with educational strategies (Education 5.0), that emphasize the importance of hands-on learning in science education.

Moreover, the integration of improvised practical activities into the Combined Science curriculum can foster critical thinking and problem-solving skills among students. As they engage in practical work, students learn to observe, hypothesize, experiment, and draw conclusions, which are fundamental skills in scientific inquiry (Usman, 2020). This research aims to assess the impact of such activities on the teaching and learning of Combined Science in secondary schools, providing insights that could inform teaching practices and enhance educational outcomes in the region.

By focusing on the effectiveness of improvising practical activities, this study seeks to contribute to the broader discourse on improving science education in resource-constrained settings, ultimately aiming to empower both teachers and students in their pursuit of knowledge in Combined Science,

1.3 STATEMENT OF THE PROBLEM

In Hurungwe North District, Mashonaland West Province, the teaching and learning of Combined science in secondary school face challenges due to lack of laboratory facilities and resources. Many schools do not have enough equipment to carry out hands-on practical experiences. This lack of resources often leads to a reliance on theoretical instruction, which can result in disengagement and a superficial understanding of science concepts among students.

In Hurungwe North District, in Mashonaland West Province, the teaching and learning of Combined Science in secondary schools face significant challenges due to inadequate laboratory facilities and resources. Many schools struggle with insufficient laboratory equipment, materials, and supplies necessary for conducting effective practical experiments. According to Timothy (2010), this scarcity hampers the ability of teachers to implement hands-on learning experiences, which are crucial for enhancing students' understanding of scientific concepts.

The challenges play a role in the effectiveness of practical activities. The secondary schools from disadvantaged areas may lack access to necessary materials for engaging in science practical activities since parents may not be in a position to pay school fees which are then used by schools to buy materials. This disparity can create inequalities in learning opportunities, as noted by Muranda (2012), ultimately affecting students' performance and interest in science.

Many schools are ill-equipped to provide the hands-on practical experiences that are essential for effective science education. Many schools in Zimbabwe face infrastructural challenges, such as inadequate laboratory facilities and poor maintenance of existing equipment. These issues can severely limit the scope and quality of practical activities. Lupahla (2012) emphasizes that without proper infrastructure, even well-planned practical activities may fail to achieve their intended educational outcomes.

In addition, this lack of resources often leads to a reliance on theoretical instruction, which can result in disengagement and a superficial understanding of science concepts among students. Consequently, the schools produce poor pass rates like zero percent.

The absence of well-equipped laboratories limits the opportunities for students to engage in practical work, which is crucial for fostering critical thinking, problem-solving skills, and a deeper comprehension of scientific principles. Consequently, students may struggle to connect theoretical knowledge with real-world applications, hindering their overall academic performance and interest in the subject. According to Kibet et al (2012), if learners perform poorly in examinations, chances are high that they will not get good jobs.

Improvising practical activities present a potential solution to these challenges by allowing teachers to utilize locally available materials and resources to create engaging learning experiences. However, there is limited research on the effectiveness of such improvisation in the

context of Combined Science education within the district. This gap in knowledge raises important questions about the impact of improvising practical activities on student engagement, understanding of science concepts, and overall academic achievement.

Therefore, this research seeks to assess the impact of improvising experiments in the teaching and learning of Combined Science in selected secondary schools in Hurungwe North District. By investigating this issue, the study aims to provide valuable insights that can inform teaching practices, enhance student learning outcomes, and ultimately contribute to the improvement of Combined Science education in resource-constrained environments.

1.4 RESEARCH OBJECTIVES

This research was guided by the following research objectives:

1.4.1 To assess the benefits of improvised practical activities in teaching and learning of Combined Science concepts.

1.4.2 To identify challenges teachers face when improvising practical activities in Combined Science education in Hurungwe North District secondary schools.

1.4.3 To establish strategies on improving the use of improvised practical activities in the teaching and learning of Combined Science in Hurungwe North District.

1.5 MAIN RESEARCH QUESTIONS

What is the impact of improvised experiments in the teaching and learning of Combined Science in selected schools in Hurungwe North District in Mashonaland West Province?

1.5.1 SUB-RESEARCH QUESTIONS

The following research questions guided the study:

- What are the benefits of improvising practical activities on students' understanding of key science concepts?
- What challenges do teachers face when improvising practical activities in Combined Science education in Hurungwe North District secondary schools?

- How can the use of improvised practical activities in the teaching and learning of in Combined Science Hurungwe North District secondary schools be improved?

1.6 ASSUMPTION OF THE STUDY

The research made the following assumption:

- That all Combined Science teachers in Hurungwe North District are trained in teaching the subject at Secondary as stipulated by the Ministry policy.
- Combined Science teachers in Hurungwe North District have an experience in teaching using improvised practical activities.
- Challenges faced in Teaching and Learning Combined Science using improvised materials in the schools selected are the same in the whole district.
- Participants were going to give correct information on their experiences based on improvised practical teaching and learning of Combined Science.
- That the research was going to be completed in the stipulated time.

1.7 Delimitations

The research was carried out in Hurungwe North District in Chundu cluster which consists of five secondary schools namely, Chitindiva High School, Manyenyedzi, Huyo, Kabidza and Mahwau secondary schools. The research was carried out at Manyenyedzi Secondary School. The cluster is located about 88 km North West of Karoi town. Focus was on Form 3 Class: The research specifically targeted Form 3 class, Combined Science excluding other subjects. This delimitation allowed for a concentrated examination of the impact of improvising practical activities within a specific educational context.

1.8 Limitations

1.8.1 Resource Constraints

The research was limited by the availability of resources for conducting practical activities like travelling from one school to the other, to carry out interviews. Schools in Hurungwe North District

may have varying levels of access to materials, which could affect the consistency and quality of the improvised practical activities implemented.

1.8.2 Sample Size and Selection

The study focused on selected schools in Chundu cluster which may not represent the entire population of Form 3 classes of Combined Science in the whole District and the entire region. This limitation could affect the generalizability of the findings to other schools or regions.

1.8.3 Subjectivity in Data Collection

The assessment of student engagement and understanding may rely on qualitative data, such as interviews and observations, which can be subjective. This subjectivity may introduce bias in interpreting the effectiveness of improvised practical activities.

1.8.4 Time Constraints

The duration of the study limited the ability to observe long-term impacts of improvised practical activities on student learning outcomes. A short timeframe may not capture the full effects of these activities on students' academic performance.

1.9 SIGNIFICANCE OF THE STUDY

This research project holds several implications in education. By assessing the impact of improvising practical activities in the teaching and learning of Combined Science in secondary schools, the study will contribute in different ways. The following are the examples;

1.9.1 Learners

Improvising practical activities can significantly enhance student engagement and understanding of scientific concepts. According to Mizzi (2013), interactive learning environments, which include hands-on activities, improve student engagement and learning outcomes in science education. This study aims to provide empirical evidence on how such activities can foster deeper comprehension among students in Hurungwe District.

1.9.2: Addressing Resource Limitations

Many schools in Hurungwe North District face challenges related to inadequate laboratory facilities and resources. This study explored how teachers effectively improvise materials to conduct practical science lessons, making science education more accessible. Research indicates that practical work should be promoted, especially in resource-constrained environments, to enhance learning experiences (Usman, 2020).

1.9.3: Informing Effective Teaching Practices

The research contributed to the understanding of effective teaching methodologies in science. By evaluating the impact of improvising practical activities, the study can provide insights into best practices that educators can adopt. This aligns with findings from educational research that suggest modern teaching methods, including hands-on activities, are essential for improving student learning in science (Kasembe,2011).

1.9.4: Curriculum developers

Supporting Curriculum Development in the Ministry of Primary and Secondary Education. Insights gained from this study could inform curriculum developers about the importance of incorporating improvised practical activities into the science curriculum (STEM). As noted by educational theorists like Dewey, practical engagement is crucial for meaningful learning experiences. This research could advocate for a curriculum that emphasizes experiential learning, which is vital for subjects like combined science.

1.9.5: Policy making

Influencing Educational Policy. The findings may have implications for educational policy in the region. By demonstrating the positive impact of improvising practical activities, the study could encourage policymakers to invest in teacher training and resource allocation for science education. This aligns with broader educational goals of enhancing teaching quality and student achievement in science, as supported by various educational frameworks (Education 5.0).

In summary, this study is significant as it seeks to improve science education through practical engagement, address resource challenges, inform teaching practices, support curriculum development, and influence educational policy. The research could ultimately lead to better educational outcomes for students in Hurungwe North District in Mashonaland West Province.

1.10 DEFINITION OF TERMS

1.10.1 Improvised practical activities

Improvised practical is defined as Hands-on, inquiry-based activities that utilize readily available materials and resources to investigate scientific concepts and principles in a flexible and spontaneous manner (Ndirangu et al, 2013).

According to Kumar (2011), improvised practical activities means using everyday materials to create simple, low-cost experiments that illustrate scientific principles.

From the two definitions given above, we can therefore say it is a way of teaching and learning that tries to cover up for the shortage of materials in carrying out experiments.

1.10.2 Learning

Kolb, (2014) defines learning as the process by which individuals acquire, retain, and apply knowledge, skills, and attitudes through experience, study, or teaching.

Jobolingo (2012) states that learning can be viewed as the process through which individuals acquire new skills, knowledge, or attitudes, often through instruction or study.

In other words, we can therefore say learning are ways in which learners get knowledge and various skills from teachers or facilitators.

1.10.3 Teaching is defined as the act of facilitating learning, enabling students to acquire knowledge, skills, and attitudes. (National Council for Accreditation of Teacher Education, 2010).

According to Joyce & Kiadese (2011), teaching is the purposeful, structured, and systematic interaction between a teacher and learners, aimed at promoting learning and achieving specific educational objectives."

Therefore, in my view teaching involves the art of helping students in acquiring knowledge, skills, and values. In addition to the above, it is a process involving planning, instructing, assessment, and evaluation to promote student learning.

1.10.4 Combined Science

Combined Science is a curriculum approach that integrates two or more science disciplines, such as biology, chemistry, and physics, to provide a comprehensive understanding of scientific principles and concepts (National Science Teachers Association, 2016).

Another definition by Bybee (2010) states that it is an interdisciplinary approach to science education that combines concepts and methods from multiple scientific disciplines.

Combined science is a course of study that integrates the content and methods of two or more sciences to provide a unified understanding of the natural world (American Association for the Advancement of Science, 2013).

The three definitions come up with one thing in common that it is a subject or learning area that combines different science disciplines like Chemistry, Biology and Physics.

1.11 CHAPTER SUMMARY

This chapter provided an introduction to the research project on the impact of improvising practical activities in the teaching and learning of Combined Science.The background and significance of the study were discussed, along with the statement of the problem, research questions and objectives, purpose of the study, significance of the study, delimitations and limitations. The next chapter will search more information about the literature review.

2.0 CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter focused on various related literature, and research studies carried out by different authors to assess the impact of improvised experiments in the teaching and learning of Combined Science in selected schools in Hurungwe North District in Mashonaland West Province. The main focus was on theoretical framework, conceptual framework and finally the summary of the chapter.

2.2 THEORETICAL FRAMEWORK

2.2.1 Kolb's Experiential Learning Model diagram and theory

Concrete Experience:

Learners are actively engaged in the learning process and are encouraged to take risks and explore new ideas.

|

Reflective Observation:

|In this stage, learners reflect on their experiences and observations. They think about what they have learned and how they can apply it in different contexts.

|

Abstract Conceptualization:

| This stage involves the formation of abstract concepts and theories. Learners integrate their experiences and reflections into a broader framework of understanding.

|

Active Experimentation:

In this final stage, learners apply their new understanding to real-world situations. They experiment with new ideas and approaches, and learn from their successes and failures.

Fig 2.1 Kolb's Experiential Learning Model diagram and theory

Kolb, (2015) states that learning occurs through a cycle of four stages: Concrete Experience: The learner experiences a new situation or environment.

Reflective Observation: The learner reflects on their experience and identifies key aspects.

Abstract Conceptualization: The learner develops new concepts and theories based on their reflection.

Active Experimentation: The learner applies their new concepts and theories to real-world situations.

This model emphasizes the importance of hands-on experience, reflection, and experimentation in the learning process.

Experiential Learning Theory

Experiential Learning Theory (ELT) was developed by David Kolb. It emphasizes the process of learning through experience. Kolb's model outlines a cyclical learning process that includes four stages which are concrete experience, reflective observation, abstract conceptualization, and active experimentation. This theory is grounded in the belief that learning is most effective when students engage in hands-on experiences and reflect on those experiences to derive meaning and understanding.

According to Grayson (2017), there is a strong relationship between learner's performance and the quality of facilities available to learners. The school environment might also be a source of poor performance if learner support materials are inadequate (Muranda, 2012).

Key contributors to the foundation of experiential learning include John Dewey, who advocated for learning through doing, and Carl Rogers, who emphasized the importance of personal relevance in the learning process. Together, these theorists highlight that learning is not merely about acquiring knowledge but involves a dynamic interaction between the learner and their immediate environment.

2.2.1.1 Importance of Experiential Learning in Improvisation in Secondary Schools

Kolb,(2015) states that experiential learning prepares students for real-world challenges by allowing them to engage in practical, hands-on activities. This approach is particularly beneficial in secondary education, where students can apply theoretical knowledge to real-life situations. For instance, a science teacher might conduct a lab experiment that requires students to adapt their methods based on unexpected results, fostering critical thinking skills which are important in real life situations.

In an experiential learning environment, students are active participants in their learning process. Usman, (2020) postulates that this active engagement encourages teachers to improvise and adapt their teaching strategies based on student feedback and participation. When students are involved in discussions, group work, and hands-on projects, teachers can adjust their lessons in real-time to better meet the needs of their students.

The reflective observation stage of Kolb's learning cycle encourages students to think critically about their experiences. This reflection allows both students and teachers to identify what worked well and what did not, leading to improved strategies for future lessons (Kolb,2014). Teachers who embrace this reflective practice are more likely to improvise effectively, as they can draw on past experiences to inform their teaching decisions.

According to cited internet source accessed on 25 November, Experiential learning often involves collaborative projects, where students work together to solve problems or complete tasks. This collaborative environment not only enhances learning but also provides opportunities for teachers to improvise based on group dynamics and interactions. When students collaborate, teachers can facilitate discussions and activities that may lead to unexpected insights and learning moments.

Building Confidence and Creativity: Kolb, (2014) believes that by engaging in experiential learning, students develop confidence in their abilities to tackle challenges and think creatively. This confidence extends to teachers as well, who may feel more empowered to take risks and try new approaches in their teaching. When teachers are comfortable with improvisation, they can

create a more dynamic and responsive classroom environment that encourages student exploration and innovation

In summary, Experiential Learning Theory is a powerful framework that enhances the learning experience in secondary schools. By emphasizing hands-on experiences, reflection, and collaboration, experiential learning fosters an environment where improvisation can thrive. This approach not only prepares students for real-world challenges but also empowers teachers to adapt their instructional strategies in response to the unique dynamics of their classrooms.

2.2.2 Conclusion

The theoretical framework for this literature review integrates experiential learning theory. This framework underscores the importance of improvising experiments in science education, particularly in resource-constrained environments like Hurungwe District. By leveraging this theory, educators can enhance the teaching and learning of combined science, ultimately leading to improved educational outcomes for students.

2.3 CONCEPTUAL FRAMEWORK

2.3.1 What are the benefits of improvised experiments on students' understanding of key science concepts in Zimbabwe and the world over?

Improvising practical activities in science education has been shown to significantly enhance students' understanding of key scientific concepts, particularly in resource-constrained environments like Hurungwe District. This impact can be observed through various dimensions, including student engagement, conceptual understanding, and the development of practical skills.

2.3.1.1Enhanced Engagement and Motivation

Improvisation in practical activities often leads to increased student engagement and motivation. When teachers utilize improvised materials, students are more likely to participate actively in their learning. According to Abonyi (2015), the introduction of improvised teaching aids can positively influence science teaching, making lessons more relatable and stimulating for students. This engagement is crucial, as it fosters a deeper interest in science subjects, which can lead to improved academic performance.

2.3.1.2 Improved Conceptual Understanding

Research indicates that experiments, especially those that are improvised, help students grasp complex scientific concepts more effectively. For instance, a study highlighted that students who engage in hands-on learning experiences demonstrate better retention and understanding of scientific principles compared to those who rely solely on theoretical instruction (Abrahams & Millar, 2010). This is particularly relevant in Hurungwe District, where access to traditional laboratory resources may be limited. By improvising, teachers can create meaningful learning experiences that allow students to explore and apply scientific concepts in a practical context.

2.3.1.3 Development of Practical Skills

Improvisation not only aids in understanding theoretical concepts but also equips students with essential practical skills. Engaging in hands-on activities allows students to develop laboratory skills and scientific reasoning. According to a study by Abonyi (2015), the use of improvised instructional materials has a favorable effect on students' achievement in basic science concepts, suggesting that practical engagement is vital for skill development. This is particularly important in secondary education, where students are expected to transition from basic understanding to more complex applications of scientific knowledge. In addition to the above it is essential for learners to develop these skills as they would be able to use them in real life situations.

Studies have indicated that poor performance of students in science in developing countries is not only connected to the teaching or learning methods used but also the ways of science experiments are conducted (Ndirangu et al, 2013). For instance, in Rwanda, students do not participate in the choice of the content taught and the teachers dominate the activities in the classrooms, and the source of content is mainly from lecturing (Nzeyimana, 2014). However, with the new shift to Competence Based Curriculum (CBC) in Rwandan education system since 2015 (Republic of Rwanda, 2015), the use of improvised experiment materials will play a key role given that so far science labs are not established and well equipped in all schools. Improvisation is one of the cost-effective ways of learning by doing, where students are given the opportunity to explore and use materials in the surrounding environment. Thus, a creative teacher will always be better than the theoretical teacher as he/she demonstrates and relates theory with the real world, students get motivated and develop their science understanding themselves.

Udosen & Ekukinam, (2013) postulate that Science experiments help students to increase their self-confidence, creativity, innovation, imagination and curiosity. They also contribute in the development of critical thinking skills.

2.3.1.4 Addressing Resource Limitations

In regions like Hurungwe District, where educational resources are often scarce, improvisation serves as a practical solution to enhance science education. Teachers who are resourceful in creating improvised materials can provide students with opportunities to engage in practical work that would otherwise be unavailable. This approach not only mitigates the challenges posed by limited resources but also encourages creativity and innovation among both teachers and students (Chikwature and Oyedele,2016).

2.3.1.5 Long-term Academic Benefits

The long-term benefits of engaging students in improvised practical activities extend beyond immediate understanding. Studies have shown that students who participate in practical science education are more likely to pursue further studies in science-related fields, thereby contributing to a more scientifically literate society (Hofstein & Lunetta, 2014). This is particularly relevant in Hurungwe District, where fostering interest in science can lead to greater educational and career opportunities for students.

2.3.2 What challenges do teachers in Zimbabwe and the whole world face when improvising practical activities in Combined Science education in secondary schools?

Teachers in Hurungwe North District encounter several challenges when improvising practical activities in Combined Science education. These challenges can significantly impact the effectiveness of teaching and the overall learning experience for students.

2.3.2.1 Lack of Resources and Materials

One of the primary challenges teachers faced was the scarcity of appropriate resources and materials needed for effective improvisation. Many schools in Hurungwe North District are under-resourced, making it difficult for teachers to find suitable materials to create improvised teaching aids. Practical experiments are a crucial component in the teaching and learning of Combined

science (Rudhundu,2014). Pupils must be engaged in practical work when they learn Combined science. This enables students to gain personal experience of science through hands - on activities and to enhance the skills and thinking process associated with practice of the subject. Laboratory work is an effective way to enhance students' motivation and understanding of the subject matter. However, students sometimes do not learn from a practical task the concepts the teacher wanted them to learn. This was due to lack of the necessary chemicals and apparatus. According to Abonyi (2015), the lack of instructional resources is a persistent issue that hampers the teaching and learning of science. Teachers often struggle to provide hands-on activities that are essential for understanding complex scientific concepts. Awan (2014) states that educational aids and resources increase pupil achievement. Kasembe (2011) believes that in some schools the equipment is too old and obsolete. In a study conducted by Chikwature & Oyedele (2016), the availability of resources in most cases co-related in a positive way with pupil's performance.

In the African context, a study by Ayeni (2012) shows that the teaching of science investigation is hindered by a shortage of science resources and equipment, which are necessary for the successful facilitation of science teaching and learning. A study conducted in the Igbo Etiti local government area of Nigeria by Akindele et al. (2012) reveals that the inadequate teaching of science in high schools can be attributed to several factors, including the absence of laboratories, insufficient instructional materials, and incompetent teachers. This challenge also affects other countries like Bolivia which exemplifies challenges in resource-limited science education (Montellano, et al., 2019).

The lack of laboratories, chemicals and apparatus in most South African schools has been cited previously as an obstacle in the implementation of C2005 and NCS science reforms (Ramatlapana & Makonye, 2013; Grussendorff et al, 2014). Participants confirmed that the departmental authorities had made provisions for the supply of mundane laboratory needs. Oftentimes, the challenges were related to teachers' insufficient expertise in using the equipment, chemicals and other apparatus for successful laboratory instruction.

In the South African school system, reform efforts to improve teaching and learning in subjects such as physical sciences have been plagued by challenges at the implementation stages (DBE, 2011). Most of the schools in the country (95%) may not be able to implement these prescribed practical components of CAPS due to inadequate laboratory facilities (Grussendorff et al, 2014).

2.3.2.2 Insufficient Training and Skills

Improvisation requires specific skills and knowledge that many teachers may not possess. A study highlighted that teachers need adequate training to effectively improvise instructional materials and activities (Boakye & Ampiah, 2017). As an example, in Rwanda laboratory activities are not fully performed because of scarcity of laboratory as well as improvising skills (Ndihokubwayo, 2017). This is happening yet scholars advocate for a shift from rote learning to enquiry activities and problem-solving and from teacher centered approaches to student-centered approaches. Without proper training, teachers may feel unprepared to create engaging and effective experiments. This can lead to a reliance on traditional teaching methods that do not foster active learning. Althauser and Harter (2016) postulate that designing authentic tasks and experiments requires careful planning and alignment with the learning goals and standards. This can sometimes be an uphill task for teachers who do not have enough training to do so. Bryman (2013) argues that teachers with good professional competence and interpersonal skills are more effective in their teaching. Shortages of teachers in rural areas especially in Hurungwe North District, particularly Chundu cluster result in science classes being taken by the unskilled personnel. The result is poor performance by learners in their academic examinations.

Halligan (2019), states that in sub-Saharan Africa, only 64% of primary and 50% of secondary school teachers possess the minimum required training. However, as a result of schools hiring contract teachers without qualifications to cover gaps at a lower cost, performance becomes poor leading to poor results. In addition, up till today many teachers still hold onto the chalk and talk method of teaching which has been condemned as not appropriate, and cited as one of the reasons for Nigeria"s backwardness (Ushie and Anake, 2015). Consequently, the learners do not see science as it affects their everyday life and the teacher are making no effort to connect the concepts with the students' everyday life.

2.3.2.3 Time Constraints

Teachers faced time constraints that limited their ability to plan and implement improvised practical activities. The curriculum demands can be overwhelming, leaving little room for teachers to experiment with new teaching methods or to gather materials for improvisation. This challenge was compounded by the pressure to cover the syllabus within a limited timeframe, which can lead

to a focus on rote learning rather than experiential learning (Hofstein & Lunetta, 2004). As an example, some statutory instruments guides teachers on the number of written works per day. This would negatively affect the improvisation process as teachers would opt to cover the written work at the expense of fruitful experiments.

On the other side, teachers being the implementing agents, often confront a wide range of obstacles in effectively organising laboratory activities (Fitzgerald et al., 2017). Besides their teaching duties, science teachers are tasked with preparing equipment, solutions, and reagents for practical science lessons, including materials and equipment procurements (Mizzi, 2013; Yalcin-Celik et al., 2017). The strain on these teachers was likely magnified during times of curriculum reforms when new topics and laboratory experiment requirements were introduced.

2.3.2.4 Large class sizes

A higher number of students in classroom tends to affect student-instructor interactions and can also prevent peer exchanges during experiments in the classroom. Olowe (2013) quoting Opute (1998) stated that teaching is the teachers' activities designed and performed to produce a change in learner's behavior. Learners have different cognitive levels of understanding concepts. This greatly hinder the implementation of competency-based curriculum and restricts educators from applying learner- centered interactive methods. According to Desai (2012) teaching is one with learning outcomes, that effect changes in knowledge, abilities, skills, attitudes and mindset. Small class size is a very important aspect because it improves learners' performance as educators will now be able to assist students with learning difficulties individually (Mujaji, 2012). Therefore student-teacher ratio has to be considered always because they are a way to measure teacher's workloads and resources as well as the individual attention a student receives from the teacher because it involves some skills subjects.

2.3.2.5 Student Readiness and Attitudes

The readiness and attitudes of students can also pose challenges when implementing improvised practical activities. Some students may be resistant to hands-on learning or may lack the foundational knowledge necessary to engage effectively in practical activities. This can hinder the overall effectiveness of improvisation as a teaching strategy. As noted by Abonyi (2015), students' attitudes towards science can significantly influence their engagement and learning outcomes.

Omolara (2015) state that some attitudes help students to function effectively in school while others interfere with school life therefore it is very crucial to promote positive attitudes in students.

2.3.2.6 Assessment and Evaluation Difficulties

Improvising experiments complicated the assessment and evaluation process. Teachers found it challenging to develop appropriate assessment criteria for activities that were not standardized. This led to inconsistencies in evaluating student performance and understanding. According to Abrahams and Millar (2010), effective assessment in practical science education requires clear criteria that align with the learning objectives, which can be difficult to establish when using improvised materials.

2.3.2.7 Cultural and Contextual Factors

Cultural attitudes towards education and science also impacted the effectiveness of improvisation in teaching. In some cases, there was a lack of support from the community or parents for innovative teaching methods, which discouraged teachers from attempting to improvise. Understanding the local context and cultural dynamics is essential for successfully implementing practical activities in science education (Mizzi, 2013).

In conclusion, while improvising practical activities in Combined Science education has the potential to enhance student learning, teachers in Hurungwe North District face significant challenges.

2.3.3 How can the use of improvised experiments in the teaching and learning of Combined Science in Zimbabwe and the world over in secondary schools be improved?

Improving the use of improvised experiments in the teaching and learning of combined science in Hurungwe North District secondary schools in Zimbabwe can be approached through several strategies. Here are some key recommendations**:**

2.3.3.1. Training and Professional Development for Teachers.

Enhancing teacher skills in improvisation is crucial. Teachers should receive training on how to effectively use improvised materials in practical science lessons. Chikowore (2012) echoes the same sentiments by saying that the qualification of a teacher is important in ensuring that student

achieve better results. The Ministry of Education should provide workshops and training for teachers on designing and implementing improvised experiments (Kumar, 2011).

In addition, governments and educators can provide teacher training and support to help teachers develop the skills and confidence needed to teach combined science using improvised experiments. For example, the Kenya Science and Technology Education Project provides teacher training and support to help teachers integrate improvised experiments into their teaching practices (KSETP, 2020).

This therefore means teachers are the biggest human resource that determines performance in schools (Sutton, 2013). According to Chikowore (2013), pupils' performance can be affected by the teacher's experience and level of professional training. In this view, it is important that teachers get in service training. This can include workshops and continuous professional development programs that focus on innovative instructional methods and the effective use of available resources.

2.3.3.2. Curriculum Integration

Integrate improvised experiments into the Combined Science curriculum (Vundla,2012). The curriculum should emphasize practical activities that can be conducted with improvised materials. By integrating practical work into the curriculum, teachers can create a more engaging learning environment that allows students to explore scientific concepts hands-on. This approach can help alleviate the abstract nature of science subjects, making them more accessible to students.

Worldwide, science curriculum reforms are often accompanied by large-scale changes in the practical components, including the way students conduct experimental work. For example, recently in the United States, this quest is represented by the Next Generation Science Standards (Fitzgerald et al., 2017), while in the Australian schooling system the national Australian Curriculum: Science (ACARA 2014), launched in 2014, has as one of its three strands, a focus on science inquiry skills (Fitzgerald et al., 2017). The National Curriculum in England urges teachers to promote learners to 'work scientifically' across all scientific disciplines that involve experimental skills and strategies (DfE, 2014).

2.3.3.3. Resource Accessibility

Improving access to resources is essential. Establish science resource centers with basic materials for improvised experiments (Muranda, 2012). Furthermore, schools should be encouraged to develop partnerships with local communities and organizations to gather materials that can be used for practical activities. This could include using everyday items that students can find at home or in their communities.

2.3.3.4. Collaborative Learning

Encourage student collaboration and peer-to-peer learning through improvised experiments (Kolb, 2014). Encouraging collaborative learning among students can enhance the effectiveness of practical activities. Group work allows students to share ideas and resources, fostering a deeper understanding of scientific concepts. Teachers can facilitate this by designing group projects that require the use of improvised materials

2.3.3.5. Promoting inquiry-based learning:

Governments and educators can promote inquiry-based learning approaches that encourage students to explore scientific concepts and principles through improvised experiments. As an example, the Australian Science Teachers Association promotes inquiry-based learning approaches through its professional development programs and resources (ASTA, 2020).

2.3.3.6. Assessment and Feedback

Sutton, (2013) posits that implementing a system of assessment and feedback focused on practical skills can motivate students to engage more with improvised activities. Teachers should assess not only the final outcomes of practical work but also the processes involved, encouraging students to reflect on their learning experiences.

2.3.3.7. Community Involvement

Engaging the community in science education can provide additional support and resources. In addition, the local communities can be engaged in providing materials and expertise for improvised experiments (Hinneh, 2017). The schools can organize science fairs or community workshops where students demonstrate their practical work using improvised materials. This not

only showcases student learning but also raises awareness about the importance of science education Hofstein & Lunetta (2014). Supporting the point mentioned above, Society for Science & the Public, (2020) propound that the Science Fair program in the United States encourages students to conduct experiments and present their findings to the community

2.3.3.8. Developing and using low-cost equipment

Governments and educators can develop and use low-cost equipment to support the teaching of combined science using improvised experiments. For example, the Raspberry Pi Foundation in the United Kingdom provides low-cost computing equipment and resources to support the teaching of computer science and programming (Raspberry Pi Foundation, 2020).

2.3.3.9. Use of Technology. Incorporating technology where possible can enhance the learning experience. (Cresswell,2017) propound that the resources may be limited, using simple technology such as mobile devices to access online resources or instructional videos can provide students with additional support in understanding practical activities.

2.3.3.10. **Developing and sharing open-source resources:**

Governments and educators can develop and share open-source resources, such as experiment manuals and videos, to support the teaching of combined science using improvised experiments. For example, the Open-Source Physics project in Singapore provides a platform for teachers to share and access open-source resources for teaching physics (Wee et al., 2019).

By implementing these strategies, secondary schools in Hurungwe North District can significantly improve the effectiveness of improvised experiments in combined science education, ultimately enhancing student engagement and learning outcomes.

2.4 CHAPTER SUMMARY

The focus of the literature review was on theoretical framework and conceptual framework. The theoretical framework was looking at the theory related to the research topic. Conceptual framework focused on benefits of improvised experiments, challenges faced when using improvised experiments as well as ways of improving the use of improvised experiments during the teaching and learning of combined science in secondary schools. The literature calls for further

research into the specific impacts of improvisation on student engagement and learning outcomes in science education. The next chapter shall dwell on the methodology of the study.

CHAPTER 3

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION.

Focus of this chapter was to describe and underline the procedures that were taken by the researcher in the collection of data. Furthermore, it outlined the research approach, research design, target population, research paradigm, sample and sampling procedure, research instruments, the data collection procedures, as well as justifying them and the ethical considerations. Quantitative research methodology was utilized to make the findings rich with information.

3.2 RESEARCH APPROACH

The study adopted a quantitative approach. This design was chosen to provide a holistic understanding of the impact of improvisational practical activities on student learning outcomes and engagement. The quantitative component allowed for statistical analysis of data.

Kumar, (2020) defines quantitative approach in research as the systematic and structured approach for collecting and analyzing numerical data, using statistical methods to test hypotheses and answer research questions. Another definition by Creswell (2020) says that a quantitative approach in research is a research approach that emphasizes the use of numerical data and statistical analysis to understand social phenomena, with the goal of identifying patterns, trends, and relationships between variables. According to these two definitions, a quantitative research approach involves the use of numerical data and statistical methods to answer research questions and test hypotheses.

Quantitative research is often used in studies that aim to test hypotheses, predict outcomes, or identify patterns and relationships between variables. According to Cresswell, (2020), it involves collecting numerical data through surveys, experiments, or observations, and analyzing it using statistical methods such as regression, correlation, and hypothesis testing. Quantitative research is often used in fields such as psychology, education, business, and healthcare, where numerical data is readily available and can be used to inform decision-making. Furthermore, it involves collecting numerical data through surveys, questionnaires, or interviews.

3.3 RESEARCH DESIGN

According to Babbie (2016), a research design is a detailed blueprint for conducting research, including the research question, hypotheses, sampling, data collection, and data analysis Creswell, (2014) postulates that it is a comprehensive plan outlining the overall strategy and methods for conducting a research study, including the sampling strategy, data collection methods, and data

analysis techniques. According to the above given definitions, we can therefore say a research design is a method as well as strategies on how to carry out a research study.

Descriptive design is "a research design that aims to describe the characteristics of a population or phenomenon, often using a questionnaire or other data collection instrument" (Saunders et al., 2019, p. 145) Another writer believes that a descriptive survey is "a research methodology that involves collecting data from a sample of respondents to describe the characteristics of a population, often using statistical methods" (Kumar, 2020, p. 167). Summarizing the two definitions, a descriptive survey is a research approach that aims to describe the characteristics of a population often using a quantitative approach and statistical methods.

In the research topic, an assessment into the impact of improvised experiments in the teaching and learning of Combined Science at selected school in Hurungwe North District in Mashonaland West Province, the researcher used descriptive survey. The survey was used because of the quantitative approach that was chosen.

The researcher used a descriptive design to investigate the demographic characteristics of a population, age and sex of respondents, qualification of respondents as well as their teaching experiences. Furthermore, the survey was also used to examine the opinions of respondents on the research topic under study. It was used to describe the characteristics of a phenomenon the impact of improvised experiments in the teaching and learning of Combined Science in secondary schools. In addition, data regarding learner's opinions were collected using questionnaires and interviews. Furthermore, data regarding opinions of the teachers on the topic under study were collected using interviews and questionnaires. A survey on Manyenyedzi secondary school was used to gather information concerning benefits of improvised experiments, challenges faced when improvising as well as solutions to counter the problems.

3.4. Target Population.

Grayson (2017) defines the target population as the specific group of individuals from which data will be collected. In this research, data was collected from the target population to assess the impact of improvisational experiments in the teaching and learning of combined science. The target population is crucial for ensuring that the research findings are relevant and applicable to the context of secondary education in the Hurungwe North District of Mashonaland West.

Population: It is the group of interest to the researcher which one would like the results to be generalized. Cresswell (2017) assert that population is an entire count of people or objects with characteristics under study. The research was carried at one of the Secondary Schools since it was practically impossible for the researcher to access all schools in the district. Resources such as finance and time factor prompted the researcher to settle for one school. One important reason was that the teacher teaches at a school near the Secondary School. Furthermore, the Secondary School is just next to the main road which goes to Karoi town and this made it a feasible case study and sample.

The primary focus was on students enrolled in combined science classes across selected secondary schools in the Hurungwe North District. These students are typically aged between 13 and 18 years and are at a critical stage in their educational journey where engagement in practical science can significantly influence their understanding and interest in the subject.

The study also included science teachers who are responsible for teaching combined science at this school. These educators play a vital role in implementing practical activities and can provide insights into the effectiveness and challenges of such methods in the classroom.

The population of the school was 150 in total with 80 being girls and 70 boys respectively. In terms of the teachers, the school accommodated 11 teachers in total (8 females and 3 males). The researcher chose to focus the study on 'O' Level Combined Science learners.

The student population was diverse, encompassing various backgrounds, academic abilities, and levels of prior exposure to practical science activities. This diversity was essential for

The selected teachers have varying levels of experience and qualifications in teaching combined science. Their perspectives will help to identify best practices and areas for improvement in the implementation of practical activities.

The selection of this target population was based on the premise that students and teachers are the primary stakeholders in the educational process. Understanding their experiences and perceptions regarding experiments provided valuable insights into how these methods can be optimized to enhance science education. Furthermore, focusing on secondary schools in the Hurungwe North District allows for a localized study that can inform educational practices within that specific context.

3.5.0 RESEARCH PARADIGM

A research paradigm is "a set of assumptions, values, and principles that guide the research process and shape the way researchers think about and conduct research" (Creswell, 2020, p. 10). Another definition says that research paradigm is "a framework for thinking about and conducting research, including the assumptions, values, and principles that guide the research process" (Denzin & Lincoln, 2018, p. 15). In short, a research paradigm is a way or pattern of a research. In a quantitative approach, a research paradigm is used to guide the analysis and interpretation of data, as well as the reporting of research findings. The following information brings out the pattern that was used in the research.

3.5 SAMPLE AND SAMPLING PROCEDURES

Patton, (2010) defines a sample as a small group of members of a population selected to represent the population. According to Kamuren et al (2017), sampling is defined as seeking information about a population to explore the findings of the entire population. According to the two definitions, a sample simply means small number of people selected from a large number.

In this chapter, the sample and sampling procedures are crucial for ensuring that the research findings are representative and valid. In this study, the sample comprised five teachers and twenty learners who were purposively sampled to be the source of data needed to provide answers to the research questions.

Purposive sampling, also known as selective or judgmental sampling, is a non-probability sampling technique where participants are selected based on specific characteristics, expertise, or experiences relevant to the research study (Patton, 2010). Maree, (2010) postulates that purposive sampling technique is a process used to select a portion of the population for a study. The following are some of the importance of purposive sampling;

In-depth insights: Nisbert and Watt, (2018) posits that purposive sampling allows researchers to gather rich, detailed data from individuals with unique perspectives. On another point, expertise is an importance of purposive sampling. According to Creswell (2014), selecting participants with specialized knowledge or experience ensures informed responses. Gathering information from experts is crucial as they can provide the researcher with the right information at the right time.

Relevance: Babbie, (2016) believes that participants are chosen based on their connection to the research topic, ensuring relevant data. In addition, purposive sampling is efficient in that it focuses on a specific group, reducing data collection costs and time.

The reason for purposive sampling was founded by time, money and effort, to produce better quality research and in-depth information.

The target sample size for the study included:

20 Students: This number was deemed sufficient to provide a robust dataset for quantitative analysis, allowing for generalizations about student engagement and learning outcomes.

5 Science Teachers: A smaller sample of teachers will facilitate in-depth quantitative insights through interviews.

3.5.1 Sampling Procedures

The following steps outline the sampling procedures that were implemented in this research:

Step 1: Identification of one school within Chundu cluster.

Step 2: Selection of Participants: Within the selected school, form three students were chosen. Among those doing combined science, numbers were assigned to them using a random number generator to select participants. For teachers, only science teachers in the selected school were invited to participate in the study.

In summary, the sampling and sampling procedures outlined in this chapter were designed to ensure that the research is methodologically sound and ethically conducted. By employing a purposive sampling approach, the study aims to gather meaningful data that can inform educational practices in combined science teaching and learning.

3.6 Research Instruments

Bryman, (2012) propounds that the research instruments are the tools used by the researcher for purposes of data collection. This is echoed by Babbie, (2016) who posits that research instruments are tools used as measurement or observation parameters when one is carrying out the research. For this study, questionnaires, interviews and observation schedules were used to solicit data from the respondents.

3.6.1 Questionnaires

Kasawaya (2015) defines a questionnaire as a document of questions whose sole purpose is to elicit responses from respondents. In short, questionnaires are designed questions with the aim of getting answers from participants or respondents in research. A questionnaire is "a set of questions used to collect data from a sample of respondents" (Saunders et al., 2019, p. 345). Kumar, (2020) defines a questionnaire as a structured and systematic set of questions designed to gather information from respondents about their attitudes, opinions, behaviors, and characteristics A questionnaire is "a self-report instrument that consists of a series of questions designed to gather information about a respondent's thoughts, feelings, and behaviors" (Creswell, 2020, p. 234). In this study, the researcher developed a questionnaire with four sections.

The structured questionnaires were the primary data-gathering instrument. They consisted of both closed and open-ended questions designed to assess students' and teachers' perceptions of practical activities in science education.

3.6.1.1 Advantages.

- Using questionnaires in the research topic "An Assessment into the Impact of Improvising experiments in the Teaching and Learning of Combined Science in Selected Schools in Hurungwe North District" offers quite a number of advantages:
- Bryman, (2012) states that questionnaires are generally inexpensive to administer compared to other data collection methods, such as interviews or focus groups. They can reach a large number of respondents simultaneously, making them a practical choice for studies involving multiple schools and teachers. The following are other advantages of questionnaires according Cresswell (2017);
- The writer believes that questionnaires provide a standardized method of data collection, ensuring that each participant responds to the same set of questions. This uniformity helps in comparing responses across different respondents, which is crucial for assessing the impact of improvisation in teaching practices
- Participants may feel more comfortable providing honest feedback when their responses are anonymous. This can lead to more accurate data regarding their experiences and perceptions of improvising practical activities in science education.

- Quantitative and Qualitative Data Collection; Questionnaires can be designed to collect both quantitative data (e.g., Likert scale ratings) and qualitative data (e.g., open-ended responses). This dual approach allows for a comprehensive analysis of the impact of improvisation on teaching and learning outcomes.
- The data collected from questionnaires can be easily coded and analyzed statistically, facilitating the identification of trends and patterns. This is particularly useful in educational research, where understanding the effectiveness of teaching methods is essential.
- Researchers can tailor questionnaires to address specific research questions or hypotheses. This flexibility allows for the inclusion of various topics, such as teacher practices, student engagement, and resource availability, all of which are relevant to the study of improvisation in science education
- According to Bryman (2012), questionnaires can be distributed and completed relatively quickly, allowing researchers to gather data in a shorter time frame compared to other methods. This is particularly beneficial in educational settings where time is often limited.
- Questionnaires can be distributed to a broad audience, including teachers, students, and administrators across multiple schools. This wide reach enhances the representativeness of the sample and increases the generalizability of the findings.

3.6.1.2 Disadvantages

- While questionnaires are a valuable tool for collecting data in educational research, Cresswell (2017), indicates that questionnaires also come with several disadvantages that can impact the quality and reliability of the findings. The following are some of the disadvantages of questionnaires.
- Questionnaires often provide limited opportunities for respondents to elaborate on their answers. This can result in a lack of depth in understanding the nuances of their experiences with improvisation in practical activities. Open-ended questions can help, but they may not be sufficient to capture complex sentiments or detailed
- Participants may provide socially desirable answers rather than their true opinions or experiences. This bias can skew the data, particularly in educational settings where teachers

and students may feel pressured to conform to perceived expectations regarding teaching practices and student engagement.

- Respondents may misinterpret questions due to unclear wording or ambiguity. This can lead to inconsistent responses that do not accurately reflect their views or experiences. Ensuring clarity in questionnaire design is crucial, but it can be challenging to achieve.
- Depending on the method of distribution, questionnaires may suffer from low response rates, particularly if participants are busy or uninterested. This can lead to a non-representative sample, limiting the generalizability of the findings and potentially introducing bias.
- Once a questionnaire is distributed, it is difficult to make changes or adapt questions based on initial responses. This rigidity can be a disadvantage if researchers discover that certain questions are not yielding useful data or if new relevant topics emerge during the research process.
- Some questionnaires may over-simplify complex issues. Questionnaires may oversimplify complex educational phenomena, such as the impact of improvisation on learning outcomes. Reducing multifaceted issues to a series of closed-ended questions can lead to a loss of important contextual information.
- Dependence on Self-Reported Data. Questionnaires rely on self-reported data, which can be influenced by various factors, including memory recall and personal biases. This reliance can affect the accuracy of the information collected, particularly in assessing the effectiveness of teaching methods.

3.6.2 Interviews

Cresswell (2020) defines interview as a conversation with a purpose. Sunders et al (2019) propound that an interview is a conversation between two persons, with a specific purpose, where one person, the interviewer, asks questions and the other person, the interviewee, provides answers. This researcher used semi-structured interviews where the interviewer uses a set of predetermined questions and the participants answer in their own words. Semi- structured interviews encourage two-way communication and provides an opportunity to interviewers to learn answers to their questions and gain the reason behind the answer. The interviews were set in order to identify the

impact of the improvised experiments during the teaching and learning of Combined Science at Manyenyedzi secondary school.

3.6.2.1Advantages

Kvale (2012) propounds that interviews provide rich, detailed, and contextualized data that can be used to gain a deeper understanding of the research topic. Another writer Seidman, (2013) states that interviews allow researchers to explore complex and sensitive topics in a way that is not possible with other methods.

Interviews provide an opportunity for researchers to build rapport with participants and establish trust, which can lead to more honest and open responses (Weimer, 2013).

Interviews can be used to collect data from a wide range of participants, including those who may not be able to complete written surveys or participate in focus groups (Bryman, 2012).

3.6.2.2 Disadvantages:

Interviews can be time-consuming and labor-intensive, requiring a significant amount of time and resources to conduct and analyze (Bryman, 2012).

Interviews are subject to social desirability bias, where participants may provide answers that they think the researcher wants to hear rather than their true opinions (Nisbet & Watt, 2018).

Interviews can be influenced by the researcher's own biases and assumptions, which can impact the validity and reliability of the data (Karumen et al, 2017).

Interviews may not be suitable for large-scale or quantitative research studies, as they can be difficult to analyze and generalize to a larger population (Cresswell, 2014).

3.7 Data Collection Procedures.

Data collection procedures refer to "the systematic and structured methods used to gather data, which can include surveys, interviews, observations, experiments, and secondary data analysis" (Saunders et al., 2019, p. 123). According to Creswell (2020), data collection procedures involve "the specific techniques and strategies used to collect data, such as surveys, interviews, focus groups, observations, and document analysis". Data collection procedures refer to "the processes and methods used to gather, record, and store data, which can include both qualitative and quantitative methods" (Kumar, 2020, p. 156). Data collection procedures are a crucial component of research. They enable researchers to gather accurate and reliable data that can be used to answer research questions, test hypotheses, and inform decision-making (Saunders et al., 2019). They help to minimize errors and ensure that data is collected in a consistent and reliable manner (Kumar, 2020). This is particularly important in quantitative research, where small errors can have a significant impact on the results.

In addition to the above points mentioned, data collection procedures can help to enhance the validity of research findings by ensuring that data is collected in a way that is consistent with the research question and objectives (Creswell, 2020). In addition, data collection procedures can help to increase the generalizability of research findings by ensuring that data is collected from a representative sample of the population (Saunders et al., 2019). Furthermore, they can help to facilitate data analysis by ensuring that data is collected in a format that is easy to analyze (Kumar, 2020). Last but not least, they can help to support research ethics by ensuring that data is collected in a way that respects the rights and dignity of participants (Creswell, 2020).

During the data collection procedure, the researcher obtained an introductory letter from the Bindura University of Science Education from the faculty of Science Education. The introductory letter enabled the researcher to seek permission to carry out the study on the selected school. The researcher also sought permission from the school where the data was collected and the school head granted their permission. Participants were selected purposively and the researcher personally interviewed the selected participants during their spare. The researcher explained the purpose of the study to the participants and their role in it. Ethical issues were taken into consideration during the data collection procedure. Questionnaires were distributed to selected teachers and students through in-person visits, ensuring clear instructions on how to complete

them. These were then collected soon after completion by the respondents. The researcher also interviewed the teachers to collect more data. The researcher arranged visits to classrooms to observe practical activities.

3.8 Ethical considerations

Cohen et al (2011) suggested that ethical issues deal with the respect and the protection of participants during data collection. Marufu (2015) asserted that ethics refers to what is socially and morally prescribed as right and wrong by the society. Chiromo (2010) suggested that information that is collected from participants should be used for the purpose of research only and should not be publicized. The investigator ensured confidentiality by making sure that the information that was collected from participants was used in the study only. Chiromo (2010) posits that the researcher must also inform the participants the purpose of the study before involving them in the investigation. During the study the researcher informed the participants that their participation was voluntary and they can withdraw anytime if they no-longer want to be involved in the study.

In taking the research ethics into account, the researcher introduced himself using the student identity card. The researcher explained the purpose, condition of the research and requested their consent. The researcher also promised respondents that their responses were not going to be used against them nor were they going to be used to discredit them. The Researcher ensured that all participants, including students and teachers were fully aware about the nature of the study, its purpose, and any potential risks involved. To ensure that the research does not impose undue burdens on participants, the researchers assessed the likelihood of any negative outcomes for participants and weighed them against the potential benefits of the research findings.

3.9 Triangulation

According to Denzin and Lincoln (2018), triangulation is the combination of multiple data sources, methods, or investigators to increase the validity and reliability of research findings.Triangulation is "the use of multiple methods, data sources, or investigators to validate and increase the accuracy of research findings" (Creswell, 2020, p. 245). In short, the two definitions, triangulation means a research strategy that involves the use of multiple methods to increase the correctness the of research findings.

In this research topic, triangulation was used by collecting data quantitatively from students and teachers through interviews and questionnaires to assess the effectiveness of improvised experiments in teaching and learning combined science. In addition, triangulation was also used

by combining data from student surveys, teacher interviews, and questionnaires to assess the impact of improvised experiments on student learning outcomes.

3.10 Data presentation, interpretation and analysis

Babbie (2016) opines that descriptive statistic is a subject concerned with reducing and organizing data into a more analyzable mass and this method of presenting data was employed in this study. The researcher used tables to summarize quantitative findings and graphs to visually represent data trends. The researcher also accompanied quantitative data with narrative summaries that highlighted key findings from qualitative data. Percentages were also used to summarize responses from the case study. Up and above all, analysis or discussion of data presented, was done as per research question, and supported with relevant data.

3.11 **Summary**

The chapter was broken down into various sub-headings which included the research design, population, sample and sampling procedure, research instruments, data collection procedures, ethical consideration and data presentation, interpretation and analysis. The researcher explained the way that was used to collect data and the source of data. The researcher also discussed the instruments used to collect data, citing the advantages and disadvantages of each instrument, supported by schools of thought. The data obtained from the use of these instruments is going to be presented in form of bar graphs and tables. The next chapter is on data presentation, analysis, and interpretation.

CHAPTER 4

DATA PRESENTATION, INTERPRETATION AND ANALYSIS

4.0 Introduction

This chapter presents analysis and discussions of findings from the study on the impact of the improvised experiments in the teaching and learning of Combined Science in secondary schools in Hurungwe North and the country as a whole. The data was presented using thematic analysis in quantitative and qualitative research under the following themes: demographic characteristics of teachers and learners, benefits of improvised experiments, challenges faced when improvising and some suggested solutions to mitigate challenges.

4.1 DATA PRESENTATIONS, INTERPRETATION AND ANALYSIS USING QUESTIONNAIRES

Quantitative approach was used to collect data for the three questions. A survey was administered to 20 students and 5 teachers who participated in improvised practical activities.2 teachers were selected for in-depth interviews while the other 3 were given questionnaires to answer. 20 questionnaires were issued out to the students for answering and were monitored and collected at the end. According to the quantitative data, the majority of teachers suggested that providing teachers with training and support on improvising practical activities would improve the use of improvised practical activities in the teaching and learning of Combined Science education.

4.2 Demographic Information.

4.2.1 Respondents by Gender

Table 4.1 Gender of learners (N = 20)

Sex	**Number**	**%**
Boys	8	**40**
Girls	12	**60**
Total	20	

Among the 20 student respondents, 40% were male and 60% were female. This slight female majority reflects broader trends in educational participation in Zimbabwe, where female students

are increasingly engaging in science subjects. The higher percentage of female students may influence classroom dynamics and interactions during practical activities, as previous studies have indicated that gender can affect participation and engagement in science education In short, 8 of the learners were boys and the other 12 were girls.

4.2.2 Respondents by gender

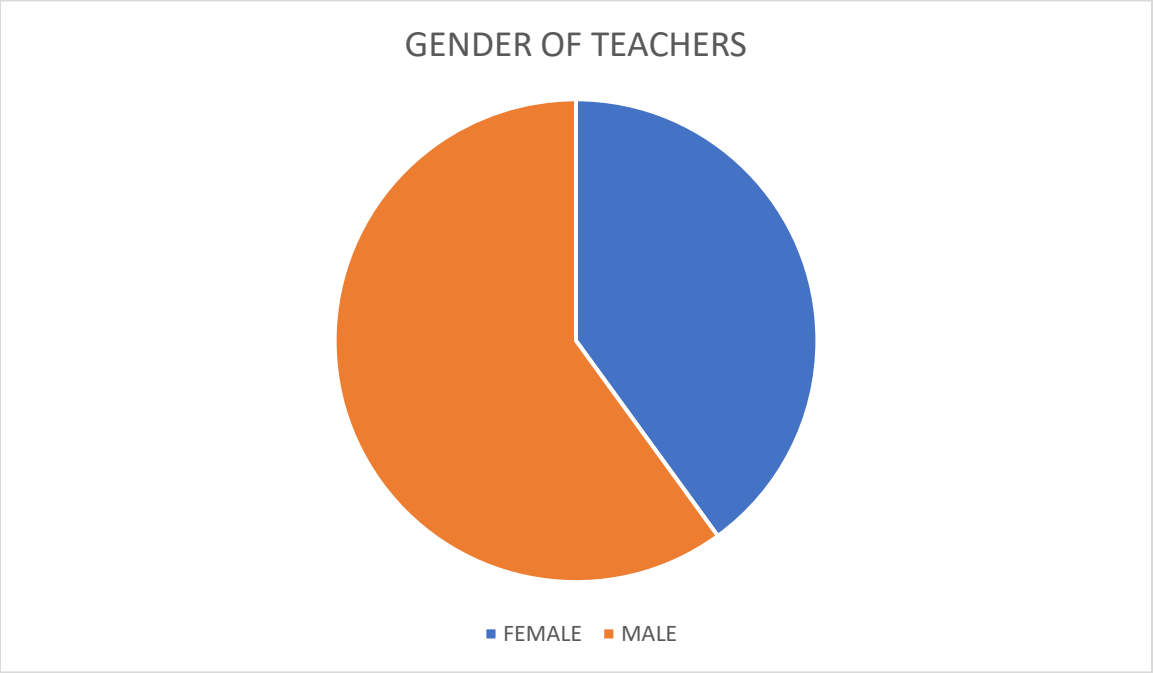


Fig 4.1 – Gender of teachers (N=5)

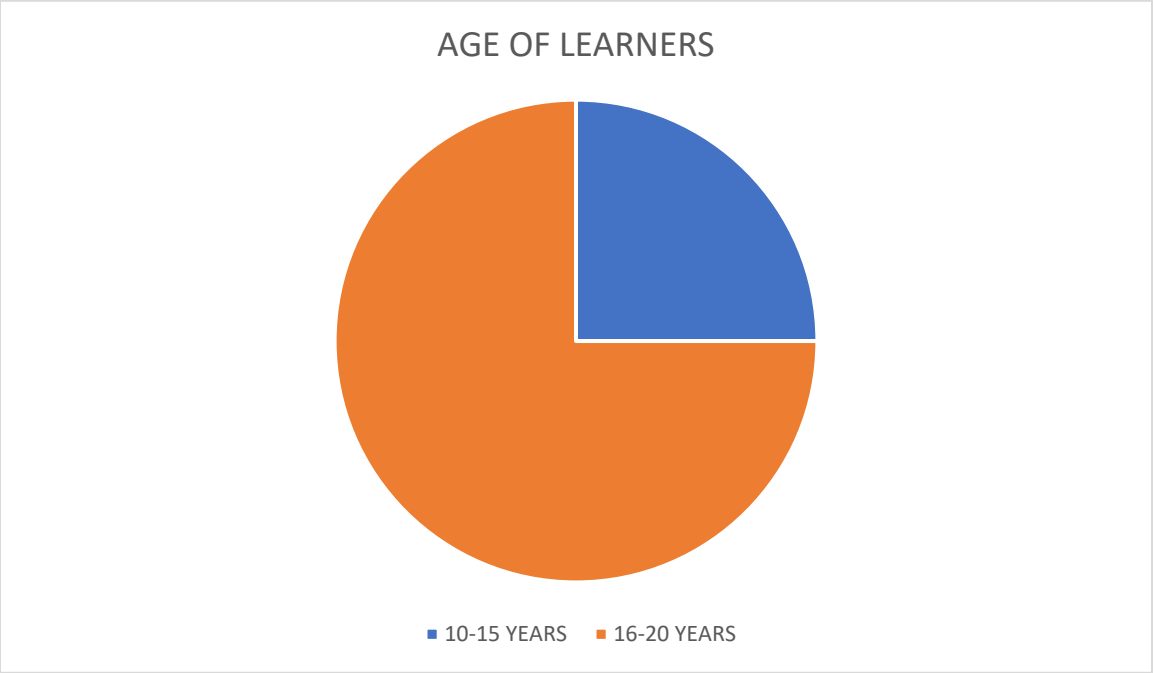
The pie chart above is an exact representation of the demography of teacher respondents in line with their gender. 3 of the teachers which is 60% of them are male contrasting with a fraction of 2 representing women which is 40% as shown on the pie chart. The researcher observed that, the school is staffed with both male and female teachers for Sciences subjects across grade levels henceforth the learners have room to consult either gender, wherever need be. However, from the teacher respondents, the observations made, also informed the researcher that not all teachers at the school are teachers for Sciences subjects.

4.2.3 Respondents by Age

Table 4.2 Age of learners (n = 20)

Age	Boys	Girls	Total	%
10– 15years	1	4	5	25
16 – 20 years	7	8	15	75
Above 20 years	-	-	-	-
Total	8	12	20	100

Fig 4.2



The majority of student respondents fell within the age range of 16-20 years (75%), followed by those aged 10-15 years (25%) as shown by the pie chart. This age distribution is typical for secondary school students in Zimbabwe, where students generally enter secondary education around the age of 12 and complete it by 18. The concentration of students in the 15-16 age range suggests that they are at a critical stage of cognitive and social development, which can significantly influence their engagement and learning in practical science activities.

4.2.4 Respondents by Age

Fig 4.3 Age of Teachers (n = 5)

Fig 4.3 below, indicates the age of the teachers who responded to the questionnaire. 2 of the respondents are within the range of 20 – 29 years, 2 within the age range of 30 – 39 years, the other 1 in the range of 40 – 49 years. Wherefore, it can be deduced that the responses are not biased towards a particular minority group but is balanced as the groups have respondents that took part in this research.

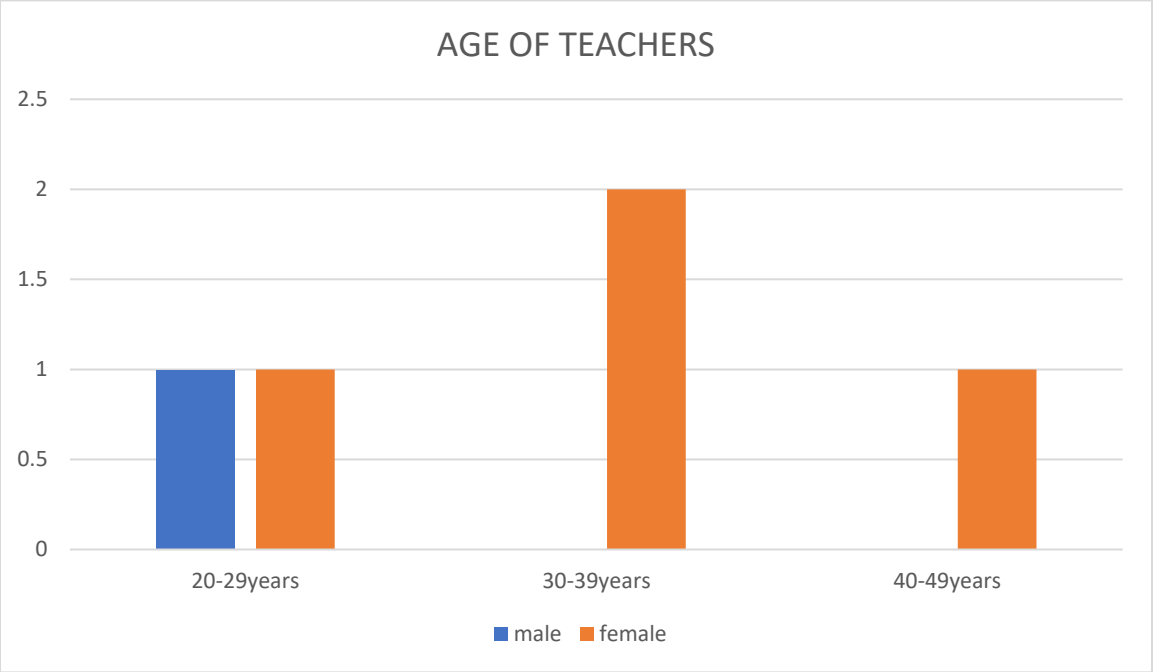


Fig 4.3 The age of the teachers

Table 4.3

Age	**Female**	**Male**	**Total**
20 – 29 years	1	1	2
30 – 39 years	-	2	2
40 – 49 years	1	-	1
50 and 60	-	-	-

Above 60	-	-	-
Total	2	3	5

4.2.5 Respondents by highest professional qualification

Table 4.4 Teachers highest professional qualification (n= 5)

Highest level of qualification	**Male**	**Female**
Diploma in Education	1	1
Bachelor's in education	1	-
Bachelor of Arts	-	1
Diploma in Accounting	1	-
Total	5	

Diploma in Education: 40% of the teachers hold a Diploma in Education. While this qualification provides foundational teaching skills, it may limit the depth of subject matter expertise, particularly in specialized areas of combined science. Bachelor of Education: 20% of the respondents possess a Bachelor's Degree in Education. Other Qualifications: 40% of the respondents hold other qualifications, such as various diplomas. While these qualifications may provide additional skills, they may not be as comprehensive as formal degrees in education or science.

4.2.6 Respondents by teaching experience

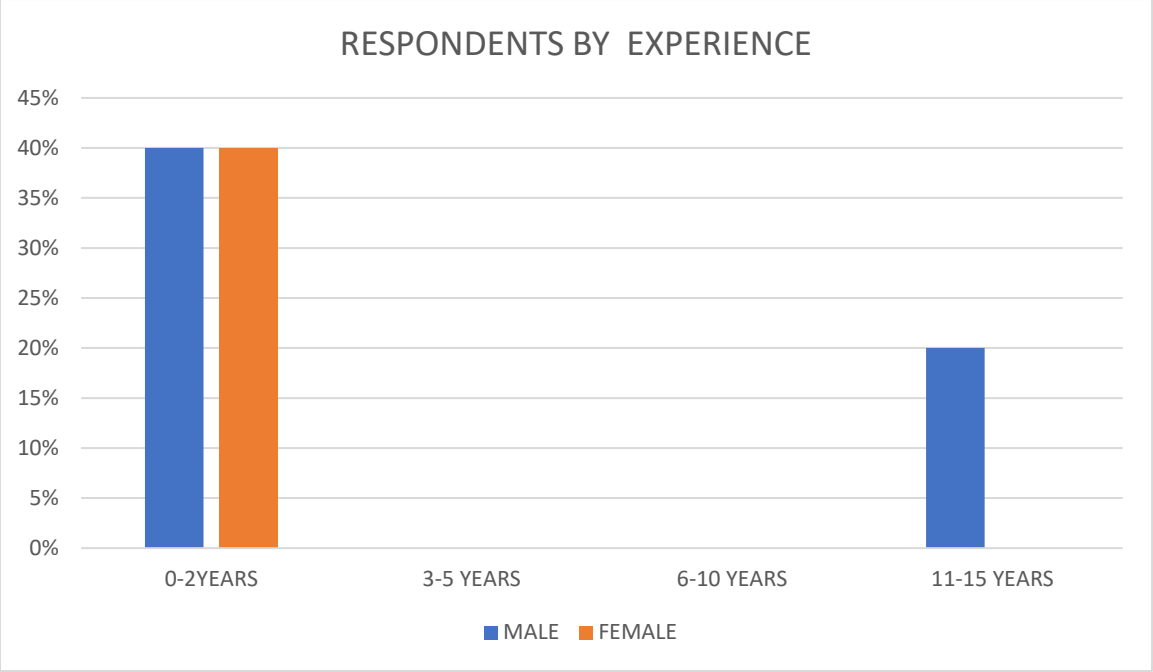


Fig 4.4 Teaching experience (n = 5)

Fig 4.4 is a presentation of the teaching experience of teacher respondents. Respondents were categorized based on their years of teaching experience, which ranged from less than 1 year to over 11 years. Most teachers, (80%) who took part in this research, had at least 1 or more years of teaching experience. Only (20%) of the total number of teachers had 11years of teaching experience in the service. This categorization helped in analyzing how experience impacts the implementation of practical activities in science teaching.

4.3 Data presentation, interpretation and analysis through open ended interviews

The responses from open ended interviews. were analyzed thematically, revealing several key themes:

4.3.1. What are the benefits of improvised experiments in the teaching and learning of Combined Science in secondary schools in Hurungwe North?

T1 and T1 who participated in the study proved that various schools in rural set ups improvise during teaching and learning of Combined Science. It was also noted that there are quite a number of benefits of improvised experiments. This is what some of the participants said;

"*Improvisational activities make science lessons more interesting. Using local materials helped me understand concepts better because I could see them in real life." (1)*

The above- mentioned point was supported by another participant who had this to say; "I am interested in doing things rather than listening to the teacher telling us things about Science." (L2)

It was also noted by one participant that some learners understand concepts better during improvised experiments. "*Students demonstrated a better grasp of scientific principles when they engaged in hands-on activities. When students conduct experiments, they remember the concepts longer than when they just listen to lectures." (T1)*

Both students and teachers highlighted the importance of being resourceful. One teacher had this to say; "*Improvisation encourages creativity, students learn to think critically about how to use what they have. It also helps learners in rural schools to understand concepts better." (T2)*

During the study it was discovered that learners enhance engagement and feel motivated during practical activities.

Improvisation in practical activities often leads to increased student engagement and motivation. When teachers utilize improvised materials, students are more likely to participate actively in their learning. According to Abonyi (2015), the introduction of improvised teaching aids can positively influence science teaching, making lessons more relatable and stimulating for students. One respondent puts out by saying out; I feel motivated when carrying out experiments during the lessons."

The researcher also observed that skills are developed when experiments are done. One participant highlighted by saying;

"Improvisation not only aids in understanding theoretical concepts but also equips students with essential practical skills they need in their real life sitations." (T3)

Engaging in hands-on activities allows students to develop laboratory skills and scientific reasoning. According to a study by Abonyi (2015), the use of improvised instructional materials has a favorable effect on students' achievement in basic science concepts, suggesting that practical engagement is vital for skill development. This is particularly important in secondary education, where students are expected to transition from basic understanding to more complex applications of scientific knowledge.

During the survey the participants agreed that improvisation addresses resource limitations.

In regions like Hurungwe District, where educational resources are often scarce, improvisation serves as a practical solution to enhance science education. Teachers who are resourceful in creating improvised materials can provide students with opportunities to engage in practical work that would otherwise be unavailable. This approach not only mitigates the challenges posed by limited resources but also encourages creativity and innovation among both teachers and students (Kolb, 2014).

"*In our schools we do not have resources, so we try to improvise to bridge the gap by improvising." (T4)*

According to the study that was carried out, improvisation has long-term academic benefits.

The long-term benefits of engaging students in improvised practical activities extend beyond immediate understanding. Studies have shown that students who participate in practical science education are more likely to pursue further studies in science-related fields, thereby contributing to a more scientifically literate society (Hofstein & Lunetta, 2014). This is particularly relevant in Hurungwe District, where fostering interest in science can lead to greater educational and career opportunities for students.

4.3.2 What are the challenges faced when using improvised experiments in the teaching and learning of Combined Science in secondary schools?

Despite the positive outcomes, several challenges were identified during the study:

Some teachers expressed difficulty in sourcing materials for practical activities, which limited the scope of improvisation. T3 respondent had this to say;

"*Here in rural arears, we do not have enough resources to carry out these experiments. Our school does not have enough funds to buy materials as there is very low fees payment."*

The same issue was discovered when the researcher toured around the school. The researcher toured the school, he realized that the school has no laboratory except subject book lockers with a handful of textbooks. This observation resonates with Makopa (2011) who argued that schools with limited resources have higher chances of recording poor pass rates or rather high failure rates in many of the subjects. This was also confirmed by the research participants, T1, T2, L1 and L2 who concurred that, and there are no basic instruments and equipment in most rural schools.

It was also noted that rural schools in Hurungwe lack adequate resources. Many schools struggle with insufficient materials to conduct practical activities, which limits the scope of improvisation. Teachers often have to rely on everyday items, which may not always effectively demonstrate scientific principles.

In support of the above one of the participants noted that:

"*The scarcity of resources can lead to frustration and hinder the learning process, as students may not fully grasp the concepts being taught due to inadequate experimental setups."*

Most respondents agreed with the researcher that high teacher-pupil ratios occasionally occurring due to the exodus of teachers looking for better schools can hinder the effectiveness of teaching and learning. In many schools in Zimbabwe, the TPR is often unfavorable especially in rural remote schools where teachers are always moving from one school to the next leading to overcrowded classrooms where teachers struggle to provide adequate support to each student. This result in learners always having new teachers, with some having little or no experience in teaching. Respondent T5 had this to say:

"*I have stayed here for more than six years but all these other teachers you see are new to this school. At times with too many students to manage, we may resort to more traditional, lecture-based teaching methods, which are less effective for practical subjects that benefit from active learning." (Teacher1).*

The existing curriculum may not adequately support improvisation in practical activities. One respondent stated that;

"In some cases, the curriculum is rigid and does not allow for flexibility in teaching methods."

Teachers may feel pressured to adhere strictly to prescribed content, limiting their ability to adapt lessons based on available resources or student needs. This rigidity can stifle creativity and innovation in teaching practices

Another significant challenge that the participants brought to attention is the lack of training and preparedness among teachers. It was discovered during the interviews that many educators may not have received formal training in improvisational techniques or may lack confidence in their ability to create effective learning experiences using improvised materials. This gap in skills can result in poorly executed practical activities that fail to engage students or convey the intended scientific concepts effectively. One respondent had this to say;

"*Most of us here as teachers do not have the required skills to carry out these experiments."*

It was discussed during the study.

While improvisation can enhance engagement, it can also lead to mixed student attitudes. Some students may be enthusiastic about hands-on learning, while others may be skeptical or disengaged, particularly if they perceive the improvised activities as inferior to traditional methods. This disparity in student attitudes can affect overall class dynamics and learning outcomes.

Assessing student understanding in the context of improvised practical activities poses its own set of challenges. L5 aid; "*Teachers may find it difficult to develop appropriate assessment tools that accurately measure student learning and comprehension of scientific concepts when using improvised materials."*

This can lead to inconsistencies in evaluating student performance and hinder the ability to provide constructive feedback.

Finally, time limitations can significantly impact the effectiveness of improvisation in practical activities. To support the above-mentioned point, T1 said, "*We have a lot of work to do. As a result, it is difficult to carry out some experiments as they need a lot of time.*"

T2 had this to say; "*you cannot do everything… So, you can only do the demonstration and sometimes you can only give learners some worksheet on the experiment to practice and then they will have the answer…"*

Teachers often face tight schedules that leave little room for experimentation or exploration. The time required to prepare for and conduct improvised activities can be substantial, and when combined with the demands of covering the curriculum, it can lead to a rushed or superficial learning experience.

4.3.3 How can the use of improvised experiments in the teaching and learning of Combined Science in Zimbabwe and the world over in secondary schools be improved?

From the above contributions, it was noted that there were various ways of mitigating the challenges encountered. The researcher and the participants discussed quite a number of points which they thought were some of the ways of mitigating challenges faced during the teaching and learning of Combined Science in secondary schools.

It was noted during the study that teachers need enough training to gain more skills.

T3 indicated that

"*There must be in-service training in schools where teachers are trained under the Ministry of Tertiary Education in universities gaining skills and knowledge on the improvisation of experiments."*

The researcher also discovered that the tasks at hand were too many for teachers to run in schools because the workload increased therefore making teachers lose track of time. Time management was an issue that needed attention because some experiments take too much time

Favorable teacher pupil ratio can solve challenges in teaching and learning:

T4 explained*; "A favorable teacher-pupil ratio allows teachers to engage more effectively with each student. This is particularly important in combined science, where practical activities require guidance and supervision."*

One of the most effective strategies is to mobilize resources from the community and local businesses. Schools can engage with parents, local organizations, and businesses to gather

materials that can be used for practical activities. This not only provides necessary resources but also fosters a sense of community involvement in education. In line with the above analysis, T5 highlighted that:

"*Local farmers can donate materials for biology experiments, while businesses could provide items for physics demonstrations*."

Investing in professional development is crucial for equipping teachers with the skills needed to improvise effectively. Workshops and training sessions focused on improvisational techniques can enhance teachers' confidence and creativity in using available materials. Continuous professional development can also include peer mentoring, where experienced teachers share their improvisation strategies with less experienced colleagues, fostering a collaborative learning environment.

4.3.3.1 Collaborative Learning Approaches were brought to attention as a solution.

Implementing collaborative learning strategies can significantly enhance the effectiveness of improvised practical activities. Group work encourages students to share ideas, resources, and responsibilities, leading to a richer learning experience. Teachers can design activities that require teamwork, such as conducting experiments in small groups, which not only fosters collaboration but also allows students to learn from one another.

4.3.2 Use of Technology and Multimedia Resources. In trying to solve some challenges, T1 had this to say;

"*We need to use technology more often when experimenting in order to solve the problem of shortage of resources."*

Incorporating technology and multimedia resources can enhance the improvisation of practical activities. Teachers can utilize videos, simulations, and online resources to supplement hands-on activities. For instance, virtual labs can provide students with experiences that may not be feasible in their physical environment. Additionally, using smartphones or tablets to document experiments can help students analyze and reflect on their learning.

4.4 Summary

This chapter was inclined on data presentation, analysis, and interpretation. The chapter looked at the demographic information which is about ages, experience and qualifications of respondents. The chapter also discussed the benefits as well as the challenges during the teaching and learning of combined science. Ways of improving the teaching and learning using improvised experiments were also discussed. Data was presented in form of charts and tables before an analysis of the data ensued. These are benefits of improvised, challenges faced when improvising and strategies to try and mitigate these challenges. All data presented in this research insinuates that, shortage of resources and laboratory in secondary schools is an eyesore for many stakeholders. The next chapter shall articulate the summary of the research, major research findings and related recommendations.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter summarized the previous chapters on introduction, literature review, research methodology and data presentation, interpretation and analysis. It also focuses on the summary, conclusions and recommendations on the impact of improvised experiments in the teaching and learning of Combined Science in secondary schools in Hrungwe North district. The thrust of this chapter is a summary of the main findings facilitating the drawing up of the entire research project.

5.1 Summary

The aim of the study was to assess the impact of improvised experiments in the teaching and learning of Combined Science in secondary schools. Chapter 1 set out the introduction of the study through a description of background, statement of the problem, research objectives, research questions, significance of the study, limitations, delimitations, assumptions and conclude by giving definitions of important terms in the study. The aim of this chapter was to give readers background understanding of the research problem. This chapter gave an overview of the study. The impact of using improvised experiments in the teaching of Combined Science was explained. Emphasis was placed on improvised experiments that result in learners gaining confidence, scientific attitude and develop practical skills through hands on approaches.

The role of chapter 2 was to examine previous theoretical and practical studies concerning practical work as effective instructional method. The chapter identify gaps between existing literature and the current research topic and establish the means through which knowledge gaps can be filled. Also included in this chapter is the theoretical framework of the study. The study is based on the theory of experiential learning. Experiential learning theory emphasizes the process of learning through experience. It is about Kolb's model who outlines a cyclical learning process that includes four stages which are concrete experience, reflective observation, abstract conceptualization, and active experimentation. The reasons behind the challenges faced when improvising include: learners and teachers' attitude, poor laboratory conditions, resource limitations. time frame, teacher pupil ratio and pedagogical content of the teacher.

The principal role of chapter 3 was to give a detailed description of research design employed to provide the overall strategy for answering the research questions for this project. Furthermore, it highlighted tools and techniques used in primary data collection. The study was guided by both qualitative and quantitative paradigm. Qualitative data were obtained through a questionnaire as research instrument, while quantitative data was obtained through interviews and observations as research instruments. The population of this study was taken from all form 3 learners taking Combined Science at Manyenyedzi secondary school. Stratified simple random sampling was used to select a sample of 20 form 3 Combined Science learners from the population. Purposive sampling was used to select 5 Combined Science teachers to answer the questionnaire.

The role of chapter 4 was to present the results from the study. The responses on the questionnaire were used to explain the qualitative results. The chapter present a detailed analysis of the research findings through the use of statistical descriptions involving the construction of tables, graphs and pie charts. The findings obtained were linked to the research questions, objectives of the study and used to draw up the conclusion.

Chapter 5's main emphasis is to summarize the previous chapters on introduction, literature review, research methodology, data presentation, interpretation and analysis. It also focuses on the summary, conclusion and recommendations on the impact of teaching Combined Science through improvised experiments. The thrust of this chapter was a summary of the main findings facilitating the drawing up of a conclusion of the entire project. The major findings of this research are that, improvised experiments have been effective in the teaching of Combined Science at Manyenyedzi secondary school.

5.2 Conclusions

The research indicated that there were quite a number of benefits of teaching through improvised experiments in secondary schools. Some of the benefits of improvised experiments included; enhanced engagement and motivation, improved conceptual understanding, development of practical skills, addressing resource limitations, long-term academic benefits, stimulates creativity, and critical thinking, encourages active learning and problem solving as well as allow collaborative learning. The results of this study clearly showed that students having a more positive attitude towards their lesson were found to be better achievers.

The research also found out that there were challenges that teachers faced during the teaching and learning of Combined Science using improvised experiments. The challenges included existence of large classes and limited of materials and equipment, lack of resources, insufficient training and skills, time constraints, assessment and evaluation difficulties.

It was also noted during the survey that there are quite a number of things that can be done to mitigate challenges faced during the teaching and learning of Combined Science. These include; training and professional development for teachers, curriculum integration, resource accessibility, collaborative learning, community involvement and the use of technology in schools.

5.2.1 What are benefits of improvising practical activities on students' understanding of key science concepts?

The findings of this study indicated that there are quite a number of benefits of improvising practical activities in secondary schools. According to the results extracted from the survey carried out in this research, practical work has been able to promote learners' positive attitude and enhance motivation for effective learning in science as described by Okam and Zakari (2017). The majority of teachers indicated that practical was necessary in the teaching of Combined Science because practical made it an interesting subject. According to Timothy (2010), using practical method in the teaching of Combined Science fosters opportunity for the acquisition of meaningful learning of the concept to the point of achieving transfer and application of knowledge.

In addition to the above point, it was also noted during the study that practical activities often led to increased student engagement and motivation. According to Abonyi (2015), the introduction of improvised teaching aids can positively influence science teaching, making lessons more relatable and stimulating for students. This engagement is crucial, as it fosters a deeper interest in science subjects, which can lead to improved academic performance.

The study proved that improvisation in secondary schools result in long-term academic benefits.The long-term benefits of engaging students in improvised practical activities extend beyond immediate understanding. Studies have shown that students who participate in practical science education are more likely to pursue further studies in science-related fields, thereby contributing to a more scientifically literate society (Hofstein & Lunetta, 2014).

Also indicated by the Combined science teachers was that improvised experiments promote learners' understanding of the concepts much better, and also stimulated students' interest in science. Research indicates that experiments, especially those that are improvised, help students grasp complex scientific concepts more effectively. For instance, a study highlighted that students who engage in hands-on learning experiences demonstrate better retention and understanding of scientific principles compared to those who rely solely on theoretical instruction (Abrahams & Millar, 2010). This is quite relevant at Manyenyedzi secondary school, where access to traditional laboratory resources was limited. Furthermore, by improvising, teachers can create meaningful learning experiences that allow students to explore and apply scientific concepts in a practical context.

This is consistence with Chikwature and Oyedele (2018) who reiterate that the use of experiments encourages students to follow procedures carefully and promote students to perform experiments, record observation and summarise data and draw conclusion. Practical approach usually implies learning by doing. Practicals developed learners' skills on handling and organizing apparatus and materials and in following given instructions. This is supported by Usman (2020) who postulates that improvisation not only aids in understanding theoretical concepts but also equips students with essential practical skills. In addition, when students engage in hands-on activities, allows they develop laboratory skills and scientific reasoning. According to a study by Abonyi (2015), the use of improvised instructional materials has a favorable effect on students' achievement in basic science concepts, suggesting that practical engagement is vital for skill development. This is crucial in secondary education, where students are expected to transition from basic understanding to more complex applications of scientific knowledge. In addition to the above it is essential for learners to develop these skills as they would be able to use them in real life situations.

Therefore, practical work can motivate learners by stimulating interest and enjoyment, used to teach laboratory skills, enhance the learning of scientific knowledge, give insights in to the scientific method and develop expertise in using it and, develop scientific attitudes such as open mindedness and objectivity (Olowe, 2016).

Biology teachers also indicated that practical allowed learners to learn better when they saw and touched objects, they do not forget what they have seen and this reinforces their content grasp. This is consistence with Jacobs et al (2012) research which has shown that retention and recalling

of what was learned is linked to experimental experience. He emphasised that learners will remember 90% of what was said and done. Practical yield better results in Biology and prepared learners to answer questions in Paper 3 during ZIMSEC examination. This is consistence with Mizzi (2013) who holds the view that the use of experiments creates confidence in one's own abilities and is very effective in science teaching because it leaves learners to find out knowledge on their own and in their own ways but under the teacher's guidance.

Teachers were also asked whether lack of a science laboratory would prevent them from doing practical work in Combined Science. Most of the teachers indicated that the unavailability of a laboratory could not prevent them from carrying out experiments in science, while the minority of the teachers said that if there was no laboratory at school then they would not be able to carry out practical work in science and thus were not carrying out the practical. The teachers, who indicated that if the school did not have a science laboratory, then they would not carry out practical work with their learners, explained that "classrooms were not conducive for conducting practical, as some practical were dangerous to be carried out in the classrooms".

The majority of teachers who indicated that lack of a laboratory would not prevent them from carrying out practical in science by saying that if there was no laboratory at school, then one should improvise to carry out the experiments. Whether the school has a laboratory or not, learners will still write Paper 3 examinations at the end of the year. Accordingly, teachers need to expose learners to practical work if they are to do better in Paper 3. This implies that learners must be exposed to practical work and demonstrations. If learners are not exposed to practical work, due to the lack of a laboratory for example, they might not be able to answer questions on Paper 3 and this in return might affect their final performance in Combined Science.

To add ice on the cake, teachers who are resourceful in creating improvised materials can provide students with opportunities to engage in practical work that would otherwise be unavailable. This approach not only mitigates the challenges posed by limited resources but also encourages creativity and innovation among both teachers and students (Olowe, 2016).

5.2.2 What challenges do teachers face when improvising practical activities in Combined Science education in Hurungwe North District secondary schools?

A number of challenges faced by teachers when improvising practical activities were noted during the study. These include problem of large classes, learners' and teachers' attitude, time constraints, insufficient training skills, lack of resources and materials and assessment learning difficulties.

In the study, it was discovered that teachers are employed and soon transfer to other schools looking for better conditions. This result in the schools always having new teachers and at times with less experience to carry out science experiments. As a result of this, most teachers have to teach more than the required number of learners. This can result in variability within and between practical classes, in any cohort which has any implication for equity and well as for learning outcomes generally. Jeanne (2010) articulates that smaller classes benefit all pupils because of individual attention from the teacher.

Weimer (2013) stress that student achievement increases significantly in classes of fewer learners. Smaller classes, completed by diverse teaching methods create better student performance, more positive attitudes and fewer discipline problems. Pupils in large classes end up disengaging because of too much instruction from the teacher to the whole class instead of individual attention. According to Weimer (2013) student –teacher ratio is the number of students who attend school divided by the number of teachers. As an example, a student- teacher ratio of 20:1 indicates 20 students for 1 teacher.

Teachers are demanded to play roles such as facilitator, enabler not only as lecturer and transmitter of knowledge. These opportunities and roles cannot be achieved when teachers are faced with large classes and heavy workloads. Rose (2010) states that the larger the number of students in a class, the greater the amount of time devoted to classroom management rather than instruction. A teacher with many students in the class cannot help the learners individually.

A higher number of students in classroom tends to affect student-instructor interactions and can also prevent peer exchanges during experiments in the classroom. Usman, (2020) opines that learners have different cognitive levels of understanding concepts. According to Desai (2012) teaching is one with learning outcomes, that effect changes in knowledge, abilities, skills, attitudes and mindset. Small class size is a very important aspect because it improves learners' performance

as educators will now be able to assist students with learning difficulties individually (Usman, 2020). Therefore student-teacher ratio has to be considered always because they are a way to measure teacher's workloads and resources as well as the individual attention a student receives from the teacher because it involves some skills subjects

The researcher and the respondents also find out that some learners and teachers' negative attitudes pose a threat in carrying the teaching and learning of Combined Science in secondary schools. According to Jones (2020), teachers and learner attitude have a great implication on learners' performance in the teaching of combined science through experiments. Teachers' approach in the teaching of science through practical work has effects on learners' attitude towards learning and understanding concepts. A situation where the teacher monopolises the teaching and learning process of combined science with less participation of learners could result in apparent lack of interest in the learning area hence poor performance.

Another challenge discussed was that teachers often faced time constraints that limit their ability to plan and implement improvised practical activities. The curriculum demands can be overwhelming, leaving little room for teachers to experiment with new teaching methods or to gather materials for improvisation. This challenge was compounded by the pressure to cover the syllabus within a limited timeframe, which led to a focus on rote learning rather than experiential learning (Hofstein & Lunetta, 2014). This would negatively affect the improvisation process as teachers would opt to cover the written work at the expense of fruitful experiments.

Smith and Smith (2018) reviewed that, they are some very elegant experiments and procedures that are often slow and require precision to gain meaningful results for example gas exchange for classic elodea experiment. Significantly if students are unclear about the principles before the practical and take insufficient care in collecting the data, they may gather data that is inconsistent with the theoretical expectation, rather than clarifying concepts this will merely reinforce misconception.

Nzeyimana (2014) postulated that for a Combined Science teacher to carry out effective experiments in the Laboratory, planning must be done in time and carefully. Furthermore, the teacher must test his or her apparatus before the actual lesson to avoid embarrassment and time wasting.

Ndirangu et, al (2013) propounds that pre-laboratory session is very important because it reduces errors which the teacher may have committed in the actual laboratory session. In addition, the sitting arrangements of students are put into consideration as well as the time to spend in carrying out the investigation.

A study highlighted that teachers need adequate training to effectively improvise instructional materials and activities (Boakye & Ampiah, 2017). Without the proper training, teachers may felt unprepared to create engaging and effective experiments. This resulted in reliance on traditional teaching methods that do not foster active learning. Olowe (2016) postulate that designing authentic tasks and experiments requires careful planning and alignment with the learning goals and standards. This can sometimes be an uphill task for teachers who do not have enough training to do so. Fitzgerald (2017) argues that teachers with good professional competence and interpersonal skills are more effective in their teaching.

Fitzgerald et al (2017) points out that the two main methods are teacher centred and child centred approach. In the teacher centred approach, the teacher concentrates on fully giving information to the learner. It is assumed that the teacher knows the best and hence directs all learning. The teaching dominates over learning and pupils are assumed as empty vessels into which information is to be poured. Udosen et al, (2013) expressed that new methods and techniques are being employed in the teaching of science. It is therefore desirable that Combined Science teachers are trained and well versed in knowledge of preserving specimens and animals, techniques of evaluation and lesson unit planning. Hence if the pedagogical content knowledge background of the teacher is poor, other instructional methods may be used in place of experimental approach such as lecture method which does not expose students to greater learning opportunity by doing it.

Weinstein (2013) states that the teacher should have knowledge of the science and behavior of his students in order to handle them effectively in the teaching- learning process. He/she should try to impart knowledge and skills to then according of their mental abilities, capacities, interests and attitudes, as well as emotional and social make up.

In this way, if scientific knowledge is imparted to the deserving students, it will make the tasks of the teacher and the taught easier. Creswell (2014), reiterates that it is also essential for a science teacher to be trained in the latest techniques, strategies and methodology of teaching science including the use of the all type of aid material and developed technology.

One of the primary challenges teachers faced was the scarcity of appropriate resources and materials needed for effective improvisation. Manyenyedzi secondary school as well as other schools are under-resourced, making it difficult for teachers to find suitable materials to create improvised teaching aids. Practical experiments are a crucial component in the teaching and learning of Combined science (Rudhundu,2014). Pupils must be engaged in practical work when they learn Combined science. This enables students to gain personal experience of science through hands - on activities and to enhance the skills and thinking process associated with practice of the subject. Rudhundu, (2014) goes on to say that laboratory work is an effective way to enhance students' motivation and understanding of the subject matter. However, students sometimes do not learn from a practical task the concepts the teacher want them to learn. This is due to lack of the necessary chemicals and apparatus. Abonyi, (2015) postulates that the lack of instructional resources is a persistent issue that hampers the teaching and learning of science. Teachers often struggle to provide hands-on activities that are essential for understanding complex scientific concepts. In a study conducted by Chikwature & Oyedele (2016), the availability of resources in most cases co-related in a positive way with pupil's performance.

The attitudes of students posed challenges during the implementation of improvised practical activities. Some students may be resistant to hands-on learning or may lack the foundational knowledge necessary to engage effectively in practical activities. This can hinder the overall effectiveness of improvisation as a teaching strategy. As noted by Abonyi (2015), students' attitudes towards science can significantly influence their engagement and learning outcomes. Abonyi (2015) state that some attitudes help students to function effectively in school while others interfere with school life therefore it is very crucial to promote positive attitudes in students.

The study also found out that improvising experiments in secondary schools complicated the assessment and evaluation process. Teachers found it challenging to develop appropriate assessment criteria for activities that were not standardized. This led to inconsistencies in evaluating student performance and understanding. Awan (2010), states that the effective assessment in practical science education requires clear criteria that align with the learning objectives, which can be difficult to establish when using improvised materials.

5.2.3 How can the use of improvised practical activities in the teaching and learning of Combined Science in Hurungwe North District secondary schools be improved?

Various ways can be done to improve the effectiveness of experiments in the teaching of Combined science at Manyenyedzi secondary school. These include the training of staff to gain skills, have favourable teacher pupil ratio, resource mobilization and community involvement, collaborative learning approaches, provision of standard laboratory and adequate laboratory equipment, employment of enough teachers and using technology.

There was need for teachers to make sure that materials were available and improvise where possible.

It was noted during the study that teachers need enough training to gain more skills.

The researcher also discovered that the tasks at hand were too many for teachers to run in schools because the workload increased therefore making teachers lose track of time. Time management was an issue that needed attention because some experiments take too much time

Favorable teacher pupil ratio can solve challenges in teaching and learning:

Resource Mobilization and Community Involvement. One of the most effective strategies is to mobilize resources from the community and local businesses. Schools can engage with parents, local organizations, and businesses to gather materials that can be used for practical activities. This not only provides necessary resources but also fosters a sense of community involvement in education. In line with the above analysis, one of the participants highlighted that:

Professional Development and Training for Teachers was highlighted as another point that was crucial in solving challenges faced in schools during improvisation. Investing in professional development was crucial for equipping teachers with the skills needed to improvise effectively. Workshops and training sessions focused on improvisational techniques can enhance teachers' confidence and creativity in using available materials. Continuous professional development can also include peer mentoring, where experienced teachers share their improvisation strategies with less experienced colleagues, fostering a collaborative learning environment.

Collaborative Learning Approaches were brought to attention as a solution to challenges faced. Implementing collaborative learning strategies can significantly enhance the effectiveness of

improvised practical activities. As cited by Okam (2017), group work encourages students to share ideas, resources, and responsibilities, leading to a richer learning experience. Teachers can design activities that require teamwork, such as conducting experiments in small groups, which not only fosters collaboration but also allows students to learn from one another.

Use of Technology and Multimedia Resources. In trying to solve some challenges, it was agreed that incorporating technology and multimedia resources can enhance the improvisation of practical activities. In addition, teachers can utilize videos, simulations, and online resources to supplement hands-on activities. For instance, virtual labs can provide students with experiences that may not be feasible in their physical environment. Additionally, using smartphones or tablets to document experiments can help students analyze and reflect on their learning.

There was need for learners to be allowed access to improvised equipments so as to familiarise with them. Teachers need to assemble in advance all the necessary materials and equipment to be used for practicals and budget their time well. Preparation of materials in advance saves time and allow experiments to be successful.

Another point that was brought out is that the Ministry of Education together with the Public Service should employ enough teachers to cater for increased population of learners and deal with the problem of large classes as well as poor infrastructure. In addition, teachers should improve their teaching methodology to sustain the interest of learners. This is consistence with Grayson (2017), who opines that no science can be properly taught without experiments and these experiments should be part of science teaching because they are performed to find relations among concepts and to verify hypothesis. More training and workshops for teachers to be held which emphasize on the use of practical work methods and how they can be improved to enhance learners' performance. This is in harmony with Okam (2017) that is important to consider whether learning is more effective if learners are to do experiments themselves or they watch the teacher demonstrating the experiments and simply describing the experiments to the learners and tell them the results.

The other point was that school administrations should motivate teachers who are creative and innovative. This can lead to better ways of improvisation.

5.3. Recommendations

Therefore, the recommendations of this study are as follows:

- There is need for staff development programs so as to impart knowledge in teachers and encourage them to make use of improvised experiments during the teaching and learning of Combined Science.
- Teachers who carry out improvisation should be rewarded and motivated adequately.
- School administration and the community to take urgent attention to teachers' houses as well as classes.
- Workshop and seminars should be organized for serving Science teachers on improvisation and utilization of essential material resources in the teaching and learning of Combined Science.
- Non-governmental organization should take it as a responsibility in funding the local production of material resources used in the teaching and learning of Science and mathematics
- There is need for resource mobilization and community involvement.
- Teachers should try as much as possible to use technology and multimedia resources.
- Teachers should plan their lessons in a more practical way to enhance learners' attitude as well as achievement.
- There is need for training and workshops for teachers which emphasize on the use of improvised experiments and how they can be improved to enhance student's performance.
- The Ministry of Primary and Secondary Education should articulate a clear policy on inclusion and provide adequate financial support to all the schools to support learners.
- Teachers should be innovative and think outside the box in advance to gather all the necessary materials from the local environment and equipment to be used in practical activities.
- The training of teachers at teachers' colleges should align with Education 5.0 to inculcate hands on skills in learners.

- More attention and consideration should be given to improvised experiments during teaching and learning especially in rural secondary schools where resources are scarce.
- There is an urgent need to re-think and re-focus current state of practical teaching in a way that enables effective teaching.
- Practical activities should be well planned, effectively conducted and made an integral part of the pedagogy.
- The school administration to partner with stakeholders and hold several awareness campaign programmes in the local community on the importance of experiments in secondary schools.
- The school administration, teachers, relevant government bodies, NGOs and the community should chip in and donate where possible to make sure that the practical work is conducted effectively.
- Rural schools should be provided with standard laboratory and adequate laboratory equipment.
- Teachers should vary their teaching methodology to sustain the interest of the students.
- The Public Service Commission should employ enough qualified combined teachers to cater for teacher pupil ratio.
- The administration of schools should supply their schools with all necessary equipment and chemicals needed to facilitate practical work in the teaching of Combined Science.

5.4. Recommendations for further study.

Recommendations for further studies are crucial in research as they provide a foundation for future investigations and help to advance knowledge in a particular field. Saunders et al., (2019) states that recommendations help researchers identify gaps in existing research and suggest areas for further investigation. Creswell, (2020) believes that recommendations from previous studies can inform the design of future research, including the development of research questions, objectives, and methodologies. The following are some recommendations for further study;

- An area of further study would be to assess how the political environment might be affecting the distribution of Science equipment and materials to rural schools.

- Further studies should be undertaken to explore the use information and communication technology (ICT) tools in the teaching and learning of Combined Science.
- Further studies should examine the impact of learner centred activity on the efficacy of practical work which can give room for learners to design their own experiments.
- There is need to conduct a countrywide study that will shed more light on why Combined Science teachers are reluctant to use improvised experiments at secondary school levels.

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APPENDICES

APPENDIX A: QUESTIONNAIRE GUIDE FOR A FORM THREE TEACHER

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF BIOLOGICAL SCIENCES

Dear Colleague

My name is Edwell Kani. I am currently studying my Degree Course at Bindura University of Science Education. My research has to do with the impact of improvised experiments in the teaching and learning of Combined Science in selected schools in Hurungwe North District in Mashonaland West Province.

All completed questionnaires will be treated confidential and anonymous. The questionnaire consists of a number of questions. You can answer it by writing some details and in the table you can indicate by putting a tick next to your choice. I want to thank you for your willingness to be of help in this regard.

Your cooperation is greatly appreciated.

SECTION A: PERSONAL DETAILS

1. NAME IN FULL_____
2. SEX_____
3. AGE_____
4. STATION_____
5. POSITION_____

6. PERIOD AT STATION_____

7. NUMBER OF YEARS IN SERVICE_____

8. PROFESSIONAL QUALIFICATION_____

9. SUBJECT SPECIALISATION_____

SECTION B: TEACHING AND LEARNING EXPERIENCE

1. How long have you been teaching combined science? _____

2. What methods do you currently use to teach combined science? (Select all that apply)

- Lecture-based

- Demonstration-based

- Experiment-based

- Project-based

- Other (please specify) _____

3. How often do you use improvised experiments in your teaching? ___times per week.

SECTION B: BENEFITS OF IMPROVISED EXPERIMENTS

Do you think the use of improvised experiments has the following benefits to both teachers and learners at your school or other schools around the country? (TICK ONE BOX FOR EACH BENEFIT)

	Strongly agree	**Agree**	**Disagree**	**Strongly Disagree**
Facilitate and make learning easier				
Skills are developed				

Improved Understanding concepts				
Addressing Resource Limitations				
Long-term Academic Benefits				
Enhanced Engagement and Motivation				
Improved teacher confidence				

1. Have you noticed any changes in your students' attitudes towards combined science since using improvised experiments? If yes state any one change_____

2. How do you think improvised experiments have impacted your own teaching practices? _____

SECTION C: CHALLENGES AND LIMITATIONS

Do you think teachers face the following challenges when using improvised experiments during the teaching and learning of Combined Science at your school or other schools around the country? (TICK ONE BOX FOR EACH CHALLENGE)

	Strongly agree	**Agree**	**Disagree**	**Strongly Disagree**
Large class sizes				
Lack of Resources				
Insufficient Training and Skills				
Time Constraints				

Large class sizes				
Student Readiness and Attitudes				
Assessment and Evaluation Difficulties				

What other challenges do you face when using improvised experiments in your teaching? (List down at least two)

- Other challenges _____

SECTION D: RECOMMENDATIONS, SOLUTIONS AND FUTURE DIRECTIONS

Do you think the following solutions help when using improvised experiments during the teaching and learning of Combined Science at your school or other schools around the country**? (TICK ONE BOX FOR EACH SOLUTION)**

	Strongly agree	**Agree**	**Disagree**	**Strongly Disagree**
Training and Professional Development for Teachers				
Curriculum Integration				
Resource Accessibility				
Collaborative Learning				
Assessment and Feedback				
Community Involvement				

Use of Technology				

1. What recommendations would you make for improving the use of improvised experiments in teaching combined science? State at least two_____

2. How do you think the use of improvised experiments can be sustained and scaled up in schools? Give one suggestion_____ _____

Thank you for taking your time to complete this questionnaire! Your responses will help inform our research on the impact of teaching and learning combined science using improvised experiments.

APPENDIX B: QUESTIONNAIRE GUIDE FOR A FORM THREE LEARNER

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF BIOLOGICAL SCIENCES

This questionnaire is used for educational purpose for the research project for Kani Edwell who is currently studying at Bindura University of Science Education. Your cooperation is greatly appreciated. Your personal and school details will not be disclosed.

1. NAME IN FULL_____

2. SEX_____

3. AGE_____

2. GRADE/ FORM_____

3. FAVOURITE SUBJECT IN SCHOOL _____

SECTION B: LEARNING EXPERIENCE

1. How often do you participate in science experiments in class? (TICK ONE ANSWER)

- Always_____
- Often_____
- Sometimes_____

- Rarely_____

- Never_____

2. What do you think is the most interesting part of science experiments?

_____

3. Have you ever conducted an experiment using improvised materials? (TICK ONE ANSWER)

YES_____NO_____

4. If yes, what materials did you use? _____

SECTION C: BENEFITS OF IMPROVISED EXPERIMENTS

1. How do you think improvised experiments help you learn science concepts? _____

2. Have you ever felt more engaged or motivated to learn science when using improvised experiments?

Yes_____ No_____

3. What do you think are the benefits of using improvised experiments in science learning? (Select all that apply)

- Improved understanding of science concepts_____

- Increased interest in science_____

- Enhanced critical thinking and problem-solving skills_____

- Other (please specify) _____

SECTION D: CHALLENGES AND LIMITATIONS

1. What challenges do you face when conducting science experiments in class? (Select all that apply)

- Limited resources

- Lack of equipment

- Difficulty in understanding instructions

- Other (please specify) _____

2.How do you think these challenges can be addressed?

1_____2_____

SECTION E: RECOMMENDATIONS AND FUTURE DIRECTIONS

1. What recommendations would you make to your teachers or school administrators to improve science learning using improvised experiments?

_____

2. How do you think improvised experiments can be used more effectively in science learning?

_____

Thank you very much for your time and participation in the questionnaire.

APPENDIX C: INTERVIEW FOR TEACHERS

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION AND TECHNOLOGY

DEPARTMENT OF BIOLOGICAL SCIENCES

Greetings colleagues my name is Edwell Kani, currently studying my Honours Bachelor of Science Education Degree at BUSE. My research has to do with the impact of improvised experiments in the teaching and learning of Combined Science in selected schools in Hurungwe North District in Mashonaland West Province.

For the purpose of this research, I will be asking you questions. I kindly request you to be open and be honest when answering these questions. You are also free to tell us what you like and dislike during the interview.

Moreover, all the information that I am going to collect during the course of this interview will be kept safe and secret. I would not use your name or any other identifying information and everything that you would say will only be entirely used for the research purpose.

Interview guide

Section 1: Background Information

1. Can you tell me a little bit about your teaching experience and background in science education?

2. How long have you been teaching combined science, and what level of students do you typically teach?

3. What methods do you currently use to teach combined science, and how often do you use improvised experiments?

Section 2: Teaching and Learning using Improvised Experiments.

1. Can you describe a recent lesson where you used an improvised experiment to teach a combined science concept?

2. How do you design and plan improvised experiments for your combined science lessons?

3. What resources do you typically use to support your improvised experiments (e.g., textbooks, online resources, equipment)?

4. How do you assess student learning and understanding during and after an improvised experiment?

Section 3: Impact on Student Learning and Engagement

1. How do you think improvised experiments have impacted your students' understanding of combined science concepts?

2. Have you noticed any changes in student engagement or motivation since using improvised experiments in your teaching?

3. Can you describe any notable successes you've experienced when using improvised experiments with your students?

Section 4: Challenges and Limitations

1. What challenges do you face when using improvised experiments in your teaching (e.g., resource constraints, time limitations)?

2. How do you overcome these challenges, and what support systems do you have in place?

3. Are there any limitations to using improvised experiments in teaching combined science, and if so, how do you address them?

[redacted]

Informed Consent

I hereby agree to participate in research regarding.....Kami E.....

In giving my consent I state that:

I understand the purpose of the study and what I will be asked to do.

I understand that I am participating freely and without being forced in any way to do so.

I understand that this is a research project whose purpose is not necessarily to benefit me personally.

I have been informed about the nature of the research and the nature of my involvement.

The researcher has answered any questions that I had about the study and I am happy with the responses.

I understand that I can withdraw from the interview at any time and that this decision will not in any way affect me negatively.

I understand that I may refuse to answer any questions I do not wish to answer.

I understand that personal information about me that is collected over the course of this interview will be stored securely and will only be used for purposes that I have agreed to.

I understand that information about me will only be told to the researcher's supervisor, and that my identity will not be referred to.

THE HEADMASTER
MANYENYEDZI SECONDARY SCHOOL
P. BAG 2020, KAROI
SIGNATURE.....

Manyenyedzi Secondary School

P BAG 2028

Karoi

4 December 2024

The School Head

Manyenyedzi Secondary School

Private Bag 2028

Karoi

Dear sir

RE: PERMISSION TO CARRY OUT A RESEARCH AT MANYENYEDZI SECONDARY SCHOOL

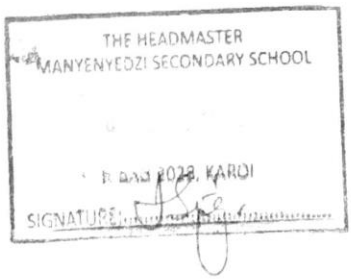
I, the head of the above-mentioned school grant Edwell Kani, a final year student studying with BUSE specializing with Honours Bachelor of Science Education in Biology, permission to carry out a research at Manyenyedzi Secondary School. The research is titled, an assessment into the impact of improvising experiments in the teaching and learning of Combined Science in selected schools in Hurungwe North District in Mashonaland West Province.

Yours Faithfully

Sigauke Leonard (HEAD)

EC 521214J

Cell 0777588560



Manyenyedzi SDA Primary School
Private Bag 2028
Karoi

03 December 2024

THE Provincial Education Director
Ministry of Primary and Secondary Education
Mashonaland West
P O Box 328
Chinhoyi

Dear sir/ Madam

RE: REQUEST FOR A PERMISSION TO CARRY OUT AN EDUCATIONAL RESEARCH

I wish to carry out a research in Hurungwe North District in your province. Below are my details;

Kani Edwell from Bindura University of Science Education. Registration number B225828A, Honours Bachelor degree in Biology student. The research is on the impact of improvising experiments in the teaching and learning of Combined Science in selected schools in Hurungwe North District in Mashonaland West Province. The targeted school is Manyenyedzi secondary. The research period is from September 2024- December 2024.

Yours Faithfully

Kani Edwell

EC number 0996060Y

Cell number 0772202728

THE HEADMASTER
MANYENYEDZI SDA PRIMARY SCHOOL
P. BAG 2028, KAROI
SIGNATURE:.....

SAMED

P Bag 1020
BINDURA
ZIMBABWE

Tel: 0271 - 7531 ext 1038
Fax: 263 - 71 - 7616

BINDURA UNIVERSITY OF SCIENCE EDUCATION

Date: .....

TO WHOM IT MAY CONCERN

NAME: KANI EDWELL REGISTRATION NUMBER: B225828A

PROGRAMME: HBScEdBz PART: 2.2

This memo serves to confirm that the above is a bona fide student at Bindura University of Science Education in the Faculty of Science Education.

The student has to undertake research and thereafter present a Research Project in partial fulfillment of the Honours Bachelor of Science programme. The research topic is:

An assessment into the impact of improvising experiments in the teaching and learning of Combined Science in Selected Schools in Hurungwe North in Mashonaland West Province

In this regard, the department kindly requests your permission to allow the student to carry out his/her research in your institutions.

Your co-operation and assistance is greatly appreciated.

Thank you

BINDURA UNIVERSITY OF SCIENCE EDUCATION
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
OCT 2024
P. BAG 1020
BINDURA

Ndemo (Dr.)
CHAIRPERSON - SAMED

THE HEADMASTER
MANYENYEDZI SDA PRIMARY SCHOOL
P. BAG 2028, KAROI
SIGNATURE: ..... Head