

BINDURA UNIVERSITY OF SCIENCE EDUCATION

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DEPARTMENT OF SCIENCE EDUCATION

An investigation on challenges faced in teaching practical Physics in a rural secondary school.

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APPROVAL FORM

The undersigned certify that they have read and recommended to Bindura University of Science Education for acceptance of a project entitled “An investigation on challenges faced in teaching practical Physics in a rural secondary school,” submitted by Marvellous Musuka in partial fulfilment of the requirements of Bachelor of Science Education Honours Degree in Physics (HBScEd Physics.)

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DEDICATION

This study is dedicated to my mother and siblings.

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I would like to take this moment to say my heartfelt thanks to my supervisor, Dr. Mutambara, who had invaluable guidance, encouragement and support during the course of this study. His experience and positive criticism contributed significantly to the development of this work.

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ABSTRACT

This study examined the challenges encountered in teaching of practical physics in rural secondary schools as the case of the Pafiwa, Sherukuru, Zambe and Bethania Secondary Schools which make up the Mutasa Central Cluster. This study was inspired by the longstanding disparity between the curriculum commitment to inquiry-based, practical experimentation and the actual conditions of constrained resources and theoretical teaching in rural areas. This study was informed by three objectives which were to study what happens in the teaching of practical physics, to evaluate the difficulties that are involved in teaching it and what can be done to enhance its teaching. Qualitative case study design was used, as the Constructivist Learning Theory developed by Bruner considers learning as a dynamic process of building new knowledge on the basis of previous knowledge. Data were gathered by interviewing physics teachers and school administrators and focusing group discussions with learners. The data underwent thematic analysis to reveal patterns, themes and relationships generated by the data. Results showed that teaching methods in applied physics are mostly theoretical and teacher-dominated and lessons are usually restricted to demonstrations, not practical experimentation by students. Teachers mentioned lack of laboratory equipment, infrastructural inadequacy, unstable electricity and huge classes as significant obstacles to successful practical teaching. The absence of professional development opportunities also limited the possibility of teachers using learner-centred approaches. However, there were those teachers who were creative and improvised experiments with materials they had in their vicinity to partially overcome the resource shortfall. The research found that these issues can be addressed through a multi-faceted approach that involves the sufficient supply of resources, ongoing teacher education, community participation and policy advocacy. The recommended measures to implement were enhancing laboratory resources, conducting professional development seminars, facilitating the sharing of resources between schools and the promotion of the contextualisation of learning using local examples and materials.

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ACRONYMS

Acronym	Meaning
FDGs	Focus Group Discussions
NGOs	Non-Governmental Organisations
OCED	Organisation for Economic Co-operation and Development
PhET	Physics Education Technology
STEM	Science, Technology, Engineering and Mathematics
UNESCO	United Nations Educational, Science and Cultural Organisation

Chapte1: The problem and its context

1.0 Introduction

The physics curriculum can be used to address the 21st century demands, however, its implementation is fraught with issues and challenges. In spite of the fundamental role, which physics plays in the national development and arming learners with problem-solving and analytical skills, rural schools remain subject to persistent barriers. This chapter presents the background to the study by giving a clear overview of the context within which the study will be carried out and presenting a statement of the problem under investigation. The chapter also presents the research objectives and questions under which the study will be conducted. The importance of the study in enhancing strategies to improve the teaching and learning of practical physics in the rural learning institutions will also be given. This chapter will also state the assumptions of the study, delimitations and limitations of the study. Key terms to be found used throughout the study will also be found towards the end of the chapter before the summary.

1.1 Background to the study

The Organisation for Economic Co-operation and Development (OCED, 2019) has consistently highlighted that students in rural or marginalised regions underperform in science subjects due to limited exposure to hands-on learning and lack of instructional support. These environments often produce learners who can recite scientific principles but lack the experiential understanding needed to critical thinking and problem solving. These skills are needed in a world that is increasingly shaped by science and technology. In Latin America, da Silva et al. (2019) found that rural schools in Brazil frequently relied on theoretical instruction, with science teachers operating in isolation, lacking both resources and professional development opportunities. Such findings mirror the researcher's own experience, where collaboration with other physics educators was minimal and opportunities for skills enhancement were rare or non-existent.

This phenomenon finds strong resonance across African schools. In Kenya for instance, Mureithi and Wambugu (2016) found that there was direct correlation between under-resourced laboratories and poor learner performance in physics especially in rural counties. Their study revealed that despite the availability of comprehensive science syllabus, many

schools operated without basic apparatus, leading to dominance of rote learning over practical experimentation.

In Tanzania, Kita (2018) identified low teacher morale, poor remuneration and a shortage of qualified physics teachers as key contributors to the deteriorating quality of physics education in rural areas. The absence of targeted government interventions and insufficient investment in physics subject infrastructure further exacerbated these problems, rendering the subject inaccessible and irrelevant to learners.

Closer to Zimbabwe, in South Africa Krakhel et al (2020) presented a compelling analysis of rural schools where Physics educators reported feeling professionally isolated and unsupported. These teachers often managed overcrowded classrooms with out-dated materials and were expected to deliver the same curriculum as their urban counterparts despite severe limitations. Moreover, the rigid structure of the curriculum often left little room for context-relevant adaptations that could make Physics more relatable for rural learners. The result was widespread disengagement, with learners viewing Physics as an abstract and difficult subject, disconnected from their lived realities. This perception was also shaped by the lack of representation of rural experiences in curriculum content, further alienating learners from the subject.

In Zimbabwe, similar issues have been widely acknowledged in educational discourse. Mabasa and Singh (2020) found that rural learners continue to underperform in Physics subject, largely due to lack of laboratory facilities, poorly trained teachers and minimal support from the community or educational authorities. Many rural schools in Zimbabwe still lack electricity, let alone running water or science laboratories. This makes the delivery of practical Physics education particularly challenging. The researcher observed the exact conditions in the rural school or practice. Blackboards were used in place of whiteboards, improvised materials served as laboratory substitutes and science kits were either unavailable or locked away due to fear of breakage or theft. In some instances, the kits were kept away for safe keeping in preparation for examination use only. Teaching practical Physics under such conditions became more of an act of resilience than an academic endeavor.

The situation was further compounded by low levels of parental and community support for Physics education. Many parents, unfamiliar with the relevance of Physics to daily life or employment, were reluctant to encourage their children to pursue the subject. Most learners often dropped the subject when registering for examinations. In addition, learners often

questioned its value, asking why they should about electricity or magnetism when they homes lacked power. These sentiments were common and they signaled a wider disconnection between curriculum content and local realities. Wang (2020) argues that in such settings, the failure to contextualise Physics education leads to a science of alienation among students, resulting in disinterest and poor performance.

During the course of the professional practice as a teacher of physics in rural secondary schools in Mutasa District, the researcher experienced first-hand the challenges that were persistent and deeply embedded in regard to teaching practical physics. The absence of laboratory facilities, poor infrastructure, old teaching resources and low student participation in the learning processes were some of the experiences that highlighted the mismatch between what the curriculum required and what the classrooms of the rural schools were like day by day. The researcher repeatedly noted that in spite of the inquiry-focused approach of the curriculum and active experimentation, lessons were mostly theoretical and practical sessions were usually replaced by textbook examples and color descriptions because of the lack of resources.

The same has been expressed all over the world in the under-resourced learning institutions where the teaching of science is held back by infrastructural and systemic factors. According to a study by Darling-Hammond et al. (2020) schools in most of the low-income or rural regions in the United States have a hard time keeping the laboratories operating and qualified science educators, which means that students have fewer chances to experience the process of genuine scientific research.

In the course of these professional experiences, the researcher observed a disturbing trend. This was despite the national education policies keeping advancing Science, Technology, Engendering and Mathematics (STEM) education as one of the pillars of socio-economic development in Zimbabwe. This as a result, left the rural schools to remain ill-prepared to satisfy that need. In cases where teachers are dedicated and students have potential, it became almost impossible to teach them practical physics due to the absence of the institutional support, relevant training, and resources. These are not only logistical, but also pedagogical and psychological challenges. Educators are not given tips on how to construct meaningful hands-on lessons with locally available resources and students are not often introduced to science in a manner that connects with their surroundings. This leads to a systemic failure to

develop interest, curiosity and competence in physics, which worsens the national strategy to develop a workforce capable of working in the future.

As such, the peculiarity of the current research is that it dwells upon the real life of the teaching of practical physics in one of these rural schools. Although the overall nature of the challenges facing STEM education in Zimbabwe have been investigated in broader studies, little research has been conducted that specifically focuses on practical physics instruction, as viewed through the lens of teachers who have to deal with these limitations on a daily basis. The reason why the researcher decided to do this study is because he realised that the current interventions and policy frameworks have failed to adequately deal with the specific circumstances of rural science education. This would require a subtle, context-based interpretation to inform policies and practices that would enable significant change. Through the systematic investigation of these issues based on empirical studies, this study will provide information that may be used to inform resource distribution, teacher preparation, and curriculum reform in a manner that effectively captures the needs of rural students and teachers. Therefore, the personal experience of the researcher with these difficulties, along with the evidence of the accumulating international and regional research, confirms the urgency and significance of the work. Evidence-based interventions that are focused and offer solutions to the systemic issues that limit teaching of practical physics in rural Zimbabwean schools are urgently needed. Devoid of these, the rural learners will continue to be left behind in the fringes of science education and the cycles of exclusion and poor performance continue.

1.2 Statement of the problem

Despite the critical importance of science education in building scientific literacy and preparing learners for participation in technology-driven global economy, rural secondary schools, particularly in Mutasa District, continue to face profound and persistent challenges in the teaching and learning of practical physics. Numerous studies across the world have consistently shown that rural schools are disadvantaged by systematic barriers such as infrastructure, shortage of trained Physics educators, lack of teaching and learning resources and minimal professional development support (da Silva et al, 2019). These constraints result in an education system where learners are exposed to theoretical knowledge without the accompanying experimental learning that promotes critical thinking and problem-solving. In Zimbabwe, Mabasa and Sign (2020) found that most rural schools operate without functional

laboratories and where materials are available; they are either outdated, insufficient or locked away for limited use during examinations. This deprives learners of meaningful engagement with physics content, leading to disengagement, poor performance and as a result higher dropout rates from the subject. Against this backdrop, the study shall investigate challenges faced in teaching practical physics in rural secondary schools.

1.3 Objectives of the study

The study shall be guided by the following research objectives;

1. To examine the instructional practices used in teaching practical physics in rural secondary schools.
2. To assess the challenges encountered in the delivery of practical physics in rural secondary schools.
3. To identify feasible strategies for improving the implementation of practical physics in rural secondary schools.

1.4 Research questions

The study will be guided by the following research questions;

1. Which instructional practices are being used in teaching physics in rural secondary schools?
2. What are the challenges encountered in the delivery of practical physics in rural secondary schools?
3. What strategies can be developed for improving the implementation of practical physics in rural secondary schools?

1.5 Significance of the study

Firstly, the research aims to highlight the critical role of practical physics in promoting scientific literacy and skills development among rural learners, which are essential for participation in a technology-driven global economy. The study seeks to reveal the gap between curriculum expectations and classroom realities in rural secondary schools, particularly in the context of delivering practical components of the physics syllabus. The study identifies specific infrastructural, pedagogical and systemic challenges that hinder the effective teaching of practical physics in under-resourced rural schools. In addition, the

research offers insights for education policymakers, curriculum developers and school administrators on how to better support rural science teachers through improved resource allocation, teacher training and professional development. Furthermore, science educators stand to benefit from the findings by gaining a deeper understanding of alternative, context-specific strategies for delivering practical physics using locally available materials. Finally, the study contributes to the limited body of empirical literature on science education in rural Zimbabwe and offers valuable direction for future interventions targeted at improving STEM education in marginalised contexts, particularly within Mutasa District.

1.6 Assumptions of the study

- It is hoped that the participants will be willing to participate in the study and give truthful, precise and complete information regarding their experiences.
- The chosen rural secondary school in Mutasa District represents the overall situation and struggles of such schools in the rural Zimbabwe.
- The teachers and learners who participate in the study are experienced and exposed to teaching and learning of practical physics enough to make a contribution towards the research.
- The data gathering techniques (interviews, observations) applied will be useful in capturing the realities of teaching practical physics in the rural school environment.

1.7 Delimitations of the study

The study will be confined to the investigation on challenges faced in teaching practical physics in a rural secondary school. It would be carried out in rural secondary schools in Mutasa District in Manicaland among a cluster of 4 schools of Mutasa Central. The cluster is composed of Pafiwa, Sherukuru, Zambe and Bethania secondary schools. The district is predominantly rural peasant farmers and the geographic landscape of the areas is dry and mountainous. The cluster of schools has a total enrolment of 3500 learners from form 1 to upper 6. The participants of the study will involve form 3 students and physicals teachers.

1.8 Limitations of the study

Time Constraints

The researcher may face limitations in balancing research activities with other professional and personal responsibilities. This could affect the depth of data collection and analysis. Limited time may also restrict the number of schools or participants involved in the study. To mitigate this, the researcher will plan a detailed schedule and prioritise critical research tasks efficiently.

Lack of research knowledge

As an emerging researcher, limited experience in academic research may present challenges in designing instruments, analysing data and drawing valid conclusions. This limitation may affect the overall rigour of the study. However, the researcher will consult supervisors, refer to academic literature and attend research lectures where possible to improve competence.

Financial constraints

Conducting fieldwork, printing materials, and travelling to rural areas requires significant financial resources. Limited personal funds may hinder the timely execution of research activities. To overcome this, the researcher will make savings in advance, seek assistance from colleagues and apply for a small bank loan if necessary.

Respondents' reluctance to participate

Some participants may be hesitant to share information due to fear of judgment or lack of interest. This may affect the credibility and richness of the data collected. To address this, the researcher will explain the purpose and benefits of the study clearly, ensure confidentiality, and obtain informed consent in line with ethical research practices.

1.9 Definitions of key terms

Challenge

According to Krakhel et al (2020) a challenge is a difficult task or situation that tests someone's ability or determination. Wang (2020) argues that a challenge is an obstacle or condition that creates difficulty in achieving desired outcomes or performance levels. Contextually, challenges faced in teaching practical physics are those conditions or obstacles within the rural school environment that hinder the effective delivery of hands-on physics instruction.

Physics

Physics is the branch of science concerned with the nature and properties of matter and energy, including mechanics, heat, light, radiation, sound, electricity, magnetism and the structure of atoms (Kita, 2018). da Silva et al (2019) define physics as a fundamental science that seeks to understand the behaviour of the universe through the study of matter, energy and their interactions. Therefore, physics in this study refers to the subject taught in secondary schools that involves both theoretical concepts and practical experiments aimed at understanding the principles governing the physical world.

Rural

Rural areas are geographic areas located outside towns and cities, typically characterised by low population density, limited infrastructure and greater dependence on agriculture or natural resources (Mureithi and Wambugu, 2016). Wang (2020) states that rural areas are regions situated outside urban settlements, often marked by limited access to public services, lower economic activity and underdeveloped educational and health facilities. Contextually, rural in this study refers to geographically remote or less-developed areas in Zimbabwe, such as Mutasa District, where schools often operate under conditions of limited resources, infrastructural constraints and reduced access to quality science education.

1.10 Summary

This chapter presented the background to the study by giving a clear overview of the context within which the study would be carried out. The chapter presented the statement of the problem under investigation. The chapter also presented the research objectives and questions under which the study would be conducted. The importance of the study, the assumptions, delimitations and limitations of the study were also stated. Key terms to be found used throughout the study are found towards the end of the chapter before the summary. The next chapter which is chapter two, presented a review of literature related to challenges faced in teaching practical physics in a rural secondary schools.

2.0 Chapter 2: Review of related literature

2.1 Introduction

This chapter shall present a review of literature related to the study of challenges faced in teaching practical physics in a rural secondary school. The review was presented starting with the theoretical framework from which the study was underpinned. The empirical literature review as also organised along sub-themes developed from the research objectives. The subheadings included the instructional practices used in teaching practical physics in rural secondary schools, the challenges encountered in the delivery of practical physics in rural secondary schools and feasible strategies for improving the implementation of practical physics in rural secondary schools.

2.2 Theoretical framework

This study is underpinned by Bruner's Constructivist Learning Theory proposed by Jerome Bruner (1966). The theory believes that learning is an active process in which learners construct new ideas based on their current and past knowledge. Bruner argues that understanding is best achieved when learners are actively involved in discovering principles rather than being passive recipients of information. This means that learners should engage in practical experiences that allow them to manipulate materials, observe outcomes and derive meaning from their own experimentation. In the context of teaching practical physics in rural secondary schools, this theory provides a strong foundation because it emphasises the value of hands-on learning and problem-solving, which are essential in developing critical and analytical skills among learners (Mabasa and Singh, 2020). Applying this theory, teachers in rural schools can design learning activities that enable learners to explore physical phenomena using simple, locally available materials. For instance, even in the absence of well-equipped laboratories, learners can investigate concepts such as motion or electricity through improvised experiments using everyday items.

The advantages of applying Bruner's theory lies in that it is a learner-centred approach. It promotes deep understanding and retention of knowledge. It encourages creativity, participation and contextualisation of learning, which are crucial for motivating rural learners who may find physics abstract or irrelevant to their daily lives (Mabasa, 2020). However, the

theory's effectiveness depends on the availability of resources, time, and teacher competence in facilitating discovery-based learning. In under-resourced rural schools, these conditions may not always be met, making full implementation difficult (Kita, 2018). However, teachers can receive targeted professional development to build skills in improvisation and learner facilitation, while education authorities can promote resource-sharing initiatives and community support systems to strengthen practical teaching. Despite its limitations, Bruner's Constructivist Learning Theory remains highly relevant because it aligns with the goals of Zimbabwe's competency-based curriculum, which advocates for inquiry-driven, hands-on learning. Therefore, this theory provides both a philosophical and practical framework for understanding and improving the teaching of practical physics in rural secondary schools.

2.3 Empirical literature review

2.3.1 Instructional practices used in teaching practical physics in rural secondary schools

Mabasa and Singh (2020) posits that practical physics teaching in rural secondary schools around the world is frequently based on resource-limited, imaginative solutions to the usual problems of small laboratory facilities, crowded classrooms and poor infrastructure. Mabasa and Singh (2020) discovered that schools in low-income and remote areas of the United States have difficulties with operating laboratories and teachers have to resort to improvised experiments and demonstrations with the help of readily available materials. The same trends have been detected in Latin America, where da Silva et al (2019) identified that teachers in rural Brazil often rely on hypothetical explanations with locally available teaching resources, such as recycled bottles, wires and magnets to demonstrate major physics concepts. Though limited, these methods enable students to participate in practical inquiry, which is consistent with constructivist philosophies about the importance of learning through practice and relating theory to personal experiences.

African teachers have undergone similar realities at the continental level, with few laboratory resources and limited opportunities to professional development hindering effective practical teaching. According to Mureithi and Wambugu (2016) the majority of rural schools in Kenya use teacher demonstrations and improvised devices to support experimentation, such as water containers and bicycle parts, which are reused to teach pressure and motion. In Tanzania,

Kita (2018) emphasised the importance of creativity and improvisation of teachers to help students learn the science when infrastructure and governmental support are insufficient. These illustrations show that, in many parts of Africa, the effectiveness of applied physics education is frequently determined by the creativity and effort of teachers and not by the material wealth.

Krakhel (2020) discovered in South Africa that teachers of physics in rural schools frequently work in severe conditions, with outdated teaching resources and overcrowded classes to teach a challenging curriculum. However, others have also succeeded in making physics more accessible by putting lessons into the context of rural life of students, like, explaining electricity in terms of the local solar power systems or using farm work as an example of lever. Mabasa and Singh (2020) noted that in Zimbabwe, most rural schools do not have laboratories and use improvised experiments and verbal explanations. Instructors have been found to create laboratory experiences with common items such as tins, strings and bulbs to demonstrate scientific concepts. These instances demonstrate that despite insurmountable odds against rural schools, effective hands-on instruction in physics can still flourish with resourcefulness, situational adjustment and inquiry-based teaching methods that help to make science more relevant to the real-world of learners.

Lange (2016) states that instructional practices in rural secondary schools often lean heavily on ingenuity, improvisation and student-centred inquiry to compensate for severe resource constraints. Teachers in many low-income regions find that laboratory equipment is insufficient or absent, class sizes are large, and infrastructure, electricity, water, space is unreliable, so they adopt alternative methods to deliver practical physics (Mehari and Nassir, 2019). One common strategy is improvisation with locally available materials. For example, in Ethiopia, science teachers have fashioned simple apparatus from everyday objects, plastic bottles, wires, tins, salvaged electronics, to demonstrate principles such as circuits or energy transfer (Mehari and Nassir, 2019). These improvised experiments stimulate learners' creative problem-solving, build ownership of the learning process, and reduce dependence on formal laboratory setups.

Demonstration methods are another frequent practice in under-resourced rural schools (Lange, 2016). Where individual students cannot each have apparatus, the teacher performs experiments at the front of the class while structuring the lesson around prediction, observation and discussion. Instead of simply showing a teacher-led demonstration, effective

practitioners ask students to predict outcomes, observe results live, record observations and explain discrepancies, thus shifting from passive observation to guided inquiry (UNESCO, 2021). This strategy helps engage learners in the reasoning process even when they cannot all handle equipment themselves.

Lange (2016) states that field-based or project-based learning also features in rural physics instruction. Teachers take advantage of the environment around the school to teach physics concepts outside the classroom. Student investigations of motion using thrown objects, measuring the period of pendulums fixed to local structures, or timing water flows using improvised timers allow learners to see physics in action in their immediate surroundings. In South Africa, research has shown that rural learners benefit when teachers link physics lessons to locally relevant phenomena (Lange, 2016). Such strategies foster ownership and show that physics does not only belong to a lab but to everyday life.

Where digital infrastructure permits, virtual laboratories and online simulations supplement the lack of hands-on apparatus (Sunzuma, 2024). Although access to computers and Internet may be patchy in rural areas, where available, teachers use online simulators to illustrate circuits, forces and energy. These virtual labs allow learners to conduct experiments “virtually” when physical materials are unavailable (Lange, 2016). While not a perfect substitute for tactile experience, they expand the range of phenomena students can explore at low cost. More importantly, many of these methods adopt a student-centred and inquiry-based philosophy. Instead of delivering prescriptive “do this, record that, get that result”, teachers use guided inquiry. Learners pose questions, design simple experiments, for example, investigating inertia with household objects, collect data and draw conclusions. This heuristic approach encourages deeper understanding, builds scientific habits of mind, and aligns with contemporary pedagogical thinking (Morton, 2015). Problem-solving challenges grounded in local context, for example, asking students to design a simple rain-water collection device to measure volume changes under different flow conditions, further reinforce relevance and motivation.

Collaboration between students is also woven into these practices. Small group investigations help learners share limited equipment, discuss observations and test ideas together (Sunzuma, 2024). Peer-instruction, students explaining concepts to each other, helps consolidate understanding and correct misconceptions before formal assessment. Assessment is often integrated into practical lessons: teachers observe how students perform tasks, read their

write-ups, ask follow-up questions to test comprehension and provide feedback immediately to improve technique and conceptual grasp (Morton, 2015). Such instructional practices are not without challenge, for instance, improvisation depends upon teacher creativity and may lack accuracy or reproducibility; group work in overcrowded classes may be hard to manage; and virtual labs may suffer from poor internet connectivity. Nonetheless, by prioritising inquiry, engaging learners with their real environment and using whatever materials are at hand, rural physics instruction can become more meaningful, accessible and aligned to learners' lives. Against this background, the researcher shall investigate instructional practices used in teaching practical physics in rural secondary schools.

2.3.2 Challenges encountered in the delivery of practical physics in rural secondary schools

Practical physics in rural secondary schools is plagued by a complex and interlocking set of challenges that extend beyond mere scarcity of equipment. The challenges encompass teacher preparedness, curriculum demands, infrastructural deficiencies, assessment culture and socio-economic realities that together constrain meaningful hands-on science learning (Morton, 2015). The literature consistently shows that the absence of functional laboratory facilities remains a primary and pervasive barrier. Teachers report either non-existent laboratories or rooms devoid of working apparatus, an observation corroborated across contexts from Zimbabwe to South Africa and beyond (Sunzuma, 2024). Where basic instruments such as voltmeters, reliable power supplies or motion sensors are missing, practical work is either curtailed or reduced to teacher demonstrations that, without careful pedagogical structuring, can become passive spectacles rather than inquiry opportunities (Krakehl, 2020). In rural settings the situation is frequently aggravated by intermittent electricity and restricted budgets, so that even when equipment exists it is often unusable, the result is that learners seldom exercise the investigative practices, measuring, controlling variables, recording and interpreting data that build scientific understanding.

Western (2017) also agrees that one of the major challenges faced during the teaching of practical physics is the lack of resources. In many rural schools, laboratories lack essential equipment such as voltmeters, ammeters, or even power supplies (Makoni and Madzima, 2020). Morton (2015) asserts that when resources are scarce, teachers must employ creative

strategies to make lessons engaging and effective. In this case, PhET (2025) suggest that the teacher can make use of improvised materials from the local environment, such as wires from discarded electronics, torches for light sources, and batteries to simulate electrical experiments. In addition, the teacher used online resources and physics simulations to demonstrate experiments that could not be physically conducted due to resource constraints (Western, 2017). For example, PhET interactive simulations helped learners visualise concepts such as Ohm's Law and projectile motion. This approach can make lessons dynamic, relatable and achievable despite material limitations.

According to PhET (2025) closely linked to the material shortages is the problem of teacher expertise and professional isolation. Empirical studies reveal that a significant fraction of rural physics teachers teach "out-of-field" or lack specialised training in physics pedagogy, which diminishes their confidence to design and facilitate practical work (Krakehl, 2020; Sunzuma et al., 2025). Professional isolation is not merely geographic: lack of access to continuous professional development, peer networks and subject-specific mentoring leaves teachers without up-to-date strategies for improvisation or inquiry-based instruction. Mupira and Ramnarain's work on inquiry approaches in disadvantaged South African contexts demonstrates that even motivated teachers need structured training and support to shift from recipe-based demonstrations to guided investigation that elicits conceptual change (Mupira and Ramnarain, 2018). Without such investment, improvisation risks becoming an ad hoc survival tactic rather than a systematically taught competence.

Class size and classroom organisation present further, practical impediments (Soyikwa, 2024). Large enrolments constrain the teacher's ability to provide hands-on experience to each learner; group work becomes the default, yet overcrowding complicates management, equitable access to apparatus and the quality of formative feedback (Masondo, 2021). The literature emphasises that group-based practicals can promote collaboration and peer instruction, but only where roles, expectations and assessment practices are clear; otherwise, groups devolve into unequal participation and superficial engagement (Soyikwa, 2024). Field observations from Zimbabwean studies describe teachers assigning one piece of apparatus to a group of six or more learners, with only the "hands" of one or two pupils actually collecting data while the remainder observe passively, hardly a recipe for deep, transferrable understanding. To manage overcrowded classrooms, the teacher adopted cooperative learning strategies. Chikoko (2020) notes that dividing learners into manageable groups enhances

engagement and reduces classroom chaos. Each group conducted mini-experiments or worked on tasks collaboratively, which encouraged peer learning and teamwork. Gergen (2019) supports this view, stating that group work promotes critical thinking and shared problem-solving. However, challenges such as unequal participation and classroom noise can arise (Masondo, 2021). These can be mitigated through assigning specific roles within groups, such as recorder, leader and experimenter and setting clear performance expectations.

According to PhET (2025) curriculum design and assessment culture add systemic pressure on teaching practical physics in rural secondary schools. A curriculum that prescribes practical competencies but is coupled to high-stakes, theory-weighted examinations encourages teachers to prioritise coverage and rote preparation over the slow, messy business of investigation (Sunzuma, 2025). Where national examinations place scant emphasis on procedural skills or experimental reasoning, teachers rationally allocate limited time to factual content that will yield measurable results. Consequentially, practical physics is squeezed into a peripheral role or used merely to confirm pre-taught answers rather than to generate inquiry questions and data-driven reasoning (Krakehl, 2020). International reviews argue that aligning assessment with intended competencies is essential, otherwise policy intent and classroom practice diverge.

Furthermore, Soyikwa (2024) alludes that socio-economic and contextual realities of rural communities also influence practical physics teaching. Many learners enter school with limited exposure to household technologies or industrial examples commonly used to motivate physics in urban settings, making it harder to relate abstract concepts to lived experience (Soyikwa, 2024). At the same time, poverty constrains schools' ability to procure consumables and increases absenteeism, which interrupts sequential investigative projects that require continuity. Community attitudes, where parents may not appreciate the labour market relevance of physics, can further depress enrolment and participation in elective practical work. Studies from Southern Africa document how teachers' attempts to contextualise lessons, for example by using farming tools to illustrate levers or friction, succeed only when teachers have the time and pedagogical space to adapt lessons.

Technological solutions offer promise but reveal their own equity problems. Virtual laboratories and simulations, for example, PhET Interactive Simulations, allow exploration of phenomena that would otherwise require costly apparatus and enable learners to manipulate variables safely and repeatedly (PhET, 2025). Research, however, underlines that such tools

are only effective where devices, connectivity and teacher facilitation are reliable (Brindley, 2015). In many rural contexts intermittent or absent Internet, limited computer access and low teacher familiarity with digital pedagogies mean that virtual labs are under-utilised or used as substitute demonstrations rather than interactive inquiry platforms. Where schools succeed in deploying offline versions or school-level tablets loaded with simulations, learners report improved conceptual visualisation, but the scaled-up evidence remains mixed because of infrastructural and capacity constraints.

Safety and ethical considerations in improvisation are also prominent challenge in teaching practical physics (PhET, 2025). Teachers frequently resort to improvised apparatus, batteries, salvaged wiring, makeshift ramps, to enact experiments (Sunzuma, 2025). While this improvisation develops ingenuity and contextual relevance, it carries risks if safety protocols are not rigorously taught and enforced. The literature calls for teacher training that emphasises low-cost, safe alternatives and risk assessment skills so that resourcefulness does not compromise learner welfare (Soyikwa, 2024). Practical work must therefore be underpinned by clear safety guidelines adapted to local realities, with community buy-in where needed for materials and storage.

Masondo (2021) posits that time constraints compound the foregoing challenges of teaching practical physics. Practical investigations, particularly inquiry-based tasks, require multiple lesson periods for planning, experimentation, analysis and reporting. Teachers constrained by dense curricula and limited contact hours shorten or collapse investigations, reducing them to single-lesson demonstrations (Sunzuma, 2025). Empirical reviews suggest that without explicit timetable allocation and recognition of the time needed for experiential learning practical components will remain superficial (Soyikwa, 2024). Remedies include curriculum restructuring that protects practical work time and school-level scheduling innovations such as double lessons or rotating practical weeks; such measures, however, demand systemic will and resource reallocation.

Despite these daunting barriers, the literature emphasises resilient and effective teacher practices that mitigate many constraints. Carefully scaffolded demonstrations, where pupils predict outcomes, design follow-up mini-investigations and critique methods, can approximate inquiry even when individual hands-on access is limited (Masondo, 2021). Contextualisation, using local materials and phenomena, strengthens relevance and motivation; examples abound of teachers using bicycle wheels to teach rotational dynamics,

local water sources to discuss fluid flow or small solar panels to explore circuits and energy conversion (Soyikwa, 2024). In addition, structured group roles and rotating responsibilities increase active participation within large cohorts, while rubrics and continuous formative assessment help teachers provide targeted feedback despite heavy workloads. Sunzuma (2025) also adds that policy and system-level interventions are equally important. Evidence points to the effectiveness of targeted laboratory kits designed for low-resource schools, combined with teacher training and maintenance plans, rather than one-off equipment donations that fall into disuse (Sunzuma et al., 2025). Collaborative models, where clusters of rural schools share mobile laboratory kits, teacher networks and periodic specialist visits, have shown promise in widening access and reducing isolation (Krakehl, 2020). International and national reviews urge alignment of assessment, curriculum and teacher development so that practical competencies are both taught and tested; otherwise the incentives that drive classroom priorities will remain misaligned (Wang, 2020). Therefore, the challenges of teaching practical physics in rural secondary schools are multifaceted and mutually reinforcing: scarce and unreliable resources, teacher capacity gaps, overcrowded classes, misaligned assessment systems, socio-economic constraints and fragile infrastructure.

The literature is unequivocal that no single remedy suffices. Effective improvement requires a coherent package, investment in context-appropriate resources and maintenance, sustained professional development oriented to inquiry and improvisation, curriculum and assessment reform to value practical skills and pragmatic deployment of technology where infrastructure allows (Masondo, 2021). Crucially, teachers in rural settings must be recognised as professional problem-solvers and supported with networks, materials and policies that convert their ingenuity into consistent, safe and pedagogically sound practical learning experiences. Only when systemic supports and local practice are aligned will practical physics in rural schools shift from occasional improvisation to a dependable engine of scientific understanding and aspiration.

Another challenge is the lack of proper instructional techniques to cater for learners with diverse abilities. Hove (2022) advises using visual aids, models and step-by-step demonstrations to support inclusive learning. The teacher can use simple charts and diagrams to explain physics concepts, such as force diagrams and circuit connections. Learners with learning difficulties were supported through simplified instructions and repeated demonstrations. For example, when explaining Newton's Laws, the teacher used role-play

and real-life examples, such as pushing a wheelbarrow, to make concepts relatable. Although adapting lessons takes time and preparation, the teacher collaborated with fellow educators and parents to support learners requiring additional help.

Furthermore, limited classroom and laboratory space is another challenge faced in rural schools. Morton (2015) posits that teachers can conduct some practical sessions outdoors. Zondo (2024) suggests that outdoor learning can enhance engagement, particularly in resource-constrained contexts. For instance, lessons on motion and forces were conducted in open spaces where learners could measure distances and time intervals using simple stopwatches. Morton (2015) argues that lack of classroom infrastructure can reduce instructional quality, yet teachers can adapt by organising flexible, structured outdoor learning environments. Masondo (2021) adds that creating clear routines and expectations ensures effective learning, even in non-traditional spaces. Outdoor lessons not only reduced overcrowding but also provided learners with practical exposure and a sense of real-world experimentation.

As such, the review has shown that challenges encountered during the delivery of practical physics in rural secondary schools highlight the importance of teacher creativity, adaptability and innovation. Despite shortages of resources and infrastructure, teachers can foster meaningful learning through improvisation, group collaboration, inclusive teaching, and flexible learning environments. These strategies demonstrate that effective practical physics instruction does not depend solely on advanced laboratories but rather on the teacher's ability to connect physics concepts to learners' everyday experiences. As such, creative and learner-centred approaches ensure that even under resource constraints, rural learners can meaningfully engage with science and develop essential experimental skills.

2.3.3 Feasible strategies for improving the implementation of practical physics in rural secondary schools

Improving the implementation of practical physics in rural secondary schools requires a holistic, contextually grounded and sustainable approach. The approach must address both systemic and classroom-level barriers. The literature above has consistently emphasised that reform must go beyond the mere provision of laboratory equipment to include teacher development, curriculum alignment, assessment reform and community involvement.

According to Krakehl (2020) a central and feasible strategy is the promotion of teacher professional development focused on practical pedagogy. Soyikwa (2024) states that rural physics teachers must be equipped not only with content knowledge but also with the methodological skills to conduct meaningful investigations under resource-constrained conditions. Continuous professional learning communities, whether in-person clusters or virtual networks, can provide mentorship, peer exchange, and collaborative problem-solving opportunities (Masondo, 2021). Krakehl (2020) highlights that professional isolation is one of the most corrosive problems in rural education; therefore, building networks that connect rural teachers to urban-based specialists, universities and educational NGOs can refresh classroom practice and boost teacher confidence. Hove (2022) puts that professional development initiatives should prioritise inquiry-based methods, safe improvisation and strategies for contextualising physics concepts to local environments.

In a research carried out by Hove (2022) it was noted that equally significant is the provision of low-cost, context-appropriate laboratory kits that support hands-on learning without imposing unrealistic maintenance burdens. Studies across sub-Saharan Africa reveal that heavy investment in fully equipped laboratories is unsustainable without on-going maintenance, storage, and replenishment budgets (Soyikwa, 2024). Instead, compact kits containing essential apparatus for mechanics, electricity and optics adapted for rural schools, can democratise access to practical work. Masondo (2021) adds that locally fabricated kits can also be developed using indigenous materials with guidance from science educators and local artisans. This helps to reinforce community ownership while reducing dependence on imported supplies.

The integration of technology and virtual simulations offers another feasible pathway, provided it is implemented thoughtfully. PhET (2025) states that offline platforms such as PhET simulations and other open-access digital resources allow learners to visualise abstract phenomena and manipulate variables safely. These tools can replicate experiments that are otherwise impossible in low-resource settings, such as those requiring precise instrumentation or posing safety hazards. Brindley (2015) notes that even limited access to digital simulations, when coupled with strong teacher facilitation, enhance conceptual understanding and student motivation. Governments and NGOs can support this by providing low-cost tablets preloaded with offline simulations and teacher guides. Hybrid models combining

virtual pre-lab exercises with simple physical demonstrations maximise both comprehension and engagement, bridging the experiential gap caused by limited laboratory access.

A further strategy lies in curriculum and assessment alignment when implementing physics education in rural areas. Where national curricula articulate the importance of practical skills but assessment focuses almost entirely on written recall, teachers will inevitably prioritise theory. Soyikwa (2024) argues that assessment drives instruction; therefore, reforming examination systems to include authentic evaluation of experimental design, data handling and analytical reasoning is crucial. Introducing school-based assessment components, moderated externally, encourages teachers to integrate practical work continuously rather than treating it as an optional extra. When assessment rewards investigative skills and problem-solving, teachers have both the motivation and justification to devote classroom time to experimentation, even under resource constraints.

Infrastructure improvement remains essential but should be approached incrementally and strategically (Krakehl, 2020). Instead of waiting for complete laboratory construction, schools can be supported to establish multi-purpose science corners or mobile laboratories, fitted with essential utilities such as running water, electricity and safe storage cabinets. Community and private-sector partnerships can contribute materials or technical labour. Soyikwa (2024) documents cases where modest refurbishments, like converting disused classrooms into shared science spaces, dramatically increased practical activity. Small investments in safety infrastructure such as fire extinguishers and first-aid kits also improve teachers' willingness to attempt practical work. Importantly, maintenance plans must accompany infrastructure investments to ensure sustainability rather than one-off improvements.

Another practical and proven measure is the strengthening of community and industry partnerships (Soyikwa, 2024). Local artisans, engineers and technicians can collaborate with schools to co-design experiments and construct simple teaching aids. In rural Zimbabwe and South Africa, programmes where local workshops assist in producing low-cost experimental tools, such as inclined planes, pulleys and circuits, have proven effective (Sunzuma, 2025). Beyond resource generation, such partnerships demonstrate to learners the relevance of physics to their communities, promoting motivation and career awareness. Parents and local authorities can be mobilised to contribute raw materials, provide logistical support for excursions, and encourage gender-inclusive participation in science.

Brindley (2015) posits that at the pedagogical level, fostering collaborative and inquiry-based classroom cultures is vital. Even with limited apparatus, teachers can design structured group activities that rotate roles, observer, recorder, experimenter and analyst, so that all learners engage meaningfully (Mupira, 2018). Peer-assisted learning, where stronger students mentor weaker ones during experimental tasks, helps distribute expertise and maintains engagement in overcrowded classes. Krakehl (2020) stress that inquiry is not dependent on equipment but on the intellectual framing of lessons, teachers can nurture inquiry by encouraging prediction, questioning, data interpretation and reflection.

The establishment of teacher resource centres and regional hubs provides a sustainable model for sharing expertise, materials and mentorship (Krakehl, 2020). These centres can host demonstration lessons, maintain lending libraries of apparatus and facilitate workshops for both pre-service and in-service teachers. In Kenya and Ghana, regional teacher centres have been successful in revitalising science education by ensuring continuous access to support and materials (Soyikwa, 2024). Such decentralised structures are particularly suitable for rural contexts where schools are geographically dispersed and travel to central training institutions is impractical. Another feasible strategy concerns policy incentives and targeted funding mechanisms. Governments and development partners can institute small grants for rural science teachers who demonstrate innovation in practical work, thereby rewarding creativity and encouraging replication of effective methods (Brindley, 2015). Policies that reduce teacher turnover by offering rural allowances and career advancement incentives are equally crucial, since high attrition rates undermine continuity and skill retention (Krakehl, 2020). Funding models should prioritise sustainability, ensuring not only procurement but maintenance, replenishment, and teacher support over time.

Furthermore, embedding research and reflective practice into the teaching culture ensures continual improvement. Teachers should be encouraged to document and share their experiences of improvisation and inquiry-based strategies through action research projects, school-based journals, or online platforms. This approach transforms isolated ingenuity into collective professional knowledge (Mupira, 2018). Universities and teacher training colleges can support this by integrating reflective fieldwork components into pre-service programmes, preparing future teachers to thrive in resource-limited environments. Furthermore, community awareness and learner engagement initiatives play an indirect but powerful role in sustaining improvements. Awareness campaigns showcasing successful rural science

projects, such as small solar experiments or water purification prototypes, can build community pride and support for science education. When learners perceive tangible benefits from physics learning, such as explaining everyday technologies or solving local problems, their motivation increases and classroom participation deepens.

The review suggest that, these strategies converge on a central principle: that improving practical physics in rural schools is not simply a technical challenge but a social, pedagogical, and systemic one. No single reform suffices in isolation, rather, progress depends on an integrated effort that combines teacher empowerment, relevant resources, curriculum coherence, technological innovation, and local partnership. Rural teachers have repeatedly demonstrated resilience and ingenuity in overcoming adversity; with structured support and recognition, their creativity can evolve from individual improvisation into a stable culture of hands-on, inquiry-driven physics education. As such, by aligning policy, professional development, community engagement and resource innovation, rural secondary schools can transform practical physics from a marginalised aspiration into a routine, inspiring and intellectually rigorous experience for all learners.

2.4 Summary

This chapter presented a review of literature related to the study of challenges faced in teaching practical physics in a rural secondary school. The review was presented starting with the theoretical framework from which the study was underpinned. The empirical literature review as also organised along sub-themes developed from the research objectives. The subheadings included the instructional practices used in teaching practical physics in rural secondary schools, the challenges encountered in the delivery of practical physics in rural secondary schools and feasible strategies for improving the implementation of practical physics in rural secondary schools. The next chapter, which is chapter three shall present the research methodology to be used to collect data.

3.0 Chapter 3: Research methodology

3.1 Introduction

This chapter presented the research methodology that would be utilised in collecting data for the study. The chapter presents the research design, research instruments, population, sample and sampling procedures. The data collection procedures and data presentation and analysis plan were also discussed.

Anderson (2015) argue that research methodology is a way to solve a research problem. Creswell (2016) broadly states it as systematic way that can be understood as a science of studying research. Barbour (2018) asserts that research methodology considers the logic behind the methods which are used in context of the research study and reasons for using a particular method or technique instead of another. Gray (2019) argues that the choice of research methodology is determined by researcher's expectations of research results, in that regard a research methodology is influenced by whether the research is inclined towards a positivist, interpretivist, or other perspective.

3.2 Research design

A case study design will be employed since the research focuses on the challenges encountered in teaching practical Physics in a rural secondary school. Gray (2019) posits that this approach is most suitable because it allows for an in-depth exploration of a specific context, capturing the unique experiences, practices and constraints faced by teachers and learners. The researcher is already familiar with the operational environment of the selected school, which strengthens the ability to collect rich and contextualised data. The case study design, supported by qualitative methods, enables a detailed understanding of both the processes and outcomes of the phenomenon through systematic observation, description and analysis. This qualitative approach is appropriate as it provides insights into the participants' perceptions and lived experiences, thereby addressing the study's objectives comprehensively. According to Denzin and Lincoln (2016) qualitative research methods were developed within the social sciences to allow researchers to explore social and cultural phenomena in depth. Therefore, given the interpretative nature and subjective aims of this study, focused on understanding challenges, strategies and behaviours, the qualitative case

study design is the most effective framework for generating meaningful and contextually grounded findings.

3.3 Population

Population refers to the complete set of individuals, items, or data points that share certain characteristics and are the subject of study (Bryman, 2017). According to Barbour (2018) the population is the entire group about which researchers want to draw conclusions. Therefore, population may refer to a specific group of people who have experienced a particular phenomenon or share a certain trait relevant to the research. It is the entirety of the subjects that the researcher intends to study. In this study the population is composed of teachers, school administrators and learners at a rural secondary school. It is from this population that the researcher shall draw the target population.

3.4 Target population

Lavrakas (2009) defines a target population as the total set of units for which the survey data are to be used to make extrapolations. Thus, the target population defines units which the results of the study are meant to generalise. The researcher's target population are the 5 teachers teaching physics in the school and 120 form 2 learners from the form 2 classes taking Physics classes. The researcher targeted this population because they are directly involved with teaching and learning of physics. In addition, the population was targeted because it was the classes the researcher was assigned to teach for integrated teaching period. It is from this target population that the researcher shall draw the sample from.

3.5 Sampling

The sample size for this study is 48 and includes physics teachers and learners. Barbour (2018) defines sampling as the collection of some part of totality on basis of which inference about a totality is made. The researcher shall use sampling to systematically select elements for instance in the distribution of questionnaires. The researcher shall also use sampling to choose the most appropriate elements especially in selection of editors and reporters for interviews. In case of sampling learners, the researcher shall carry out random sampling and for the teachers and school administrators stratified random sampling.

3.5.1 Random stratified sampling

The researcher shall draw a sample of 40 learners of equal mixed gender doing physics subject at the rural secondary school. Random stratified sampling is a sampling technique that involves dividing a population into distinct subgroups, or strata that share similar characteristics (Yin, 2014). Researchers shall then randomly select samples from each stratum to ensure that every subgroup is represented in the final sample. According to Denzin and Lincoln (2016) random stratified sampling is a method that enhances the representativeness of a sample by ensuring that specific subgroups are proportionately included based on their prevalence within the population. Gray (2019) defines it as a sampling procedure that combines random sampling with stratified sampling to reduce sampling bias and improve the accuracy of the results. In this case, random stratified sampling is a powerful method for obtaining a well-rounded sample that reflects the diversity within a population. As such, by carefully selecting participants from different strata, researchers can capture variations in responses and draw more reliable conclusions (King & Horrocks, 2017). This technique not only improves the representativeness of the sample but also aids in the analysis of differences between groups, making it particularly valuable in studies where subgroup differences are significant. The researcher came up with small paper cuttings of the same size and colour machine the number of girls in the class. Only 5 of the papers will be marked X. The girls will be asked to line up and pick the papers without looking. The girls that pick the papers marked X will be taken as part of the study sample. The same procedure was done with the boys to pick the same of 5 boys. This process will be done in each of the four classes taking physics subject. As such, a sample of 40 learners will be drawn, thus 40 learners of mixed gender from each class.

3.5.2 Purposive sampling

The researcher shall sample 8 participants purposively, sampling 5 teachers and 3 school administrators who include the head, deputy head and senior teacher. Purposive sampling, also known as non-probability sampling, is a technique used in research where participants are selected based on specific characteristics or criteria relevant to the study (Bryman, 2017). This method allows researchers to target a particular group of individuals who possess the attributes necessary to provide rich and insightful data. In this case, the researcher targets all teachers teaching physics and school which have the same characteristics of the study phenomenon and administrators for their role as policy makers in the school. King and Horrocks (2017) argue that purposive sampling is often used to select participants who have

experienced the phenomenon being studied. Therefore, purposive sampling will be used deliberately to select participants based on predetermined criteria that align with the research objectives. This approach is particularly useful when the researcher aims to gain in-depth understanding or insights from a specific population segment. As such, by focusing on individuals who are particularly knowledgeable or experienced regarding the research topic, purposive sampling can enhance the richness and relevance of the data collected. This method is not intended to produce a representative sample but rather to ensure that the selected participants can provide valuable information pertinent to the study. Therefore, 40 learners and a total of 8 teachers and school administrators were drawn from the four schools in the cluster.

3.6 Data collection instruments

Data collection instruments are tools that are employed in the study used to seek responses from the respondents (Creswell, 2016). According to Kothari (2017) research instruments are the tools or devices used by researchers for the collection of data to facilitate accurate and reliable analysis. Therefore, research instruments are the systematic tools, techniques or devices employed by a researcher to gather relevant information from respondents or sources in order to address the research objectives effectively. Research instruments include observations, questionnaires, interviews and documents among others. In this research the researcher will use interviews and focus group discussions (FDGs) in collecting data from respondents.

3.6.1 Interviews

The researcher will interview physics teachers and school administrators. Each interview is expected to last at least 10 minutes and with 14 questions which include demographic data and questions aimed to solicit data on the study objectives. Tuckman (2016) states that an interview is when two people talk or discuss an issue, it involves two or more people when questions are asked by interviewer to elicit facts from the interviewee. According to Cohen, Morrison (2018) an interview is a purposeful conversation in which the researcher asks questions and the participant responds, allowing for the exploration of people's experiences, opinions and feelings in depth. Therefore, an interview is a systematic method of data collection that involves direct interaction between the researcher and the respondent to obtain

detailed and meaningful information relevant to the study. It is an easy activity because questions were easy to answer particularly low order questions. When conducting the interview the researcher has to explain the format which has to be used and indicate how long the interview will take, then researcher should ask one question at a time and encourage respondent and not lose control of the process. Interviews are important in this study because they provide an opportunity for the researcher to hear the views of the target sample.

Creswell (2016) states that an interview is a flexible especially when the interviewer has the freedom to formulate questions. The interview also focuses on the issue being studied. According to Wolcott (2017) the interview method in research, has a wider application meaning that it can be used with any type of population. However, the interview has its disadvantages. For instance, the interview is time consuming (Kothari, 2017). In addition, the interviewer can be bias and influence the respondent, for example respondent might give answers they believe that the interviewer wants to hear rather than what they truly believe. However, the researcher shall overcome the disadvantages of interviews by following ethical procedures and emphasizing to respondents that the interviews are for research purposes.

3.6.2 Focus Group Discussions (FGDs)

Focus group discussions were held with learners to find out their opinion on challenges faced in teaching practical Physics in a rural secondary school. The researcher held four focus group discussions with 10 participants each for a period of 25-30 minutes. The focus group discussed 4 questions set to solicit data to respond to the study objectives. According to Casey (2015) a focus group discussion is a carefully planned conversation designed to obtain perceptions on a defined area of interest in a permissive and non-threatening environment through group interaction. According to Tuckman (2016) a Focus Group Discussion (FGD) is a good way to gather together people from similar backgrounds or experiences to discuss a specific topic of interest. Therefore, a focus group discussion is a qualitative data collection method that gathers information from a small group of participants who share their views, experiences and opinions on a specific topic through guided discussion moderated by the researcher. The group of participants was guided by a moderator (or group facilitator) who introduces topics for discussion and helped the group to participate in a lively and natural discussion amongst themselves. The FGDs were used to explore the meanings of study findings that cannot be explained statistically. Therefore, Tuckman (2016) states that FGD provides insight into different opinions among the different learners involved. It is also a

good method to use prior to designing a questionnaire. Some learners did not participate due to fear or lack of confidence. It was therefore important for the researcher to create an enabling environment whereby all feel welcome to participate. The FGDs were kept small groups so as to manage the group effectively.

3.7 Data collection procedures

According to Creswell (2016) data collection procedures are the systematic steps that a researcher follows to gather information relevant to a study's objectives. Kothari (2018) defines data collection procedures as the methods and processes used to obtain accurate and reliable information from identified sources for analysis. Therefore, data collection procedure refers to the structured process through which a researcher obtains information from participants or documents to answer the research questions effectively. Data was collected using interviews and focus group discussions. The researcher began by seeking permission from the school authorities and informing participants about the purpose of the study. Interviews were carried out with physics teachers and school administrators for a period of 10-15 minutes each. The interviews were conducted to gain insights into the challenges faced in teaching practical physics. The researcher met with groups of 10 learners participating in the focus groups in each school and conducted the FGDs. Each discussion was done for a period less than 30 minutes. The researcher moderated the discussions and took down notes to record the occurring themes. Each session was guided by a set of prepared questions to ensure consistency, while allowing flexibility for participants to elaborate on their responses. Notes will be taken and with consent, discussions were audio-recorded to ensure accuracy and completeness of the data.

3.7 Data presentation and analysis plan

Data presentation and analysis in this study will follow a qualitative approach, as the data will be derived from interviews and focus group discussions. The collected information will first be transcribed from audio recordings and organised into meaningful categories. The researcher will then employ thematic analysis, where data will be examined to identify recurring patterns, themes and subthemes related to the challenges and strategies in teaching practical physics in rural secondary schools. According to Braun and Clarke (2013) thematic

analysis is a method for systematically identifying, analysing and reporting themes within qualitative data. The findings will be presented descriptively using narrative explanations supported by direct quotations from participants to give authenticity and depth to their views. The data will also be interpreted in relation to the study's objectives and existing literature to highlight similarities, differences, and emerging insights. Tables and summaries may be used to enhance clarity where necessary. This approach ensures that the analysis provides a rich, detailed and accurate understanding of the participants' experiences and the contextual realities of practical physics instruction in rural settings.

3.8 Ethical considerations

According to Cochran (2019) ethical considerations in research refer to the principles and guidelines that ensure the study is conducted responsibly, protecting the rights, dignity and well-being of participants while maintaining the integrity of the research process. Flick (2018) defines ethical considerations as the moral obligations researchers must follow, including obtaining informed consent, ensuring confidentiality and minimising harm to participants, to uphold trust and ethical standards in research. Therefore, ethical considerations are the moral principles and practices that guide researchers to conduct studies respectfully, safely and honestly, safeguarding participants and the research's credibility. Five key ethical considerations were observed.

3.8.1 Informed consent

Informed consent involves ensuring participants understand the study's purpose, procedures, risks and benefits before agreeing to participate voluntarily. The researcher provided clear, consent forms to participants and verbal explanations to the participants, as well as consent forms to the five teachers and school administrators, ensuring they can withdraw at any time without consequences.

3.8.2 Confidentiality

Confidentiality refers to protecting participants' personal information and ensuring their responses are not linked to their identities. The researcher assigned anonymous codes names to participants, stored data securely on a password-protected device and ensures interview transcripts from teachers and administrators are anonymised to prevent identification.

3.8.3 Minimising harm

This means avoiding physical, emotional or psychological harm to participants during the research process. The researcher designed non-invasive written tests and questionnaires that avoid sensitive topics, conduct interviews in a comfortable school setting and monitor learners for signs of stress, offering breaks or counselling support if needed.

3.8.4 Voluntary participation

This ensures participants join the study freely without coercion or undue influence (Flick, 2018). The researcher emphasised to learners, teachers and administrators that participation is optional and no penalties (for example, academic or professional) occurred for non-participation, with small incentives like stationery offered only as tokens of appreciation, not coercion.

3.8.5 Transparency and integrity

This involved conducting the research honestly, reporting findings accurately and avoiding fabrication or misrepresentation of data. The researcher maintained clear records of data collection and analysis, use triangulation (for example, combining test results, questionnaires, interviews and document analysis) to validate findings and report results truthfully, even if they do not support the expected outcomes, to uphold the study's credibility.

3.9 Summary

This chapter presented the research methodology that would be utilised in collecting data for the study. The chapter presented the research design, research instruments, population, sample and sampling procedures. The data collection procedures and data presentation and analysis plan were also discussed. The next chapter, which is chapter four shall present, analyse and interpret data.

4.0 Chapter 4: Data presentation, analysis and discussion of findings

4.1 Introduction

This chapter focused on presentation, analysis and discussion of data findings on the challenges faced in teaching practical Physics in a rural secondary school. Demographic characteristics data of participants were presented using tables, graphs and pie charts and descriptive narratives employed to analysed and interpret the data. The thematic analysis was employed in analysing data gathered through interviews and focus group discussions.

4.2 Demographic data of participants

4.2.1 Gender of participants

The table below shows the gender of participants who took part in the study.

Table 4.1 Gender of participants

Gender	Teachers		Learners		Total	
	M	F	M	F	M	F
Number of participants	5	3	20	20	25	23
Total percentage					52.1%	47.9%

The data in the table shows that there were slightly more male participants 25 (52.1%) than female 23 (47.9%) in the study. It indicates a fairly balanced gender distribution. Among teachers, there were five males and three females, suggesting that men were somewhat more represented in teaching roles. However, among learners, the numbers were equal, with twenty males and twenty females, reflecting gender parity in this group. Such balance among learners aligns with efforts to promote gender equality in education, as highlighted by UNESCO (2023) which emphasises equal access and participation for both sexes in learning environments. The small difference in the overall gender percentages may reflect existing patterns in professional roles, where men sometimes outnumber women in certain educational positions (OECD, 2022). The data suggest that while gender representation among teachers in teaching Physics, the gender proportion remains uneven in favour of men.

4.2.2 Highest academic qualification for teachers and administrators

The table below shows the highest academic qualification of teachers and school administrators.

Table 4.2 Highest academic qualification of interview participants

Highest academic qualification	Diploma	Degree	Masters
Number of participants	5	2	1
Percentage total	62.5%	25%	12.5%

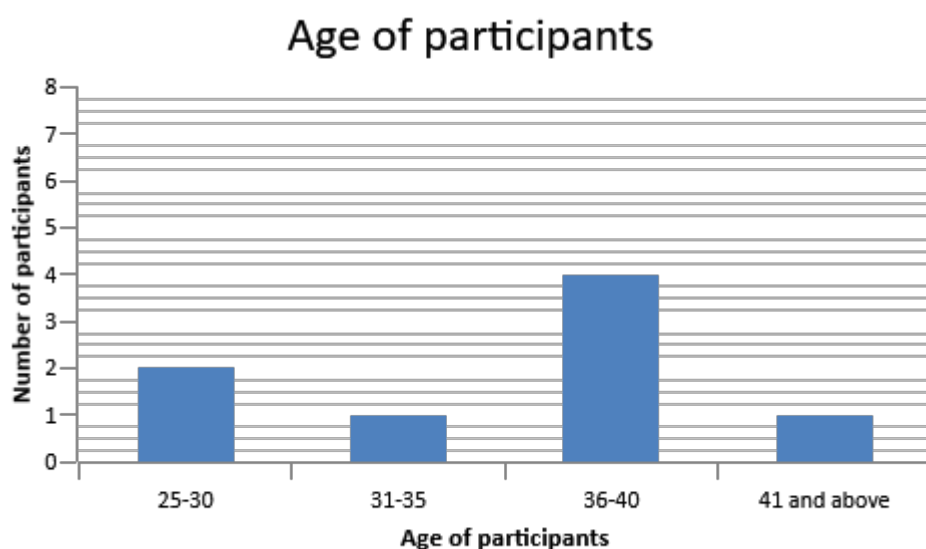
The table shows that 5 (62.5%) of the participants had attained a diploma in education, 2 (25%) had attained a degree and 1 (12.5%) had achieved a masters' degree.

The data revealed that the majority of respondents had qualified for the teaching job having earned the entry qualification of diploma in education. The table also shows that 3 other respondents had advanced to attain a degree and master's degree. The data implied that the majority of participants still had to do more in terms of professional development to achieve more pedagogical skills. Sunzuma (2025) posits that the more advanced a teacher is in terms of qualification, the better they are positioned to instruct. As such, the teachers' ability to overcome challenges experienced in teaching physics could be met with fewer, an observation that was noted in the beginning chapter on background to the study. As such, the teachers' ability to overcome challenges experienced in teaching physics could be addressed with fewer strategies, an observation noted in the introductory chapter on the background of the study.

4.2.3 Age of participants in the interviews

The researcher found out the age of participants who participated in the interviews. The data was presented on the graph below;

Fig 4.1 Age of participants on interviews



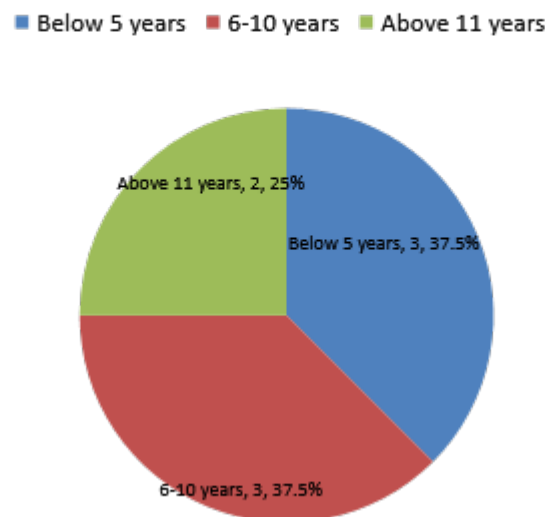
The graph above shows the age of participants. It shows that the majority 4 (50%) of participants who participated in the interviews were between the ages of 36-40 years. The graph also shows that 2 (25%) of the participants were between the ages of 25-30 years. The graph also goes on to show that 1 (12.5%) of the participants were aged between 31-35 years and 1 (12.5%) were above the age of 41 years.

The data indicate that most of the Physics teachers who participated in the interviews were in the mid-career stage, likely possessing considerable teaching experience and professional stability. A smaller proportion aged between 25-30 years, implied the presence of younger teachers who may bring newer teaching perspectives or resent training experiences. This age distribution aligns with findings by Wang (2020) who notes that mid-career teachers often dominate active teaching roles due to accumulated expertise and confidence in the subject areas. Wang (2020) also suggested that having a balance of age groups among teachers can enrich collaboration and mentoring opportunities. The data therefore, reveals that the interview participants were mainly experienced educators who were able to explain the challenges faced in teaching physics in rural areas they faced.

4.2.4 Teaching experience of Physics teachers

Fig 4.2 Teaching experiences of Physics teachers

Teaching experience of Physics teachers



The pie chart above shows that 3 (37.5%) of the participants had a teaching experience below 5 years, 3 (37.5%) had a teaching experience between 6-10 years and 2 (25%) of the participants had a teaching experience above 11 years.

The data suggests that the majority were relatively early-to-mid-career teachers who may still be developing and refining their instructional practices. Such distribution reflects trends identified by OECD (2022) which note that many teachers in science subjects like Physics tend to be in the early or middle stages of careers, partly due to workforce turnover and challenges in teacher retention. According to Sunzuma (2025) teachers with moderate experience often demonstrate strong adaptability and openness to new teaching methods, while more experienced teachers provide depth of knowledge stability. Therefore, the data suggest a workforce with a healthy mix of newer and more seasoned teachers, potentially offering both innovation and expertise within the teaching of Physics.

4.3 Data presentation and discussion

4.3.1 Theme 1: The instructional practices used in teaching practical physics in rural secondary schools

The study sought to examine the instructional practices used in teaching practical physics in rural secondary schools. Data from interviews and focus group discussions revealed that the teaching practices in the context is largely dominated by theoretical instruction and teacher demonstrations rather than hands-on experimentation by learners. Most participants indicated that while physics curriculum emphasises experimentation and inquiry-based learning, classroom realities are constrained by limited laboratory resources, large class sizes and time pressures. One interviewed teacher remarked that,

“We mostly demonstrate the experiments ourselves because we do not have enough apparatus for every learner to perform the activity.”

This statement captures the prevailing practice where teachers assume a central, demonstrative role, leaving learners as passive observers rather than active participants in the learning process. The administrators acknowledged the limited provision of laboratory equipment and consumables as a significant factor shaping instructional choices. An administrator explained,

“Even though the syllabus requires regular practicals, we can only manage a few demonstrations per term because the school has one physics kit that must serve all science classes.”

This finding aligns with studies by Mapfumo (2019) who observed that inadequate laboratory infrastructure in rural Zimbabwean schools compels teachers to adopt demonstration-based methods rather than learner-centred experimentation. The learners in the focus group discussions expressed frustration with this situation, noting that they often ‘watch instead of doing.’ One learner commented,

“We just see the teacher doing the experiment and writing the results on the board. We do not get a chance to touch the equipment ourselves.”

Despite these challenges, the study also found evidence of teacher creativity and adaptation, some teachers improvised using locally available materials to simulate basic experiments, such as using bottles, wires and bulbs for electricity demonstrations. A physics teacher shared that,

“I have learnt to improvise, for example, when we do not have proper resistors or metres, I use locally made versions so that learners can at least see the concept.”

Such improvisation, though limited in scope, reflects a commitment to maintain some level of practical engagement despite resource scarcity. This practice echoes findings by Chikomborero (2020) who noted that teachers in under-resourced contexts often rely on improvised apparatus and contextualised examples to sustain learners’ interest in science. However, while improvisation mitigates some challenges, it cannot fully replicate the precision and variety of standard laboratory equipment necessary for comprehensive practical understanding. As such, the instructional practices observed in rural secondary schools reflect a pragmatic adaption to material constraints, where teachers blend theoretical explanations, demonstration and minimal improvisation to deliver practical physics. While this approach enables syllabus coverage, it limits learners’ opportunities to develop hand-on investigative skills and scientific reasoning. As Mavhunga (2018) notes, authentic practical engagement is critical for promoting conceptual understanding and scientific literacy among learners. Therefore, the findings reveal a clear tension between curricular expectations for inquiry-based instruction and the resource-constrained realities of rural schooling. This implied that instructional practices in practical physics remain largely teacher-centred and demonstration-oriented. The teaching and learning of practical physics is constrained by structural limitations but sustained by teacher ingenuity and commitment to delivering meaningful science education under challenging conditions.

4.3.2 Theme 2: Challenges encountered in the delivery of practical physics in rural secondary schools

The study identified a range of challenges that impede the effective delivery of practical physics in rural secondary schools. Data gathered from interviews and focus group discussions revealed that teachers and learners operate under difficult conditions that significantly constrain the implementation of meaningful, hands-on science instruction. The most frequent cited challenges included inadequate laboratory facilities, shortage of apparatus

and consumables, lack of electricity in some schools, insufficient teacher training in practical instruction and overcrowded classrooms. Teachers across all the participating schools consistently highlighted shortage of laboratory resources as the most pressing obstacle. One of the physics teachers explained,

“We do not have enough apparatus for most experiments. Sometimes we borrow from neighboring schools, but even that is not sustainable because everyone is facing the same problem.”

This scarcity of equipment results in limited experimentation and an overreliance on demonstrations as teachers struggle to provide each learner with opportunities for direct engagement. The absence of essential consumables such as chemicals, wires and batteries was also mentioned as a recurring challenge. Administrators attributed these shortages to financial constraints and inconsistent government support, noting that many rural schools operate on minimal budgets. One school administrator stated,

“Our budget mainly covers basic running costs. Laboratory materials are expensive, so we often have to wait forgo their purchase.”

This situation aligns with observations by Nyikadzino (2021) who reported that budgetary limitations in rural schools often hinder consistent provision of education resources needed for instruction. Another significant challenge identified was inadequate infrastructure, particularly the lack of functional laboratories and reliable electricity. Some schools conducted practical lessons in ordinary classrooms or under makeshift shelters, comprising safety and efficiency. A teacher from one of the schools commented,

We have no proper laboratory. We attempt to do experiments in a class room, space and safety is always a problem, particularly when working with electric parts.

It resembles the results of Mandina (2016), who observed that the lack of proper infrastructure in rural schools tends to compel educators to adjust their behavior in a manner that weakens the teaching of practical sciences.

Limited teacher professional development was also mentioned by participants as one of the significant obstacles. Some teachers stated that they had undergone very little training on how to present practical physics and that they were usually ill equipped to plan and evaluate activities based in the laboratory. One teacher admitted,

“Most of us were trained many years back and we seldom have any workshop on how to teach practicals with limited resources.”

Such deficiency of continued professional support adds to the institutional low teacher confidence and limits innovation in lesson delivery. These challenges are also compounded by large classes. According to teachers, it was almost impossible to provide active engagement and personal practical work with over forty learners within one session. A participant explained,

“It is difficult to monitor and manage everyone when working practically and have too many people in the classroom. At other times I simply carry out the experiment myself so that they may observe.”

Even the learners were complaining of such conditions. Most of them complained that they were at a disadvantage to their counterparts in the urban schools. One student stated,

“We read about experiments in the book and we do not do them. It is not easy since when we have exams we have never touched the type of equipment.”

These assertions emphasise the accruing effects of material, infrastructural, and pedagogical disadvantages on learner experience and performance. These findings indicate that the practical physics in rural secondary schools is not delivered due to interconnected systemic issues the lack of resources, poor infrastructure, ineffective teacher support and disproportionate class sizes being the primary ones. All these limitations will restrict the depth to which practical work based on inquiry, and learner- centred work can be realised. As Mavhunga (2018) indicates, the lack of real-life laboratory interaction negatively affects the process of formation of critical thinking and problem-solving abilities in learners. The solution to such issues would therefore be selective interventions in terms of resources delivery, teacher development and infrastructure to make practical physics a meaningful and fair learning experience to all students irrespective of geographical location.

4.3.3 Theme 3: Strategies for improving the implementation of practical physics in rural secondary schools

The research found that there were a number of strategies that teachers, administrators and learners put forward to enhance the application of practical physics in secondary schools in rural areas. Although the participants admitted that the resource and infrastructural challenges are still persistent, they also said that it is possible to make a significant change with proper planning, creativity and assistance. The new strategies were based on four main directions, namely mobilising and improvising resources, professional development of teachers, supporting policy and administration and engaging learners through the locally relevant strategies.

Teachers highlighted the necessity of the better mobilisation of resources and cooperation as the initial step to the improvement. Numerous participants observed that schools might enhance relations with local communities, surrounding industries, and education stakeholders and obtain or build rudimentary apparatus. One teacher suggested,

“When we get to work with local artisans or parents we can make some of the basic equipment ourselves rather than wait for the school administration.”

Such a perception is consistent with that by Chikomborero and Mandina (2020) who noted that the engagement of communities in resources development promotes ownership and sustainability of rural science education. Moreover, it was suggested by teachers that schools ought to organize inter-school sharing networks, where equipment available in one school could be shared with other schools nearby to increase access. The other major strategy that was emphasised was teacher professional development and peer learning. The participants stressed the importance of regular workshops, refresher courses and mentorship programmes that will help teachers to have the required skills to teach practical lessons even in the limited conditions. An administrator stated,

“Teachers can make the lessons more interactive by being trained more on how to improvise and manage practicals with limited resources.”

Other teachers suggested that they should organise professional learning communities at the district level where teachers can exchange ideas, locally developed experiments and best practices. This strategy is reminiscent of suggestions by Mavhunga (2018) who suggested that ongoing professional learning would increase teacher confidence and pedagogical innovation in teaching science. Another key aspect that participants emphasised is the role of

the policy and administrative support in the development of an enabling environment of practical physics. School leaders requested specific funding on the improvement of laboratories and regular supply of science kits to rural schools. One of the departmental heads commented,

“The Ministry must make it a point of distributing laboratory materials to rural schools since they are the worst hit.”

Besides that, respondents recommended that the inspection and supervision systems must not only be aimed at covering the syllabus but also review the level of practical involvement. This kind of accountability would encourage schools to devote time and resources to activities that are practical. Regarding the curriculum execution, educators presented a more liberal schedule permitting sufficient time to do experiments and prepare experiments. The large class size was also recognised as a structural problem that could be alleviated through the division of classes during practical lessons or having rotational group experiments to make the learners participate.

The study established that contextually relevant and learner-centred pedagogy could promote the teaching of practical physics in rural schools. Educators observed that the use of materials available locally and real-world examples in teaching abstract concepts can demystify them and keep the learners interested. One teacher shared,

“When I give examples, locally, such as the explanation of pressure by bicycle pumps or by the process of syphoning water, the students have more comprehension because it relates to their life.”

This plan holds the argument by Nyikadzino (2021) that contextualisation of learning science facilitates relevancy and engagement, especially in resource restricted settings. As such, the results indicate that the necessary multi-pronged approach to the improvement of the implementation of practical physics in rural secondary schools should include both systemic and instructional components. Sustainable improvement is mainly based on strengthening teacher capacity, resource provision consistency, policy support and community participation. Further, the gap between curriculum expectations and classroom realities can be bridged by empowering the teachers to incorporate local resources and learner-centred approaches. After all, these measures lead to the vision of inclusive and practical-oriented science education

that fosters curiosity, critical thinking and problem-solving abilities in all learners, despite their socio-geographical background.

4.4 Summary

This chapter focused on presentation, analysis and discussion of data findings on the challenges faced in teaching practical Physics in a rural secondary school. Demographic characteristics data of participants were presented using tables, graphs and pie charts and descriptive narratives employed to analyse and interpret the data. The thematic analysis was employed in analysing data gathered through interviews and focus group discussions. The next chapter which is chapter four presented the study summary, conclusions, recommendations and areas of further research.

5.0 Chapter 5: Summary, conclusions and recommendations

5.1 Introduction

This chapter presented the study summary. It also provided the conclusions on the main findings of the research and drew recommendations from the findings.

5.2 Summary of the study

The study was carried out to investigate challenges faced in teaching practical Physics in a rural secondary school a case of Mutasa Central cluster, which is composed of Pafiwa, Sherukuru, Zambe and Bethania secondary schools. The objectives of the study were to examine the instructional practices used in teaching practical physics in rural secondary schools, to assess the challenges encountered in the delivery of practical physics in rural secondary schools and to identify feasible strategies for improving the implementation of practical physics in rural secondary schools. In the first chapter the researcher presented the background to the study that during the course of their professional practice as a teacher of physics in rural secondary, the researcher experienced first-hand the challenges that were persistent and deeply embedded in regard to teaching practical physics. The absence of laboratory facilities, poor infrastructure, old teaching resources and low student participation in the learning processes were some of the experiences that highlighted the mismatch between what the curriculum required and what the classrooms of the rural schools were like day by day. The researcher repeatedly noted that in spite of the inquiry-focused approach of the curriculum and active experimentation, lessons were mostly theoretical and practical sessions were usually replaced by textbook examples and color descriptions because of the lack of resources. The statement of the problem, research objectives, research questions and significance of the study to various stakeholders were given. In the same first chapter, the delimitations, limitations of the study and definitions of key terms found used throughout the research were also defined. The researcher went on to present a review of literature related to the study in chapter two. The review of literature was drawn from various authorities who have written on similar research on the challenges faced in teaching Physics in rural secondary schools. The research was guided by Bruner's Constructivist Learning Theory proposed by Jerome Bruner. The theory believes that learning is an active process in which learners construct new ideas based on their current and past knowledge. The review of

literature was presented following themes developed from the research objectives. The review of literature was helpful to draw on existing knowledge and research gaps. In the third chapter, the researcher presented the research methodology used to gather data. The researcher used a case study and qualitative research approach. The population of the study, target population and sampling procedures were also explained to show how participants were sampled. Data presentation procedures and analysis plans were also shared on chapter three. In chapter four, the researcher presented, analysed and interpreted data. The demographic characteristics of participants were presented using tables, pie charts and graphs. The thematic analysis was employed in analysing data gathered through interviews and focus group discussions.

5.3 Conclusions of the study

The following conclusions were reached;

5.3.1 Theme 1: The instructional practices used in teaching practical physics in rural secondary schools

The study concluded that teaching of practical physics in rural secondary schools is mostly theoretical and teacher-centred. Lessons are often dominated by teacher demonstrations rather than hands-on experiments by learners. This approach is mainly caused by lack of laboratory resources, large class sizes and time limitations. Although some teachers try to improvise using locally available materials, such efforts are limited and cannot full replace proper laboratory work. As a result, learners have few opportunities to actively participate in experiments, which reduce their understanding and interest in physics.

5.3.2 Theme 2: Challenges encountered in the delivery of practical physics in rural secondary schools

The study concluded that the delivery of practical physics in rural secondary schools faces many challenges that limit effective teaching and learning. The main problems include a shortage of laboratory equipment and materials, lack of proper laboratory buildings, large class sizes and limited teacher training in practical instruction. Some schools also struggle with unreliable electricity and low funding. These challenges make it difficult for teachers to conduct regular experiments and for learners to gain hands-on experience. As a result,

practical physics lessons often remain theoretical, reducing learners' ability to develop scientific skills and understanding.

5.3.3 Theme 3: Strategies for improving the implementation of practical physics in rural secondary schools

The study concluded that improving the teaching of practical physics in rural secondary schools requires better resources, teacher training and community support. Teachers need regular workshops to strengthen their skills in conducting practical lessons and using locally available materials. Schools should work with local communities and education authorities to provide or make basic laboratory equipment. There is also need for consistent funding and government support to ensure that rural schools have proper laboratories and teaching aids.

5.4 Recommendations of the study

Learners

- Should participate actively in all practical activities and make use of available materials to strengthen their understanding of physics concepts.
- They should form study groups or science clubs to share ideas and practice simple experiments together.

Teachers

- Should use learner-centred and hands-on approaches by involving learners directly in experiments rather than relying only on demonstrations.
- Should attend professional development workshops to improve their skills in teaching practical physics using available and improvised resources.

The school

- Should prioritise improving facilities and ensure that available science equipment is properly maintained and used effectively.
- Administrators should support teachers by allocating funds for basic laboratory materials and encouraging collaboration with nearby schools to share resources.

The community

- Should support schools by helping to provide or construct simple laboratory equipment using local materials.
- Parents and local organisations should assist in mobilising resources or fundraising to improve science facilities in rural schools.

The Ministry of Primary and Secondary Education

- Provide adequate laboratory equipment and materials to rural schools and ensure consistent supply maintenance.
- Should organise regular training workshops to equip teachers with practical skills for effective physics instruction in resource-limited settings.

5.5 Further recommendations

Further recommendations for research are made that;

- i. Further research should investigate the effectiveness of improvised and locally made apparatus in improving learners' understanding of practical physics in rural secondary schools.
- ii. Further studies should explore the impact of teacher professional development programs on the quality of practical physics teaching and learner engagement in low-resource rural contexts.

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Appendices

Appendix 1: Interview guide

Dear Sir or Madam,

My name is Marvellous Sophia Musuka, a student studying for a Degree in Science Education at Bindura University of Science Education. As part of my professional studies, I am required to submit a completed dissertation. I am therefore conducting a study titled “*An Investigation on Challenges Faced in Teaching Practical Physics in a Rural Secondary School*.” You have been identified as a respondent for this study, and I kindly request your participation by responding to the interview questions. Please note that this research is purely for academic purposes and all ethical considerations, including confidentiality and voluntary participation, will be strictly observed.

Thank you for your cooperation and valuable contribution to this study.

Yours sincerely,

Marvellous S Musuka

Demographic Questions

1. What is your gender?
2. What is your highest academic qualification?
3. What is your age?
4. How many years of teaching experience do you have?

Interview questions

5. Which instructional methods do you commonly use when teaching practical Physics?
6. How often are practical Physics lessons conducted in your school?
7. What challenges do you face in conducting practical Physics experiments?
8. How does the availability of laboratory equipment affect your teaching of practical Physics?
9. In what ways do class sizes influence the delivery of practical Physics lessons?
10. How do you address situations where students lack prior knowledge or skills needed for practical activities?

11. What strategies have you used to make practical Physics lessons engaging and effective despite limited resources?
12. How do you assess students' practical skills in Physics?
13. What support or resources would help improve the teaching of practical Physics in your school?
14. Can you suggest any measures that could enhance the implementation of practical Physics in rural secondary schools?

Appendix 2: Focus Group Discussions for learners

1. How do you usually participate in practical Physics lessons at your school?
2. What challenges do you experience when doing practical Physics activities?
3. How do the resources and equipment available affect your understanding of practical Physics?
4. What suggestions do you have to make practical Physics lessons more interesting and easier to learn?